Identifying the barriers to the successful use of the Project Safety Nets Microloans Model in Dakar, Senegal

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In pursuit of economic development, microfinance sustainability, and women's empowerment, this research examines the challenges confronting the Japplante Women in Dakar, Senegal. Focusing primarily on the microloans model implemented by Project Safety Nets, the study aims to uncover barriers hindering the successful completion of the savings portion by the Japplante Women. The research contributes to enhancing the Project Safety Nets microloans model utilized by women in Dakar, Senegal, West Africa, with the aim of addressing economic disparities, empowering women, and fostering entrepreneurship within the community. This was a semi-structured group interview. Women 21-70 years of age who received microloans from Project Safety Nets and were a part of the Japplante Women Association were eligible for participation. Interview participants were all invited to answer the same set of questions on the same day. This interview was conducted with two translators present to translate the interview from Wolof to English to bridge the language barrier. All 45 women in the Japplante Women's Association were invited to participate in the study; 38 were present. The age range was 21 to 70 years. Initial findings suggest that inflation, increased costs of raw materials for their businesses, and diversification of expenses post-business expenditures pose significant challenges. Moving forward, the research will focus on sharing this information with the non-profit organization, Project Safety Nets in order for them to generate solutions to improve the model. By addressing these challenges, the research endeavors to contribute to the advancement of microfinance sustainability, women's empowerment, and economic development in Dakar, Senegal.

Determining the effects of heat stress on thyrotropic and somatotropic gene expression in breast muscle of fast and slow-growing broiler lines

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In the meat-producing chicken (broiler) industry, modern fast-growing broilers have been specifically bred to maximize muscle growth. Climbing global temperatures have resulted in increased vulnerability of fast-growing broilers to heat stress, which can reduce growth performance and increase mortality. Slow-growing legacy broilers, which are genetically distinct from fast-growing broilers, do not respond as negatively to high environmental temperatures, but it is unclear which physiological differences contribute to their elevated tolerance. This study sought to investigate how broiler growth rate influences somatotropic- and thyrotropic-related gene expression in response to heat stress. Male fast-growing or slow-growing broiler chicks were assigned one of two temperature treatments (control or heat stress). Between 32 and 38 days of age, birds in the heat stress temperature treatment were exposed to elevated temperatures of 95°F for 8 hours per day, and birds in the control treatment were maintained at optimal temperatures of 78°F. Pectoralis major samples were collected on days 32 and 38 to simulate the effects of acute and chronic heat stress. RNA was extracted and converted to cDNA and gene expression was analyzed by performing real-time quantitative polymerase chain reactions. We expect results to show altered expression of somatotropic and thyrotropic genes in heat-stressed modern broilers that leads to decreased metabolic and growth-related signaling. In contrast, slow growing legacy broilers' somatotropic and thyrotropic gene expression is expected to be affected by a lower magnitude or not at all. This may explain the growth reduction exhibited only by fast-growing broilers in heat stressed conditions.

Examining the influence of stage of cycle and uterine health on vaginal pH and cellular type in postpartum dairy cows

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Postpartum cows are most susceptible to uterine diseases within the first 21 days of calving, leading to consequences such as reduced milk yield, impaired reproductive function, and increased antibiotic use. The ability to determine factors that influence and/or indicate the status of uterine health are important for early remediation efforts. Visual identification is the most reliable tool used to date, which can be inefficient and subjective. Therefore, the objectives of this study were to characterize cellular and pH changes in the vaginal environment by stage of the estrous cycle and uterine health. To meet these objectives, Holstein, dairy cattle (n=16) were enrolled in the study on day of calving (d0). On days 21 ± 3 days and days 35 days ± 3 days cows were assessed for stage of cycle and uterine health with collections made for vaginal pH and vaginal cytology. Stage of cycle was determined by transrectal ultrasonography of ovarian structures. Uterine health was determined visually, using ultrasonography and assessing of vaginal cytology smears. Vaginal pH was determined using a two-way flushing catheter, syringe, 60 mL saline solution and metal insemination rod. After collection, saline's pH was measured for each cow using a portable pH meter. Vaginal cytology smears were performed by collecting two swabs of the vaginal environment immediately followed by processing with Diff Quick staining. Subsequently, all slides were evaluated for cellular type to include Superficial, Parabasal, and Intermediate cells. Other smear components were also noted to include neutrophils, bacteria, and red blood cells. Predominant cell type was considered the cellular stage that represented >75% of total cells identified. Stage of cycle and predominant cell type tended to ($P<0.1$) be related on week 3 and became highly related on week 5 ($P<0.05$). Animals in the luteal phase being more likely to have intermediate cells and those in the follicular phase more likely to have superficial cells. When all cells were included, infection increased proportions of non vaginal cells (neutrophils, bacteria) while decreasing observable vaginal cells, which weakened the relationship. The pH of the vaginal environment was not related to cell type, stage of the estrous cycle, or infection status ($P>0.05$). This trial aimed to explore novel methods to assess reproductive health in cattle. The preliminary observations suggest that future work in this area may be enlightening.

Computed Tomography Imaging of Live Broiler Chickens to Examine Skeletal Traits

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Lameness, a common issue among broiler chickens, can restrict mobility, cause pain, and compromise their welfare. Broiler chickens are known for rapid growth rate and heavier muscle mass. Certain broiler strains that grow slowly show fewer signs of lameness compared to the fast-growing genetic lines. In this study, we aimed to restrict the growth rate in a fast-growing broiler line to understand the changes in the skeletal characteristics. Seven hundred and twenty Ross 708 broiler chickens were divided into three treatments. Treatment groups were split up into 24 pens with 30 birds in each as T1 – ad libitum fed, T2 – growth restricted by 10%, and T3 – growth restricted by 20%. Growth restriction was achieved using quantitative feed restriction. Each treatment consisted of eight replicate pens, but T1 and T3 were the only groups compared for skeletal properties. Eight broilers (1/pen) from each of T1 and T3 were selected at random and scanned using computed tomography (CT) at a target body weight of 1 kg and 4 kg. The CT images were reconstructed and analyzed using "Analyze Direct 14.0" software. Lengths of the tibia and femur, distance of the hip joint, angle of the tibial joint, angle of the tarsometatarsal joint, and the distance between the base of the neck and the coccyx were measured. Total body surface area and volume as well as the volume and area of the skeleton were measured. A p-value of 0.05 was considered significant. The T3 broilers lagged 2 and 10 days behind the T1 broilers in achieving the 1 kg and 4 kg target weights, respectively. Age and body weight influenced morphological traits of the tibia and femur. Expectedly, broiler chickens with a 4kg body weight had longer bones and wider hips than those with a body weight of 1kg. Growth rate also affected some skeletal traits. At 1 kg, growth-restricted- (T3) broilers had wider angle between the tibia and femur compared to the ad libitum-fed (T1) broilers ($p < 0.05$). Growth-restricted (T3) broilers also had greater skeletal volume and surface area than the T1 birds at 4kg target weight ($p < 0.05$). These findings suggest that a 20% growth restriction in commercial broilers enables increased bone volume and surface area accumulation, particularly as birds approach market weight, potentially reducing lameness.

Transplantation of induced neural stem cells + treadmill training improves cerebral blood flow and tissue damage in piglet traumatic brain injury

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Traumatic brain injury (TBI) is the leading cause of disability and death in children. TBI in adolescents can lead to long-term impairments such as cognitive dysfunction, gait disturbances, and behavioral changes. TBI in children is a chronic disease process rather than a one-time event because the adolescent brain is still developing. There is a lack of treatments for TBI because of the complexity of the injury in children. However, it is hypothesized that the transplantation of induced pluripotent-derived neural stem cells (iNSCs) may the ability to repair damaged tissue by replacing damaged neural cells and secreting neuroprotective factors. In addition, exercise is believed to have a large influence on major modulators of synaptic membrane fluidity and function in the brain, while also increasing blood flow and oxygen concentration leading to enhanced healing following TBI. Therefore, the objective of this study was to determine if combined treatment with iNSCs and treadmill training improves tissue recovery in a piglet traumatic brain injury model. Castrated, male pigs underwent controlled cortical impact surgery to induce TBI and were assigned to the following treatment groups: PBS (n=3), PBS + Treadmill (n=4), iNSC (N=4), iNSC + Treadmill (n=3). iNSC pigs received an intraparenchymal injection of iNSCs at 5 days post-TBI. Treadmill pigs underwent treadmill training weeks 1-12 post-TBI. Brain lesion volume and midline shift were assessed via T2 weighted (T2W) imaging. Mean cerebral blood flow was assessed via arterial spin labeling (ASL) and changes in white matter integrity was assessed via diffusion tensor imaging (DTI). Lesion volume and midline shift were significantly ($p<0.05$) decreased in iNSC and iNSC + Treadmill pigs compared to PBS and PBS + Treadmill pigs. In addition, iNSC and iNSC + Treadmill pigs demonstrated significantly ($p<0.05$) improved cerebral blood flow and white matter integrity compared to PBS and PBS + Treadmill pigs. Taken together, these results suggest that iNSC treatment leads to tissue recovery and this effect is not enhanced by treadmill training. These promising results suggest that treatment with iNSCs has the potential to bridge the gap between current treatments and TBI in children and restore critical lost function.

Expression of calcium transport proteins in the shell gland of commercial laying hens at 25 and 95 weeks of age

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Older hens experience reduced eggshell quality due to calcium and phosphorus imbalances. Investigating the uptake and utilization of these minerals can help improve eggshell quality and economic output of producers. The objective of this study was to examine the expression of genes involved in calcium uptake that influence eggshell calcification in the shell gland during early (25 weeks old) and extended production (95 weeks old). Shell gland tissue was collected from 96 hens at four time points during the 24-hour egg formation cycle [1.5, 6, 15, and 21 hours post oviposition(HPOP)[-n=-12 hens/time point/age]. These time points represent bone mineralization (1.5 HPOP), eggshell calcification (15 HPOP), and transitioning between these two phases (6, 21 HPOP). Gene expression was analyzed by RT-qPCR and data were analyzed by two-way ANOVA. Results were considered significant at $P \leq 0.05$. Calbindin (CALB1), a calcium-binding protein, was higher at 95 weeks with a peak at 15 HPOP ($P \leq 0.05$). Expression of plasma membrane calcium transporter 1 (PMCA1), a calcium transporter, was higher at 95 weeks and increased during the oviposition cycle, peaking at 21 HPOP ($P \leq 0.05$). Sodium-calcium exchanger 1 (NCX1), another calcium transporter, had higher expression at 25 weeks and was lower at 21 HPOP ($P \leq 0.05$). Eggshell formation becomes impaired with age; CALB1 and PMCA1 increased in older hens, while NCX1 decreased in older hens. The shift in transporter expression during the oviposition cycle highlights areas needing research to improve eggshell quality and profitability to producers.

Assessment of Pig Muscle Mitochondrial Oxidative Capacity Using Near Infrared Spectroscopy: Validating a 6-Occlusion Protocol

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Fatigue Pigs Syndrome is characterized by open-mouth breathing, muscle tremors, and heightened skin reddening. Muscle fatigue onset is significantly influenced by the composition of muscle fiber types and their oxidative capacities. Pig musculature is predominantly composed of type IIB muscle fibers which are characterized by their rapid fatigue onset. This trait is coupled with their capacity for generating short bursts of energy, attributed to the high muscle glycolytic capacity and low oxidative capacity. Near Infrared Spectroscopy (NIRS) has emerged as a promising non-invasive method for assessing muscle oxygen levels and mitochondrial function. Drawing from NIRS protocols developed for human studies, this research study aims to assess the feasibility of employing a 6-occlusion NIRS protocol to gauge pig muscle mitochondrial oxidative capacity (MOC). This capacity is understood as the muscle metabolism recovery rate constant during the transition from exercise to rest. In this study, NIRS data were collected from anesthetized pigs (N = 4). The NIRS probe was positioned on the mid-belly of the long digital extensor (LDE) muscle. Electronic muscle stimulation electrodes were strategically placed 0.5-cm distally and proximally to the NIRS probe for muscle activation. A blood cuff was positioned proximally to LDE for oxygen occlusion during testing. The MOC collection commenced with a 30-second arterial occlusion, followed by four trials evaluating muscle oxygen levels. Each trial involved 30 seconds of muscle stimulation followed by 10-15 seconds of oxygen occlusion, yielding distinct mitochondrial capacity rate constants indicative of end recovery metabolic rates. Initially, the blood cuff was placed on the biceps femoris muscle; however, due to the large circumference of the shoulder, the cuff was repositioned proximally to the LDE muscle, where its effectiveness was confirmed. Subsequent data analysis from the second and third pigs revealed signal interference with the NIRS probe, attributed to movement induced by the expanding blood cuff. In contrast, the fourth pig exhibited successful protocol implementation. In conclusion, this study validated NIRS utility for measuring MCO from pig LDE muscle. For refinement, modifications to the blood cuff are to be explored to accommodate muscles more prone to fatigue pig syndrome like bicep femoris and semitendinosus.

Twenty Years of Lawn and Garden Participation

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The intention of this project was to analyze the trends associated with lawn and garden participation. Notably, to compare different groups to see if participation in lawn and gardening activities varied between employed versus unemployed persons and gender. Using the BSL database collected by the United States Department of Labor, we selected data in the 'Lawn and Garden Care' category and further specified data on 'Average Hours per Day' and 'Average Hours per Day for Participants'. 'Average Hours per Day' includes time spent on lawn and garden care from the entire population, while 'Average Hours per Day for Participants' includes only time from participants of the activity. We then compared respondents that were employed and unemployed and gender to examine differences between the two groups. The amount of time the average person spends doing Lawn and Garden Care activities has stayed mostly consistent throughout the past nineteen years, with an overall increase of 4% since 2003. The 'Average Hours per Day for Participants' of lawn and garden care has increased over the past nineteen years, with a large jump of participation from 2009 to 2011. People who are 'Employed' have a lower 'Average of Hours per Day' doing 'Lawn and Garden Care' activities compared to those who are 'Not Employed'. However, the 'Average Hours per Day for Participants' of 'Lawn and Garden Care' who are 'Employed' and 'Not Employed' are similar. For gender, 'Men' spend longer 'Average Hours per Day' and 'Average Hours per Day for Participants' then 'Women'. The amount of time people spend on lawn and garden activities has mostly stayed consistent over the past nineteen years. Participants of lawn and garden activities have had an increase of time of 4% since 2003, with a large increase of time in 2009 through 2011. People who are employed tend to engage in lawn and garden activities less than people who are not employed, however there is not a large difference for those participating in lawn and garden activities. Men engage in larger average hours per day and larger hours for participants then women do for lawn and garden activities.

Effects of Transitioning from High-Concentrate Diets to an Endophyte-Free Tall Fescue Mixed Hay on Beef Cattle Performance and *E. coli* Shedding

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Cattle are asymptomatic, natural reservoirs of *E. coli*.; however, fecal shedding of this bacteria is a food safety concern. Therefore, strategies to decrease *E. coli* counts pre-harvest are imperative. The objective of this experiment was to evaluate the effects of abruptly transitioning beef cattle consuming 0, 20, or 40% distillers' grains with solubles to 100% endophyte-free tall fescue and alfalfa mixed hay on *E. coli* shedding, ruminal pH, feed intake, water consumption, and animal performance. Thirty-two Angus-crossbred animals (BW = 359 ± 62.2 kg) in a randomized complete block design were used and placed into pens equipped with SmartFeed technology (C-Lock; n= 8 animals/ treatment) to measure water and feed intake. Cattle consumed a high concentrate-based diet *ad libitum* for 35-d on their respective treatments : 1) a basal diet without distillers' grains with solubles (CTRL), 2) 20% distillers' grains with solubles (20DGS: DM-basis), 3) 40% distillers' grains with solubles (40DGS; DM-basis), and 4) a positive control of 40% distiller's grains with solubles (PCTRL). After 35-d, treatments 1, 2, and 3 were abruptly shifted to 100% endophyte-free tall fescue and alfalfa mixed hay for 18-d. Water and feed intake were collected daily using the SmartFeed (C-lock) system. Body weight, rumen pH, and fecal samples were collected on d 0, 4, 11, and 18. To enumerate *E. coli*, 3MTMEC-PetrifilmTM was used. Data were analyzed using the MIXED procedure of SAS and animal was considered the experimental unit. Cattle on PCTRL had a greater ($P \leq 0.001$) feed and water intake compared to the other treatments. No treatment × day interactions ($P \geq 0.226$) were observed on *E. coli* counts or ruminal pH. However, PCTRL when compared to 40DGS on d-18 *E. coli* counts were decreased by 0.94 Log10 CFU/g (6.51 vs. 5.57). Ruminal pH had a day and treatment effect, being lower ($P \leq 0.001$) on the PCTRL compared to other treatments on d-18. Moreover, treatments did not affect ($P \geq 0.7631$) the BW and average daily gain (ADG) of animals. Currently, having producers shift from a high concentrate diet to endophyte-free tall fescue and alfalfa mixed hay is not feasible; however, this experiment provides insight to future strategies that can decrease fecal *E. coli* shedding. Furthermore, animals abruptly changed to the tall-fescue alfalfa mixed hay decreased feed and water intake, while increasing ruminal pH, without affecting overall animal performance.

Comparison of Commonly Used Infiltration Methods for Soil Health

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Infiltration rates (IR) are a key metric in soil hydrology. IR influences the water movement within landscapes shaping processes such as groundwater recharge, soil erosion dynamics, and aggregate stability. The primary goal of this study is to compare 5 IR treatments in two contrasting soil types, and determine which methods prove to be reliable, accurate, or convenient. We employed the constant-head (CH) method and the falling-head (FH) method using a 15-cm diameter ring to measure IR. Additionally, we repeated the falling-head method, but with a 6cm-diameter tempe cell (TC) ring. The Mini-Disk Infiltrometer (MDI) and a SATURO Infiltrometer were also used for comparison. The sites used for this research question are both agricultural soils . The five IR methods were repeated three times at each site, with the treatments randomly clustered a half meter from a center point. Samples were collected from this center point and analyzed for characterization data: bulk density, water retention, water potential, texture, and total organic carbon. With the collection of this information, we aim to answer the following: Are these 5 IR methods statistically different from one another, if yes, is this finding true across the repetitions at a singular location? How does this compare to the findings at our second location? Secondly, If the IR method differences are NOT independent of location, which methods are more suited to soil type based on characterizing data? And finally, what do our findings mean in terms of IR standardization? This study offers insights into the variability of diverse soil types and the reliability of different IR methods, offering enhancements in soil hydrology approaches.

Uptake and Fractionation of Rare Earth Elements (Critical Minerals) by *Pinus taeda*

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Rare earth elements (REEs)--often termed 'Critical Minerals' in the US media–are key raw materials for electric vehicle motors and other industrial components, making them essential for US security and energy independence. Currently, Biomining is a promising method of extracting REEs from ore by leveraging plant and/or microbial uptake pathways, a potential tool to harvest these critical minerals. REEs have also recently been shown to be required by certain bacteria to live, suggesting that biology may have mechanisms to concentrate and accumulate these elements that remain unexplored. To evaluate the potential for common plant extraction of REEs from the soil, we studied the uptake behavior and fractionation pattern of REEs by pine trees (*Pinus taeda*) in its roots, stem, and needles. Two young pines and their root-adjacent soil were collected from Whitehall forest and divided into component parts: soil, roots, stems/trunks, and needles. In order to obtain the rare earth elemental content of each sample, the soils were extracted using chemical extractant typically used to reflect plant availability (Mehlich III extract), plant tissues were dissolved using microwave digestion, and then all samples were diluted and run on an ICP-MS machine to quantify extractable REEs. After data analysis, we found that REEs were about 25x more concentrated in the root of the pine, at $2.14 \bullet 10^{-2}$ mg/kg, than in the stem, needles, or what was plant available in soil, which had concentrations of $8.5 \bullet 10^{-4}$, $10.4 \bullet 10^{-4}$, and $7.8 \bullet 10^{-4}$ mgREE/kg, respectively, and that REE concentration within the plant was not significantly different between the stem and needles. We also found that the light rare earth elements, lanthanum, cerium, praseodymium, neodymium, samarium, and europium, (LREEs), were slightly favored by the plant as they had approximately 18x greater concentration in the root and 9x greater concentration in the stems and needles as compared to the heavy rare earth elements, gadolinium, terbium, dysprosium, holmium, erbium, thulium, ytterbium, lutetium, scandium and yttrium (HREEs). This fractionation pattern is in contrast to what has been found in both soybeans and pokeweed (Phytolacca americana), implying that each plant may have a different mechanism for uptake. Increasing our understanding of which REEs and in what amounts are preferred for uptake by *Pinus taeda* shines light on decision making regarding bioremediation and biomining practices.

Evaluating the use of infrared camera imaging of the eye as a non-invasive, rapid, diagnostic tool to identify illness in calves

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Calves often do not show signs of illness until late-stage morbidity, which gives little time for identification and remediation. A rise in temperature is considered the most ubiquitous and critical change that precedes most other signs of illness, including lethargy, respiratory symptoms, or digestive issues. Though considered a gold standard, rectal temperatures can be an inefficient, ineffective and invasive method to identify illness. Therefore, this study's objective was to assess the use of thermal imaging of the eye as a non-invasive and rapid technique to assess core body temperature of dairy calves. Calves [n=13] at 4 ± 3 d of age were enrolled and assessed weekly until 42 ± 3 d of age. Weekly imaging was performed in a three sided, wood barn in an attempt to reduce variances in environment and a HOBO data logger recorded temperature and humidity at the time of imaging. Images were collected using a FLIR T450 thermal imaging camera. Calves were positioned two feet from the camera lens and images were taken perpendicular to the calf eye. Rectal temperature was recorded at the time of imaging. Images were entered into the FLIR Studio Pro software to be analyzed. The right eye (RE) and the left eye (LE) were analyzed by a single operator for subjective identification of the coolest (pupil) and warmest (sclera) points of the eye followed by autonomous identification of these points by the software program. All data was analyzed using SAS 9.4. Warmest and coolest points identified by the operator tended to be similar to those collected autonomously ($P<0.10$). The coolest point of the eye had no relationship to rectal temperature ($P>0.05$). Both LE and RE autonomously identified warmest points had weak correlations with rectal temperature ($P<0.05; r^2=0.32$); while the LE autonomous identification tended to predict rectal temperature ($P<0.10$). These results were that of an interaction between week of age and autonomous max temperature in left and right eyes noting that rectal temperature decreased with age ($P<0.05$). In addition, RE differences might be the result of changes in exposure to light during calf rotation while imaging. Environmental conditions did not influence rectal or thermal temperature ($P>0.05$). Additional data and modifications to the thermal imaging protocol are needed to utilize thermal imaging as an accurate core body temperature predictor.

Continued studies on the prevalence and diversity of in Baird's Tapirs (*Tapirus bairdii*) from Costa Rica

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Rickettsia spp. are bacteria that can be vectored through the bites of hard ticks, with many species known to cause a variety of severe spotted fevers in humans. There is relatively little data on the prevalence and diversity of *Rickettsia spp.* in ticks from Costa Rica. The purpose of this study is to continue characterizing the prevalence of rickettsial pathogens in ixodid ticks from Costa Rica to build off previous findings housed in the Southeastern Cooperative Wildlife Disease Study. This project used nested PCR and Sanger sequencing methods to identify potential rickettsial pathogens present in various regions in Costa Rica. Tick samples were collected from either radio-collared or road killed Baird's Tapirs (*Tapirus bairdii*) from July 2021-May 2022. Morphological keys were used to identify the tick species present, and PCR targeting the 16S rRNA gene was used to confirm any unknown identities. The ticks were then individually tested for spotted fevers R*ickettsia spp.* using nested PCR targeting the 17-kDa gene. To date, 596 ticks have been collected and tested from 12 tapirs; species included *Amblyomma colebes*, *A. ovale*, *A. tapirellum*, *Dermacentor latus*, *Ixodes tapirus*, *Ixodes luciae*. and *Rhipicephalus microplus*. 4.5% of *A. coelebs* tested positve for *R. amblyommatis*, 27.3% of *A. oblongooguttatum* tested positive for *R. monacensis*, 8.20% of *A. ovale* testing positive for *R. monacensis*, and 2.56% of *A. ovale* testing positive for *R. parkeri*. The data shows that the tapirs carry a variety of tick species that can house pathogenic species of *Rickettsia spp*., which could raise concern as tapirs begin to cross into with small farms and rural communities.

The effect of AlphaD3 on calcium and phosphorus homeostasis in kidney of laying hens

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As hens lay eggs over the course of their lives, calcium (Ca) and phosphorus (P) are depleted from the bone and used for eggshell formation. As hens age, they experience brittle bones and osteoporosis. As such, it is vital to understand renal Ca and P regulation and how vitamin D3 influences mineral homeostasis. AlphaD3 (1α-hydroxycholecalciferol), a synthetic analogue of vitamin D3, potentially improves conversion efficiency of vitamin D3, thereby improving mineral utilization by the hen. This research investigated the effect of dietary AlphaD3 in kidney across an extended egg production cycle on Ca and P homeostasis. A total of 384 commercial laying hens were sampled across the egg production cycle during 25 wks (early), 43 wks (peak), 80 wks (late), and 95 wks (extended) production at hours post-oviposition [HPOP] (1:30, 6:00, 15:00, and 21:00)] representing times of bone mineralization (1:30 HPOP), eggshell calcification (15:00 HPOP) and the transitions between them (6:00 and 21 HPOP). Hens were fed a control diet or the control diet with 3.5 µg of AlphaD3 (n=12 hens/age/time point/diet). Kidney was collected, total RNA extracted, and converted into cDNA. Relative expression of mRNA was evaluated by RT-qPCR, and data analyzed via a 3-way ANOVA and Fishers' LSD test. Significance was determined at ($p \leq 0.05$). Interactive effects of time and age were only observed for 24 hydroxylase (CYP24A1) expression, where at 21:00 HPOP, across all ages, levels were generally lower compared to 6:00 HPOP ($p \leq 0.05$). Additionally, main effects of diet were shown for CYP24A1 and 25-hydroxylase (CYP2R1), where hens fed AlphaD3 demonstrated higher expression ($p \leq 0.05$). Between 6:00 and 15:00 HPOP, expression of CYP2R1 gradually increased, then declined at 21:00 HPOP ($p \leq 0.05$). Expression of RXRA was significantly lower at 25 wks compared to remaining ages ($p \leq 0.05$), whereas RXRG increased between 25 wks to 80 wks, then gradually declined during extended production stages (95 wks) ($p \leq 0.05$). Finally, RXRA was lower at 21:00 HPOP compared to other time points ($p \leq 0.05$). These results suggest that AlphaD3 may elevate gene expression related to enzymatic conversion of vitamin D3, increasing renal Ca and P absorption. Renal absorption may also be influenced by Vitamin D genomic signaling, further affecting mineral availability. Together, dietary AlphaD3 may influence mineral transporter expression in the kidney, which could improve mineralization of bones and eggshells of laying hens.

Characterizing Mammary Ultrasound imaging and Mastitic infections in Dairy Heifers

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Though not lactating, dairy heifers are still at risk of developing mammary gland infections which could compromise their productive abilities, reproductive efficiency, and longevity in the herd. However, identifying mastitis in dairy heifers presents a challenge for dairy producers, requiring costly and time-consuming methods of microbial detection. Moreover, mastitis is most commonly subclinical and could go undetected for months causing lasting damage. The objective of this study was to characterize the healthy and mastitic tissue of the heifer's mammary gland via ultrasonography at various stages of development by correlating ultrasound imaging of quarters and culture results from collected heifer secretions. Holstein and Jersey heifers from the UGA Teaching Dairy were enrolled at approximately 9 months old (pre-pubertal and pre-mammary development). With a portable ultrasound and a convex probe, ultrasound observations on each quarter were recorded. Information recorded from these scans included characteristics parenchyma (depth, homogeneity, and echogenicity), and fluid (amount and presentation) as well as any abnormalities observed. Following this, mammary secretions from all 4 quarters were expressed if possible and collected into a labeled, sterile tube. Heifer secretions were cultured on blood agar plates in an incubator at 37 degrees c for 48 hours. Any growth was submitted to the UGA Veterinary Diagnostic lab for identification. Heifers collected from August 2023 to February 2024 were separated by quarters infected and uninfected. Infections were classified as either a *Staphylococcus aureus* (SA) or a non-aureus *Staphylococci* (NAS). Homogeneity was assessed relative to heifer age and infection status. There was a moderate positive correlation between heifer age and culturing of SA ($P<0.05$; r^2 0.56). The relationship between culturing an infection and heifer age remained weakly correlated when SA heifers were removed ($P<0.05$; r^2 0.31). Homogeneity decreased with the culturing of an infection ($P<0.05$). This novel technique and method of assessment has had little attention in literature and represents an opportunity for utilizing a valuable piece of equipment in multiple ways on dairy farms. Through this pilot study, the goal is to establish proper descriptions for characterizing mammary ultrasounds in relation to mastitic infections by which further research could establish guidelines for producers and veterinarians to follow.

Supergene Effects on Reproductive Response in Fire Ants

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The ‘social chromosome’ of the fire ant (*Solenopsis invicta*) contains a supergene composed of co-adapted alleles, leading to distinct genotypes with varying social and behavioral phenotypes. Most notably, the single queen (monogyne) and multiple queen (polygyne) social forms of the fire ant are controlled by differences in supergene genotype. We hypothesize that supergene-mediated changes in responsiveness to hormone signaling is a primary driver of behavioral variation between social forms. However, the precise mechanisms leading from an ant’s supergene genotype to its behavioral phenotype are unknown. Here we show that fire ant pre-productive queens (gynes) of different supergene genotypes display a differential response to hormone treatment. In our experimental assays, we found that the time it took a gyne to dealate (remove its wings) following treatment with methoprene (an insect juvenile hormone analog) differed between gynes sourced from monogyne and polygyne colonies (Mann-Whitney, $p = 0.0015$). Additionally, dealation time varied significantly more among polygyne gynes as compared to monogyne gynes (Levene’s test, $p < 0.001$). Our results indicate that hormone signaling likely plays an important role in the regulation of fire ant dealation, a behavior closely linked with the initiation of reproduction. Furthermore, our findings suggest that the observed variations in behavior may be mediated by the supergene. We are hopeful that this assay will be a starting point for more detailed examinations of the relationship between genotypic and phenotypic features of the fire ant.

Characterization of Muscle Fiber Number and Bundle Size of Commercial Pork Loins

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Pork is a vital protein source to people and accounts for a greater portion of global meat production than any other animal, with the loin being the most popular cut. When grading pork quality, key attributes to consider are as follows: texture, tenderness, color, and flavor. Tenderness is the most critical factor of these listed and it can be analyzed on a microscopic scale to determine impacts that muscle fiber types, spacing, and bundles have on meat quality. Therefore, the objective of this study was to determine muscle fiber bundle size and loin eye area of commercial pork loins. Pork loins were collected from ten lots of barrows and delivered to a processing plant. Boneless loins (N = 1215) were collected from the carcass's left side and sent to the University of Georgia Muscle Biology Laboratory for analysis. Upon arrival, loin eye areas (n = 1095) were collected by tracing the perimeter of the loin and measured using ImageJ. Loins were fabricated into medial, central and lateral sections, and two 1 cm3 portions were collected per section (n = 118). Two 10-cm cryosections per sample were stained using conventional hematoxylin and eosin staining procedures. Photomicrographs were collected per sample for muscle fiber bundle size and fiber number per bundle analyses. Data was analyzed as a completely randomized sample set with area as the fixed effect, and statistical significance was considered with $P < 0.05$. There was no treatment effect for numbers of fibers per bundle ($P = 0.789$); however, there was a treatment effect on bundle area ($P = 0.028$) where the medial section had more fiber per bundle ($P \leq 0.039$) than central and lateral which where not different from each other ($P = 0.827$). Conclusions that can be drawn from this study are highlighted by loin section and average bundle area statistics, where there were larger bundle areas with similar fiber amounts in the medial section of the pork loins.

Muscle Weakness and Dysfunction in a Murine Model of Hypophosphatasia

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Hypophosphatasia (HPP) is a rare genetic bone disease caused by a mutation in alkaline phosphatase (ALPL/TNSALP gene) in osteoblasts and characterized by abnormal bone and teeth development from defective bone mineralization. The TNSALP enzyme converts PPi to Pi, which then bonds with calcium to aid in bone mineralization. Clinical symptoms of HPP in humans include bone deformity, fractures, chronic muscle pain, and an altered gait. Muscle weakness is a common symptom, but the presentation of it is poorly understood due to the limitations of clinical human HPP studies. A genetically engineered sheep model of HPP has shown smaller muscle fiber size and abnormal mitochondrial structure, but no functional measurements of muscle contractile properties have been studied in animal models of HPP. The purpose of this project is to examine muscle function in a knockout mouse (ALPL-/-) model of severe juvenile HPP. Disease progression was observed in 31 mice using weight, body condition score, and behavioral metrics on the 10th, 12th, and 14th days during a 14 day period. Skeletal muscle mass, muscle contractile function, mitochondrial respiration function, muscle histological characteristics, and muscle morphology of myofibers were collected to evaluate muscle function. EDL muscle length, mass, and cross-sectional area were significantly lower in HPP mice compared to healthy WT mice. Histological staining showed no evidence of centralized nuclei, which often indicates muscle fiber damage, in HPP or WT mice. Microtubule structures in the skeletal muscles of the HPP mice were not impaired by disease either. The expression of embryonic myosin heavy chains (MyHC) was tested to account for the developing skeletal muscles of the 14 day old murine models, and HPP mice had a significantly lower percentage of fibers staining positive for MyHC. Initial mitochondrial data suggested lower complex I and complex II leak respiration rates in HPP mice, but further testing with the PCr CK-clamp technique showed no significant differences compared to WT mice. In conclusion, the HPP mouse model demonstrated muscle weakness similar to human patients with HPP but studying further development of the disease in non-lethal HPP could identify potential metabolic pathologies existing with the disease. Further exploration of skeletal muscle function in murine models of both severe and non-lethal HPP could advance knowledge of muscle-bone relationships and muscle weakness from the disease.

Impact of Grapevine Spacing and Cordon System on Carlos Muscadine Grape Berry pH, Acidity, and Sugar Content

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This study aims to evaluate the fruit quality of Carlos muscadine grapes grown under various vine spacing and cordon treatments. Vines were either grown in 10ft, 15ft, or 20 ft intervals with either a 2-cordon or 4-cordon system, vertically divided. A subsample of 80 berries from each treatment was collected and frozen whole to be later processed. Specifically, we focused on evaluating the pH, acidity, and sugar content of the homogenized berries using Titrino and Brix analysis. The data obtained are crucial in understanding the impact of vine spacing on fruit quality, providing growers with valuable insights for informed decision-making regarding cultivation practices. Results indicated variations in fruit quality based on different vine spacing and cordon treatments, suggesting potential strategies for enhancing grape quality. For vines 101-112 of the experiment, vines grown with four cordons had overall higher pH (6.9) and lower brix values (12.35) than those with two cordons (6 and 14.4 respectively). Additionally, vines grown at 20 ft spacing had higher pH and brix values compared to ones grown at shorter intervals, contrary to what was expected. This research contributes to advancing cultivation practices, facilitating the production of premium-quality grapes.

MICROBIAL RESPONSE TO DIFFERING LEVELS AND FORMS OF IRON IN SHEEP

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Iron is an essential mineral in dietary supplements across all species and aids in carrying out fundamental biochemical processes. The aim of this study was to observe the effects of differing levels of iron on the microbial activity of the gastrointestinal tract of sheep using two forms: iron sulfate and iron chloride. A random collection of sheep feces was obtained and utilized for the in vitro fecal mixed microbial fermentation used for this experiment. Iron additions were based on fecal iron content found in a previously collected sample, (FE), from an animal on the same diet in the same pasture. Following the fecal findings, iron sulfate and iron chloride stock solutions were made using the following increments: 0.00g (CON), 53.48g (0.5FE), 106.97g (FE), 213.93g (2FE), 320.90g (3FE). Samples in each treatment group were incubated for 4 and 24 hours and contents were evaluated for hydrogen, methane, and ammonia production at each time using the ANOVA and Tukey HSD program on STATA. Hydrogen and methane gas results showed that 3FE had a higher impact on hydrogen and methane gas production in comparison to CON, 0.5FE, and FE ($P < 0.05$). Ammonia concentrations indicated 2FE had a higher impact on ammonia production compared to CON, 0.5FE, and FE, whereas 3FE was found to induce greater ammonia production compared to CON and 0.5FE ($P < 0.05$). Changes in gas and ammonia production are correlated with microbial activity. However, the increase or decrease of mineral supplementation based on this study is not suggested as it is not representative of live sheep growth productivity. Further research into the impacts of iron supplementation in live sheep to determine the level maximum efficiency is needed.

Transplantation of induced neural stem cells reduces neuroinflammation and tissue damage in a piglet traumatic brain injury model

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Traumatic Brain Injury (TBI) is a leading cause of death and long-term disability in children. Patients face lifelong cognitive, behavioral, and motor function impairments due to tissue damage associated with TBI. However, there are currently no effective treatments for TBI approved by the Food and Drug Administration. Post-TBI transplantation of induced pluripotent stem cell-derived neural stem cells (iNSCs) offers the potential to repair the damaged tissue through neuroprotective, regenerative, and cell replacement mechanisms, thus improving recovery and long-term deficits. The objective of this study was to determine if treatment with iNSCs improves neuron and oligodendrocyte survival and reduces neuroinflammation leading to tissue recovery in a piglet traumatic brain injury model. Castrated, male pigs underwent controlled cortical impact surgery to induce TBI and received an intraparenchymal injection of iNSCs ($n = 6$) or PBS ($n=5$) at 5 days post-TBI. Sham animals ($n=6$) received no TBI. Brain lesion volume and midline shift were assessed via T2 weighted (T2W) imaging. Pigs were sacrificed at 12 weeks post-transplant and brains were collected for histological analysis. At 12 weeks post-transplant, T2W imaging showed a significant ($p<0.05$) decrease in lesion volume of iNSC-treated pigs in comparison to PBS control pigs. Midline shift also decreased significantly ($p<0.05$) in iNSC-treated pigs relative to non-treated pigs. Histological analysis revealed a significant ($p<0.05$) increase in NeuN+ neurons in iNSC-treated pigs compared to PBS control pigs, signifying that iNSC treatment led to neuronal protection post-TBI. Additionally, Iba1 and GFAP levels were lower in iNSC-treated pigs relative to non-treated pigs, indicating iNSC treatment mitigated microglia and astrocyte activation at the lesion site. Oligodendrocyte populations were decreased in PBS treated pigs, but not iNSC-treated pigs, meaning iNSC treatment improved oligodendrocyte survival. iNSC treated pigs also demonstrated significantly ($p<0.05$) increased DCX+ neuroblasts at the lesion border (LB), abventricular subventricular zone (aSVZ), and in the ventricular lining of the subventricular zone (vSVZ) compared to PBS controls, signaling that iNSC treatment improved neuroblast proliferation and migration. This study demonstrates the capacity of iNSCs to reduce neuroinflammation and enhance brain tissue recovery post-TBI, paving the way for a potential new treatment for TBI.

Green Tea Extract Disrupts Sex Determination in Avian Embryos

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Green Tea extract contains catechins, and while they can be beneficial antioxidants, they can also bind to estrogen receptors and thereby disrupt the effects of estrogen. To test this, fertilized quail eggs were injected with a low or a high dose of green tea extract, along with a control injection (n=56 per group), into eggs on day four of development, which is when gonadal sex determination occurs. The sex ratios of the uninjected and control eggs did not differ (37% male vs 53% male, p=0.21). However, sex ratios of both the low and high groups differed significantly from those of the uninjected eggs (low: 70% male, high: 67% male, UN: low, p<0.01, UN: high, p=0.03). Our findings indicate green tea extract does disrupt the sexual differentiation of female embryos. More work needs to be done to determine whether lower doses exert the same effect and whether doses provided at other developmental stages have similar effects.

Investigating Neurodegeneration on-set post Mechanical Injury in a 3D TBI-on-Chip Platform

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Microfluidic devices allow the incorporation of 3D hydrogels that can support the maintenance of neural cultures and mimic in vivo conditions. However, many in vitro 3D models that mimic the TBI microenvironment do not provide a detailed assessment of TBI-related neurodegeneration on-set and progression. In order to address this gap in knowledge, we have developed a novel microfluidic device that can be used to investigate the early onset of neurodegenerative factors, tau and amyloid Beta, in response to mechanical injury. Human prefrontal cortex (hPFC) were seeded in volume constrained reservoirs created using a custom designed mold. Following the maturation of neurons, we induced a weight drop of 6 g from 15 cm, which resulted in the deformation and injury of the hPFC neurons. Immunocytochemistry and western blot were performed 0 h, 24 h, 72 h, 5 d, and 8 d post injury to assess the presence of tau and amyloid-beta isoforms at their different pathological stages. Among tau and amyloid-beta, there was significant upregulation in the injury group compared to the control. Our results clearly demonstrate the feasibility of inducing a weight-drop injury and monitoring the onset of neurodegeneration post-injury. Collectively, this study establishes the application of a simple and inexpensive 3D neuronal cell culture platform to model injury progression and to evaluate the effectiveness of potential treatments.

THE IMPACT OF COPPER CONCENTRATIONS ON THE MICROBIOME OF SHEEP

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Copper (Cu), an essential trace mineral, plays a pivotal role in various processes including metabolism, erythropoiesis, and the function of the central nervous system. The study was conducted to investigate differing concentrations of Cu in the microbiome of sheep. Sheep tend to have a greater sensitivity to Cu toxicity leading to increased susceptibility to Cu poisoning (Borobia et al., 2022). The surplus amount of Cu disrupts the gut microbiome, reducing the diversity of bacterial species leading to pathogenic infections and the inflammation of the lining of the gastrointestinal tract (Ma et al. 2021). To understand the impact of Cu on the gut microbiome, fecal samples were collected to test five different levels of Cu in the chloride and sulfate forms. The levels of concentrations consisted of CON as the control, 0.5xCu as half the value of copper added, Cu as the base value of copper added, 2xCu as double value of copper added, and 3xCu as triple value of iron added. At hour 24, hydrogen gas and methane gas were collected. After analyzing the data for copper, statistical significance was found among seven treatment effects ($P < 0.05$; Table 5). In Table 5, when compared to CON ($P < 0.05$), the following levels had a greater impact of copper on hydrogen and methane gas production resulting in treatment effects: 3xCu ($P = 0.00$), 2xCu ($P = 0.00$), Cu ($P = 0.007$), and 0.5xCu ($P = 0.004$). The highest copper concentration, 3xCu, displayed a higher impact of copper on methane and hydrogen production than 0.5xCu ($P = 0.010$). Furthermore, while comparing 2xCu to Cu, 2xCu displayed significant results of copper on hydrogen and methane production ($P = 0.0046$). Finally, a treatment effect was determined when analyzing 3xCu in contrast with Cu ($P = 0.006$). There were no significance treatment effects for any of the levels pertaining to ammonia data ($P< 0.05$). Based on the results of the study, we recommend utilizing the base value of Cu for sheep. Further research is necessary to conclude evidence on how the concentration of trace minerals impacts the number of bacterial species in the microbiome of the sheep.

A Novel Neuroprotective Agent Limits Tissue Damage and Promotes Recovery in a Piglet Traumatic Brain Injury Model

Abigail Laury, Animal Biosciences Major, Department of Animal and Dairy Science; Presented in 2024

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Traumatic brain injuries (TBIs) remain a serious concern in the modern medical world, specifically in pediatrics where almost half a million children suffer a TBI annually. With no current FDA-approved TBI treatment available, the cognitive, behavioral, and motor function impairments observed in a majority of TBI cases are cause for concern and ongoing research. Neuroprotectant therapies have gained traction with positive results in treating TBI in rodent research models. However, the lack of therapeutic translation from rodent research to the clinic has highlighted the need to make therapies more translatable to human medicine through more rigorous testing in an anatomically and developmentally more comparable animal model- the swine TBI model. The objective of this study was to determine if treatment with a novel neuroprotective agent mitigates intracerebral brain damage and improves tissue recovery in a piglet model. Castrated, male pigs underwent controlled cortical impact surgery to induce TBI and received a subcutaneous injection of a low dose (LD) neuroprotectant (n=10), high dose (HD) neuroprotectant (n=10), or placebo (n=10) every 8 hours for 5 days. Lesion volume was assessed via T2 weighted (T2W) imaging, intracerebral hemorrhage was assessed via susceptibility weighted angiography (SWAN), cerebral blood flow was assessed via arterial spin labeling (ASL) at 1, 7, and 42 days post-TBI. Pigs were sacrificed at 42 days and brains were collected for histological analysis. Overall, there was a significant decrease in lesion volume, hemorrhage volume, and improvement in cerebral blood flow observed in LD and IV treated pigs compared to placebo and HD pigs at 1, 7, and 42 days. Additionally, LD and IV treated pigs exhibited significant neuron survival and an increase in the number of migrating neuroblasts at lesion border compared to the placebo and HD pigs. These results reveal a physiological improvement in the neural landscape and tissue recovery for treated pigs with the novel neuroprotectant, indicating the neuroprotectant's potential as a treatment for TBI patients.

Construction of bioreactors to determine the efficacy of octanoic acid in inhibiting methanogenesis

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The objective of this study was to construct two bioreactors to determine the efficacy of octanoic acid in inhibiting methanogenesis in an open-culture anaerobic microbiome at a neutral pH. The pKa of octanoic acid is 4.8, which means, the dissociated form (octanoate) will predominate. However, current models suggest the undissociated forms of organic acids are primarily responsible for microbial inhibition. Two identical 5-L continuously-stirred tank reactors (CSTRS) were built from ground up using available resources. The reactors were inoculated with effluent from an anaerobic digester treating milk processing wastewater. The reactors are being operated at a mesophilic temperature of 37°C and a hydraulic retention time of 40 days. Each reactor is being fed a mixture of milk processing wastewater, supplemented with minerals, vitamin, and trace metals solutions. The methane production is being measured routinely using gas chromatography to monitor the presence and activity of methanogens. The biogas composition has been averaging 60% methane and 40% carbon dioxide, prior to octanoic acid supplementation. Effluent quality is also being characterized. If octanoic acid proves an effective suppressant of methanogenesis in open-culture microbiomes, this result would have broad implications in the field of biotechnology and the animal feed industry. Octanoic acid could be produced using precision fermentation approaches and then used as a feed-additive to suppress enteric methane production in ruminant livestock, reducing greenhouse gas emissions by this sector.

Correlating a Candidate Gene to Virulence in Soybean Cyst Nematode

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Soybean production in the United States is threatened by an endoparasitic roundworm known as the soybean cyst nematode (SCN, *Heterodera glycines*). Planting resistant soybean cultivars is the principal management strategy for managing SCN field populations. However, repeated use of the same resistance genes in soybeans has led to virulent SCN populations that can complete their life cycle on resistant plants. The genes underlying SCN virulence remain to be discovered. A candidate virulence gene was previously identified by analyzing single nucleotide polymorphisms (SNPs) correlated with virulence through pool sequencing SCN nematode populations non-adapted and adapted to reproduce on resistant soybeans. The objective of this work was to confirm two potentially functional SNPs identified within the candidate gene and test for a correlation to virulence in an unrelated pair of populations either non-adapted or adapted on the same resistance source. This was achieved by genomic DNA extraction from individuals of each population, followed by polymerase chain reaction amplification, gel electrophoresis verification, column purification of the product and Sanger sequencing of the target region. The results of Sanger sequencing showed that 100% of the individuals in each of the two adapted populations were homozygous at the two SNPs whereas the two non-adapted populations had a mix of homozygous and heterozygous individuals at both SNPs. Taken together, these SNPs exhibited a 100% correlation to virulence in two unrelated populations adapted for the same virulence trait providing additional support of a role for the candidate gene in SCN virulence on resistant soybeans.

Changes in Expression of Genes Mediating Calcium Uptake in the Ileum of Laying Hens at 25 and 95 Weeks of Age

Kendall Long, Biological Science Major, Department of Poultry Science; Presented in 2024

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In laying hens, daily egg formation is reliant upon calcium homeostasis. Imbalances in intestinal mineral uptake and utilization in older hens (95 weeks of age) leads to depleted skeletal reserves and impaired eggshell integrity. This project aimed to identify changes in intestinal physiology associated with calcium uptake and utilization across the egg production cycle and during stages of bone mineralization [1:30 HPOP], calcification of the eggshell [15:00 HPOP], and transitional periods between these [6:00 HPOP] and [21:00 HPOP] (n=12 hens/age/time point). The mRNA expression patterns of calcium transport-related genes in the ileum were examined at 25 and 95 weeks of age using RT-qPCR. Data were analyzed using a two-way ANOVA, with Fisher's LSD test employed to compare results in cases of significant findings ($P \leq 0.05$). There were no significant age-by-HPOP interactions observed. Accordingly, individual effects of age and HPOP are presented. Genes related to hormonal signaling, such as vitamin D receptor (VDR), were greater at 95 weeks and had higher expression during 15:00 and 21:00 HPOP ($P \leq 0.05$). Additionally, parathyroid hormone receptor 1 (PTH1R), and calcitonin receptor (CALCR) were greater at 95 weeks but had no significant change in HPOP ($P \leq 0.05$). The calcium chaperone calbindin (CALB1) was higher at 95 weeks ($P \leq 0.05$), and expression of plasma membrane calcium transporter 1 (PMCA1) and CALB1 were highest at 21:00 HPOP ($P \leq 0.05$). Results of this study may be due to a compensatory response resulting in metabolic changes associated with aging. Findings can be used to improve nutritional strategies aimed at optimizing intestinal mineral absorption.

Evaluating Micro-UV Fluorescent Powder as a Surrogate for Fungal Plant Pathogen Spores

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Studying fungal plant pathogen spore dispersal is challenging because the spores are small, either clear or darkly colored, and many require PCR identification. A brightly colored particle that could function as a surrogate for fungal spores could facilitate important empirical research because the surrogate particles would be readily distinguishable from fungal spores, they could be experimentally placed and not cause disease but reveal patterns of potential disease spread in different plant pathosystems. We conducted experiments to estimate the velocities of UV fluorescent particles ranging from approximately 5 to 40 microns in size and compared them to published velocity measurements for spores of soybean rust, Phakopsora pachyrhizi, an economically important fungal disease. Our findings reveal that the velocity of extra small UV fluorescent particles closely matches that recorded for soybean rust spores, which were measured at 0.0194 m/s and 0.0187 m/s, respectively. This suggests that specific sizes of UV fluorescent powder may be a viable surrogate for fungal spores and potentially useful for understanding the unknown aspects of plant disease spread.

Impacts of Probiotic Treatment on Foodborne Pathogenic Bacterial Populations

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Foodborne pathogens have caused global public health and safety issues. These foodborne pathogens can live asymptomatically in the intestinal tract of cattle, causing contamination during carcass processing. One pathogen in particular, Salmonella, is an issue because of its ability to evade post-harvest mitigation strategies. Because of this, pre-harvest mitigation strategies hold promise for reducing Salmonella burden in cattle. One strategy is the use of direct fed microbials (DFM) or probiotics, which have shown the ability to reduce foodborne pathogens in cattle. However, little research exists investigating this strategy against Salmonella. Therefore, the objective of this study was to analyze the impact of DFM *Lactococcus lactis* and *Lactobacillus diolivorans* on *Salmonella Typhimurium* populations. Fecal fluid was collected from two cannulated dairy steers and added to one of three treatment groups with five (n=5) tubes per treatment: *Lactococcus lactis* (LL), *Lactobacillus diolivorans* (LD), both dosed at 10^9 CFU/mL, and no DFM supplementation served as control (CON) at two timepoints: 4 and 24 hours. All tubes were inoculated with approximately 10^2 CFU/mL of *S. Typhimurium*. At each timepoint, tubes were serially diluted and plated to determine *S. Typhimurium* concentration levels. Another study with the same design utilized an inoculation dose of approximately 10^4 CFU/mL of *S. Typhimurium* and compared LL and CON treatments. In the first study there were treatment effects for 4 and 24 hours ($P < 0.04$). At 4 and 24 hours LL, had lower *S. Typhimurium* concentration levels compared to LD ($P < 0.04$), but did not differ from CON ($P > 0.19$). Treatments LD and CON did not differ at either timepoint ($P > 0.60$). When *S. Typhimurium* was inoculated at 10^4 CFU/mL, there was a treatment effect at 4 and 24 hours ($P < 0.01$). *Lactococcus lactis* has lower *S. Typhimurium* counts compared to CON at both time points. These results indicate that *Lactococcus lactis* can demonstrate anti-pathogenic activity against *S. Typhimurium*. Specifically, *Lactococcus lactis* caused reduction in *Salmonella Typhimurium* in hindgut fermentation. These results suggest that *L. lactis* may have the ability to reduce Salmonella in an *in vivo* study.

Isolating and Characterizing Extracellular Vesicles

Leah McCarthy, Regenerative Bioscience Major, Department of Animal and Dairy Science; Presented in 2024

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Extracellular vesicles (EVs) are cell-secreted nanoparticles which carry bioactive molecules and are crucial in facilitating cell-to-cell communication and immune modulation. The field of extracellular vesicle research has grown exponentially in the last decade to encompass diagnostic and therapeutic EV preparations from a variety of cell sources. However, EV isolation and characterization methods are poorly standardized and inconsistent, particularly across different biological sources, which severely limits rigor and reproducibility. This study focused on the development and optimization of an innovative flow cytometry-based EV characterization method, using the NanoFCM NanoAnalyzer. This instrument allows for precise investigation of the subpopulations comprising heterogenous nanoparticle samples, through the use of antibody-based EV labeling. The NanoAnalyzer quantifies nanoparticles presenting EV transmembrane proteins, and allows for detailed population analysis based on the vesicular identity of each individual nanoparticle. This is valuable for determining the EV yield and purity from different sources, and allows us to compare the population composition of purified EVs. Through this study, we have characterized the nanoparticle populations of EVs from various biological sources, including neuroepithelial cells, neural stem cells, and breast cancer cells. The results of the study demonstrate the promise of this technique for revolutionizing EV characterization based on size, concentration and EV markers. Establishing standardized characterization methods is critical to generating a consistent and reliable supply of EVs, and will better enable us to define critical quality attributes for manufacturing therapeutic EV products.

Feeding Microalgae Meal and Flaxseed to Steers: Effects on HRI Beef Patty Sensory

Isabella Messick, Biological Science Major, Department of Poultry Science; Presented in 2024

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Beef is one of the most popular red meat sources in the United States due to its excellent nutritional value; however, beef products contain elevated saturated fatty acid levels which scientists linked to increased cholesterol levels and a greater cardiovascular disease risk. Studies demonstrated the benefits of supplementing dietary omega-3 fatty acids in beef finishing diets to reduce these potential negative impacts on human health, but detrimental palatability concerns have arisen in the form of off-flavors. The objective of this study was to conduct an HRI sensory panel to determine the effects of feeding a microalgae/flaxseed blend to steers on HRI ground Round and Chuck beef patty palatability ratings. Steers (N=28) were randomly selected to be fed either a conventional feedlot diet (CON) or a conventional diet with omega-3 enhancement (OMG). Round (90/10) and Chuck (80/20) patties were produced and assigned to one of four storage times in an HRI box: 0, 30, 60, or 90 days. Panelists (N=16) were trained, and 21 sessions were held with eight samples per session, consisting of four CON patties and four OMG patties. Patties were thawed for 20 hours, cooked at 204°C to 71°C, and divided into six wedges. Panelists analyzed the patties based on beef-flavor intensity, juiciness, cohesion/binding, and off-flavor. In Chuck patties, there were no Treatment × Time interactions nor Treatment main effects beef flavor, cohesion, juiciness, and off-flavor ($P>0.05$), but there were Time main effects where patties held for 0 days had smaller sensory ratings ($P<0.05$). In Round patties, there were no Treatment × Time interactions, storage time, or treatment main effects for cohesion and juiciness ($P>0.05$). For beef flavor and off-flavor, there was no Treatment × Time interactions nor Treatment main effects ($P>0.05$); however, there were Time main effects where patties held for 0 days had smaller ratings compared to all other storage times ($P<0.05$). These data suggest omega-3 fatty acid enhancements of Chuck and Round ground beef patties had no detrimental effects on panel palatability ratings when stored in an HRI manner.

The physiology of calcium and phosphorus regulation in the kidney of laying hens following the production cycle and daily egg formation

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Vitamin D3 plays a critical role in regulating renal calcium and phosphorus homeostasis to ensure they are available for eggshell mineralization. Mineral use in older hens is less efficient, resulting in fewer and less viable eggs and more brittle bones. Supplementation with AlphaD3, a pre-activated analogue of vitamin D3, could improve conversion efficiency of vitamin D3 and improve renal mineral absorption in laying hens. This study sought to identify gene expression associated with calcium hormonal signaling and mineral transport in the kidney of hens supplemented with AlphaD3. Kidney tissue was collected at 4 times post-oviposition [HPOP, (1:30, 6:00, 15:00, and 21:00)] and 4 ages (25w, 43w, 80w, and 95w) from hens fed a control or AlphaD3 diet (n=12 hens per time point/age/diet). Genes were analyzed using RT-qPCR and data were analyzed using a 3-way ANOVA and Fisher's LSD test when ANOVA indicated significance ($P \leq 0.05$). There were no significant differences between diets, however several age and HPOP effects were observed. Expression of calcium sensing receptor (CASR) increased between 25 and 43w, with similar levels at 80w to then decrease at 95w ($P \leq 0.05$). Parathyroid hormone receptor (PTH1R) had low expression at 25 and 43w, followed by an increase at 80w and decrease at 95w ($P \leq 0.05$). The calcium chaperone calbindin (CALB1) increased between 25 and 43w and then stayed at constant levels($P \leq 0.05$). The calcium transporter transient receptor potential cation channel subfamily 6 (TRPV6) had elevated expression between 25 and 43w and then decreased at later ages ($P \leq 0.05$). Changes over the daily laying cycle indicated greater CASR at 15:00 HPOP ($P \leq 0.05$). However, expression of PTH1R was higher at 1:30 and 6:00 HPOP, then decreased at 15:00 and 21:00 HPOP ($P \leq 0.05$). Expression of CALB1 increased between 6:00 and 15:00 HPOP, with similar levels at 1:30 and 21:00 ($P \leq 0.05$). Calcium transporter TRPV6 peaked at 15:00 HPOP and decreased at 21:00 HPOP ($P \leq 0.05$). An age by HPOP interaction was observed for sodium-dependent phosphate cotransporter 2 where at 25 and 43w, there was a peak in expression at 15:00 HPOP, however at 80 and 95w, levels at 15:00 decreased to similar levels as 21:00 HPOP ($P \leq 0.05$). These results indicate that at 15:00 there is greater calcium reabsorption as during peak eggshell formation, accompanied by high phosphorus excretion from bone breakdown. However, in older hens, renal mineral reabsorption or excretion appears to occur at lower rates.

Assessment of a Novel Neuroprotective Agent on a Piglet Traumatic Brain Injury Model through Magnetic Resonance Imaging and Histological Analysis

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Traumatic brain injuries (TBI) are prevalent among children 0-14 years old and can stunt cognitive, emotional, and physical development. The main source of TBI treatments have stemmed from rodent models providing a helpful insight into TBI pathology, but there are limitations when applying those treatments to humans. The stark differences in complexity and functionality between humans and rodents make many of these treatments obsolete. Neuroprotective therapies are an area of interest because they aid in recovery, regeneration, and preservation which can improve functional recovery. The objective of this study was to determine if treatment with a novel neuroprotective agent mitigates acute inflammatory responses and improves brain recovery in a piglet TBI model. Castrated, male pigs underwent controlled cortical impact surgery to induce TBI and received either an intravenous (IV) neuroprotectant (n=10), a subcutaneous injection of a low dose (LD) neuroprotectant (n=10), high dose (HD) neuroprotectant (n=10), or placebo (n=10) every 8 hours for 5 days. Lesion volume was assessed via T2 weighted (T2W) imaging, diffusivity was assessed via diffusion weighted imaging (DWI), and white matter integrity was assessed via diffusion tensor imaging (DTI) at 1, 7, and 42 days post-TBI. Pigs were sacrificed at 42 days and brains were collected for histological analysis. Overall, a significant ($p<0.05$) decrease in lesion volume was observed in LD and IV treated pigs along with a significant increase in white matter recovery compared to placebo and HD pigs at 1, 7, and 42 days post-TBI. Additionally, a significant ($p<0.05$) improvement in diffusivity was observed in LD treated pigs compared to IV, HD, and placebo pigs at 1 and 7 days post-TBI. LD and IV treated pigs exhibited a significant ($p<0.05$) decrease in Iba1+ microglia activation and GFAP+ astrocyte activation compared to placebo and HD treated pigs. These results indicate that treatment with the IV and LD novel neuroprotective agent led to the best recovery in the piglet TBI model which provides encouraging results for improving outcomes in human TBI patients.

Exploring Differential Expression of Zona Pellucida Proteins in the Germinal Disc Region of Flamingo Eggs

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The inner perivitelline layer (IPVL) plays a critical role in avian fertilization, acting as the site of sperm binding and penetration during fertilization. In species like the turkey and chicken, studies have demonstrated a differential abundance of zona pellucida (ZP) proteins, particularly ZPB2, between the germinal disc (GD) and non-germinal disc (NGD) regions of the IPVL. This proposal aims to extend this line of inquiry to the Chilean Flamingo, an avian species with distinct reproductive biology, to understand if similar differential abundance of ZP proteins exists and how it might contribute to the species-specific aspects of fertilization. Both a GD and NGD region was isolated from Chilean Flamingo eggs that were donated by Zoo Atlanta. The IPVL from the GD and NGD regions were sonicated and protein concentration determined suing a BCA protein assay. StainFree precast gels from Bio-Rad were used to allow for quantitative Western blotting using custom ZPB1, ZPB2, and ZPC antibodies. Quantitative comparison of these proteins between the GD and NGD regions was completed using ImageLab software from Bio-Rad. Similar to both turkey and chicken, the relative abundance of ZPB1 and ZPC were similar between GD and NGD region. The concentration analyses for ZPB2 remain unclear possibly due to sequence differences at the target region of the protein. Further research is needed to determine if ZPB2 is more abundant at the GD region in other avian species. Additionally, sequence analyses of flamingo ZPB2 could provide insight into if changes in the sequence of ZPB2 contribute to speciation.

The Response From Elementary Agriculture Teachers on Extended Day / Extended Year Added to Their Contracts

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Elementary Agriculture Education (EAE) Teachers are financially compensated the same as elementary core class teachers, however, many EAE Teachers additional responsibility overseeing the agriculture program animals and facilities. Extended day/Extended year contracts are common among grade 6-12 Agriculture Teachers to provide compensation pay for working during the summers for taking care of the programs animals and other resources that must be kept up order for programs to remain operational. Identify the number of extended year contract days appropriate for Georgia Elementary Agricultural Education Teachers. A survey was created and distributed using Qualtrics and sent out to 49 Elementary Agricultural Teachers, of those, 34 completed the survey. Researchers used several different styles of questions ranging from fill in the blanks, to multiple choice and scales. The questions ranged from basic information like school demographics to questions about how interested on a scale of 1-10 (1="no interest" and 10="very interested") how interested are they in bringing their students to FFA competitions such as forestry id, poultry evolution, livestock evolution, etc. Researchers asked if additional days were made available how willing would they be to complete activities related to FFA on the same interest scale. Researchers asked more questions gauging how many additional days teachers would need beyond their regular 9- month contracts and how many additional hours are required to take care of their school's resources like greenhouses and animals. Of the 33 teachers who responded when asked how many additional days (summer days) they wanted to add to their contract the average was 12.82 days. However, the Mean does not accurately reflect teachers' interests. Not all schools are the same, some do not have greenhouses or animals that need attention over the summer break. Five teachers responded with they want no additional days while 2 responded they want 40 additional days. The rest of the teachers fell within these days in a bimodal distribution. The results show that not all EAE teachers require the same number of additional days or have an interest in participating in FFA events over summer. When creating the Extended Day / Extended year it would not be beneficial to anyone connected to have a standard for all EAE teachers to follow but instead an individualized approach is recommended to allocate resources for each teacher and program.

Determining Accuracy of Cow-Side Tests for Subclinical Mastitis Detection at Dry Off in Dairy Cattle

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Blanket dry cow therapy (BDCT) accounts for at least 1/3 of antibiotic use on dairy farms; however, with an increasing call to reduce antibiotic usage, other options must be evaluated. Rather than treating all 4 quarters of an udder before a 2-month non-lactating dry period (BDCT), producers could implement a system to select infected or at-risk quarters for antibiotic treatment, i.e., selective DCT (SCDT). On-farm tests include the California Mastitis Test (CMT), milk conductivity (MC), somatic cell count (SCC), and differential SCC (DSCC) as determined by a Qscout® Farm Lab. The current objective was to compare the effectiveness of these cow-side tests in selecting cows for SDCT, with an emphasis on distinctions between lower cost, rapid tests (CMT and MC), quantitative objective tests (SCC), and more costly, yet targeted tests (DSCC). The CMT is a subjective, visual scoring system related to SCC. The MC is indicative of ions in the milk typically increasing during inflammation and infection. The SCC is a numerical reporting of cells in milk where infected quarters are usually ≥ 200,000 cells/mL. The Qscout® DSCC is an algorithm-based technology that assesses the distribution of white blood cell types. Milk samples were collected from lactating dairy cows (n=39) at the UGA Teaching Dairy 48 hours prior to dry off. The MC, CMT score, SCC, and DSCC were determined for each quarter. To determine infection status for diagnostic comparison, milk samples were plated on blood agar and incubated at 37ºC for 48 hours. If bacterial growth was observed, the quarter was diagnosed as infected. Fisher's exact tests were conducted with specificity and sensitivity reported to assess the diagnostic reliability relative to culture. Use of DSCC (P=0.0017) and SCC (P=0.0003) is statistically appropriate to distinguish between infected and uninfected, whereas CMT and MC were not (P>0.05). Sensitivity of DSCC and SCC was equivalent at 78%, but SCC was more specific at 83%, followed by the Qscout® DSCC at 76%. In the context of mastitis diagnosis, sensitivity would be of higher importance to reduce missed positive cows, but when similar, higher specificity would also be desired. Ultimately, SCC was the most accurate (82%) followed by DSCC (76%). Both DSCC and SCC would be good diagnostic indicators relative to culturing for mastitis detection, though producers would need to compare economic implications of utilizing these strategies.

Evaluating the Impact of Clindamycin on Mitochondrial Function Using Rooster Sperm Motility as an Indirect Assay

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Previous research has established that certain antibiotics can adversely affect mitochondrial function. However, the impact of clindamycin remains unexplored. Mitochondria play a crucial role in energy production, and their dysfunction can have significant cellular consequences. Sperm motility is highly dependent on mitochondrial function, making it an ideal model for studying mitochondrial impacts. This study aims to assess the effects of clindamycin on mitochondrial function using an innovative indirect assay based on rooster sperm motility. Rooster sperm will be collected from stock birds at the UGA Poultry Research Center using standard avian sperm collection techniques. The sperm samples will be divided into multiple groups, each subjected to different concentrations of clindamycin, ranging from low to high doses. A control group will be maintained without antibiotic exposure. Post-exposure, sperm motility will be assessed using the established Accudenz assay to obtain objective and quantifiable measurements of sperm motility parameters. The data will be analyzed to determine the dose-response relationship between clindamycin exposure and sperm motility. This study expects to find a correlation between clindamycin exposure and changes in sperm motility, which would indirectly indicate mitochondrial dysfunction. Understanding the impact of clindamycin on mitochondrial function is vital, given its widespread use in treating bacterial infections. Additionally, establishing a novel, non-invasive assay for mitochondrial function using rooster sperm motility could provide a valuable tool for future toxicological and pharmacological studies.

Evaluating Subclinical Mastitis and Its Effects on Milk Yield and Somatic Cell Counts Over Time

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Subclinical mastitis (SCM) is a type of mastitis commonly caused by microbial infection. Unlike clinical mastitis there are no visible abnormalities of the udder or in the milk. Rather, the number of cells in the milk (i.e. somatic cell count [SCC]), particularly white blood cells, increase as a result of infection and inflammation. When SCC increases beyond 200,000 cells/mL and microbial growth is detected, the animal typically receives an antibacterial therapy, which should support mammary health and milk production. Our hypothesis is that cows successfully cured with antibacterial therapy will have greater milk yield over time compared to cows that failed to successfully cure after therapy. Milk from quarters ($n=38$) with SCM was aseptically collected for assessment of SCC and bacterial presence prior to a 2-day regimen of intramammary treatment with Spectramast LC. Post-treatment milk samples were collected 7, 14, 28, and 35 days after initiation of treatment. If no bacterial growth was detected in any post-treatment sample, the infection was recorded as a “cure” (CURE), whereas a “fail to cure” (FTC) was recorded if growth was detected in any post-treatment sample. Milk yield (MY) was also documented on day 0 and at each sample collection post-treatment. The MY and SCC were analyzed with repeated measures ANOVA. Results demonstrated that the overall cure rate was 44.74%. The average SCC at time of diagnosis (day 0) for CURE quarters was 1095.77 ± 216.72 cells/mL whereas the average SCC for FTC quarters was 1559.57 ± 207.53 cells/mL, though not significant ($P>0.05$). However, SCC did differ between CURE vs FTC at days 7, 14, 28, 35 where CURE had lower SCC ($P<0.05$). Our data showed that a decrease in SCC following SCM treatment can be an indicator of improved mammary health with successful cure compared to SCM failing to cure following intramammary therapy. In contrast to our hypothesis, MY did not differ at time of diagnosis or across time post-treatment between CURE and FTC. Though disappointing, we did not investigate milk yield beyond 35 days post-treatment. Chronic SCM is associated in many studies with reductions in MY over the course of an entire lactation, especially in mature cows. Moreover, given our small sample size we did not analyzed data according to pathogen, a distinction that with additional data may yield interesting results given previous literature.

The effect of iron injection levels and second iron injection on growth performance and hematological parameters of piglets

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This study was conducted to evaluate the effect of intramuscular iron-dextran injection to suckling pigs at either a high level or with two doses on preweaning growth performance and hematological parameters. At d 1 of age, a total of 36 pigs (1.56 ± 0.13 kg) from 6 sow litters with litter size greater than 10 pigs were selected, and six piglets per litter were assigned to 3 treatments based on body weight and sex. Treatments were: 1) NC: 200 mg intramuscular iron injection at d 1 of age, 2) PC: 400 mg intramuscular iron injection at d 1 of age, 3) NC+IRON: 200 mg intramuscular iron injection at d 1 of age and 200 mg iron injection at d 7 of age. The body weight, hemoglobin, and hematocrit levels were measured at d 1 (before initial iron injection for all treatments), 3, 7 (second dose for the NC+IRON treatment), 9, 12, and 19 (weaning) of age. A repeated measures ANOVA was used to analyze body weight, hemoglobin, and hematocrit results. There were no significant differences in body weight, hemoglobin, and hematocrit levels among iron injection treatments ($P>0.89$) and no interactions between iron injection treatment and day of age ($P>0.64$) from d 1 to 19 of age, although hemoglobin and hematocrit levels were numerically greater in the PC and NC+IRON treatments at d 19 of age (129.2, 133.4, and 133.82 g/dL hemoglobin for the NC, PC, and NC+IRON treatments, respectively). Hemoglobin and hematocrit levels declined ($P<0.01$) from d 1 to 3 of age regardless of iron injection and then increased until weaning (d 19 of age; 86.9, 78.1, 87.6, 94.0, 105.7, and 132.1 g/dL hemoglobin for d 1, 3, 7, 9, 12, and 19 of age, respectively), where the hemoglobin levels were similar between d 1 and 7 of age ($P>0.76$) whereas the hematocrit levels were greater at d 7 of age compared with d 1 of age ($P<0.05$; 31.8% vs. 29.1%). Hemoglobin levels were significantly correlated with hematocrit levels ($P<0.01$), and the correlation coefficients were highest at d 1 and 3 of age and weaning (d 19 of age; $r > 0.92$). In conclusion, high hemoglobin and hematocrit levels were observed in all treatments, resulting in no significant difference in the preweaning growth performance of piglets. Although the iron injection was performed at d 1 of age, hemoglobin and hematocrit levels decreased in the first few days of life and then increased. Hemoglobin and hematocrit values are positively correlated from birth to weaning.

Effects of Age on Peak Force to Fracture Bones in Turkeys

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Turkey toms reach 40 to 50 pounds in a 20-week production cycle, primarily enabled by optimized nutrition and genetic selection. The genetic selection program in turkey has favored meat deposition traits, whereas the accumulation of bone mass has often been ignored. This disproportionate growth between bones and muscles can exert more stress on turkey bones during growth, potentially resulting in fractures or other abnormalities. The fast growth rate of turkeys is also associated with lameness and mortality, representing animal welfare and production concerns. The aim of this study was to identify how age or age-related changes in body weight impact biomechanical measurements of the long bones of male commercial turkeys. In this study, femur and tibia samples from turkeys were collected at 8 and 12 weeks of age. The samples were then loaded in a 3-point bending set up to measure the maximum force to fracture. Additionally, the weight, length, midpoint, anterior/posterior diameter, and medial/lateral diameter were measured. Data was then analyzed using linear models with age as the fixed effects. Both the femur and tibia bones from the 8-week-old individuals were shown to have a lower peak breaking force than the 12-week-old individuals. The femur bone saw a 28.15% increase in the peak breaking force from the 8-week to the 12-week-old groups, while the tibia showed a 60.26% increase in peak breaking force. Tibia and femur weight, length, anterior/posterior diameter, and medial-lateral diameter all increased between 8 and 12 weeks of age. Body weight increased by a greater percentage than bone strength in both groups, increasing by 188% between 8 and 12 weeks of age. These results show that body weight increases at a faster rate than bone size and strength in turkeys. Slowing down the growth rate or implementing environmental enrichments to encourage physical activity could potentially mitigate skeletal issues in meat turkeys.

The Impact of Zinc Concentration on The Microbiome of Sheep

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Zinc is an essential trace element that benefits metabolic processes of sheep and the resident microbial communities within their gastrointestinal tract. This study examined the impact of varying levels of zinc supplementation on the gastrointestinal microbiome of sheep. Treatments were prepared as 5 doses of zinc sulfate and zinc chloride, representing control (CON), half zinc requirement (0.5Zn), zinc requirement (Zn), double the zinc requirement (2xZn), and triple the zinc requirement (3xZn). Zinc treatments for each dose were calculated based on fecal zinc content collected at random from a group of sheep. In vitro microbial fermentation of sheep fecal fluid was done for 24 hours in anaerobic test tubes. Incubation of samples in each treatment group were done in increments of 4 hours and 24 hours. Ammonia, methane and hydrogen levels were recorded upon the 24 hour increment. Analysis of CH_4 and H_2 gas chromatography levels (mM/L) produced by both zinc forms found no significance present in any of the Zn level treatments for both CH4 and H2 ($P < 0.05$). Ammonia levels (mM/L) for samples in each treatment group were determined by spectrophotometer. Further analysis of the absorbance for determination of ammonia levels in both zinc forms found no significance present in any of the Zn level treatments ($P < 0.05$). Due to lack of significance ($P < 0.05$) in both CH_4 and H_2 production levels and ammonia levels, there is insufficient evidence to conclude zinc supplementation has any effect on the sheep microbiome. Further research into the impacts of zinc on the gastrointestinal microbial population is needed to improve the efficiency and precision of sheep production.

Impact of Savannah Music Festival on Hotel Occupancy Rates

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Music festivals and concerts wield significant influence over a city's local hospitality industry, traditionally leading to a noticeable increase in patronage for hotels and restaurants. According to the 2019 Global Hotel Study by Smith Travel Research, music festivals worldwide have been demonstrated to trigger a heightened influx of patrons, playing a pivotal role in bolstering local hotels. Since its establishment in 2003, the Savannah Music Festival has orchestrated and promoted local and international performances, becoming one of Georgia's largest musical arts events. This study aimed to discover whether the Savannah Music Festival resulted in higher occupancy rates in the Historic District of Savannah, Georgia. This was determined by conducting a standard independent sample t-test comparing the occupancy percentage during event days in 2022 and 2023, compared to non-event days within March and April. The non-event days were selected to ensure both sample groups had an equal number of days, including a comparable distribution of weekdays and weekends, to standardize the comparison. While the mean for event days was greater than that of non-event days, after conducting the t-test, the p-value was determined to be approximately 0.24. This displays the music festival had a statistically insignificant effect on hotel occupancy in the historic district of Savannah. When considering the ticket sales to non-locals relative to hotel demand in Savannah, and due to the study's limitations in considering all external variables such as conferences, other events, and festivals that drive occupancy rates. Therefore, it is understandable that this event did not have a statistically significant effect on the occupancy percentage in the historic district of Savannah, Georgia.

Does Sealant Method Impact Embryo Survival After Egg Injections?

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Many studies use egg injections as a way to test for impacts of chemicals and physiological mediators on embryonic development in birds. Within these studies, many different methods are used to seal eggs, with no clear data on which is best. Methods include, but are not limited to, super glue liquid, super glue gel, paraffin wax, and Vetbond© glue. This study explores whether one method of sealant effectively seals the egg and maximizes survival more than others. We hypothesized that the Vetbond© glue would most effectively seal eggs with the least amount of toxicity and contamination because it was designed for use on open wounds in veterinary settings. In order to test this hypothesis, we injected 160 unincubated, fertile Japanese quail eggs with 50µl of autoclaved peanut oil, and sealed the eggs with one of four treatments (n = 40 per group): (1) superglue gel, (2) paraffin wax, (3) Vetbond© glue, or (4) a 40mm square of Duct Tape. Incubated eggs for 14 days, killed the embryos via CO_2 asphyxiation, and staged embryos to determine survival rates. We compared survival rates among groups, and to a set of eggs that were not injected. The research demonstrated that there were no significant differences among sealant groups, though there was a nonsignificant trend ($p = 0.07$) in which superglue sealed eggs were numerically less likely to survive compared to uninjected eggs. Survival of embryos in eggs sealed with duct tape was surprisingly numerically higher than survival of embryos in uninjected eggs, though this difference was not significant. Based on the data, we concluded that all sealant types are acceptable for use in sealing eggs during injection experiments. This is the first study to test the use of Duct tape, which may be easier to use because it does not require melting (like the paraffin wax does) and does not have the risk of sticking to fingers and other parts of the nesting environment (as superglue and vetbond do).

Evaluating the effectiveness of micro-aeration assisted anaerobic digestion as a novel approach to stabilize coffee wastewater

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Environmental degradation poses a significant threat to the conservation of natural resources beneficial to humans and wildlife. A critical example of this is the improper disposal of food industry by-products, such as coffee wastewater. When discharged untreated into aquatic systems, these effluents deplete the dissolved oxygen, affecting aquatic life. In our study, we investigated the use of anaerobic digestion in the degradation of recalcitrant compounds present in coffee wastewater, thus facilitating biogas production and reducing the environmental impact of the effluents. Coffee wastewater contains compounds like caffeine, chlorogenic acid, and tannin with a high organic load which uses up oxygen in the waste-water bodies when discharged without appropriate treatment. Two 1.8-L continuously stirred tank reactors with a hydraulic retention time of 40 days were used to evaluate stabilization of the coffee wastewater. The feed composition consists of a 60:20:20% mixture of milk-processing wastewater, waste-activated sludge, and coffee-processing wastewater, respectively. The reactors were fed every day with 0.3L of the feed mixture, resulting in an average biogas generation of 0.00704 L/min. Steady gas production was observed 7 days after inoculation with the average biogas composition of 67.2% and 32.8% of CH_4 and CO_2, respectively. Operational parameters were carefully controlled; pH levels were sustained at 7.23 ± 0.2, while the absolute and relative oxidation-reduction potential (ORP) were maintained at –490 mV and –483 mV, respectively. We achieved a 63% reduction in COD, with caffeine, chlorogenic acid, and tannins reduced by 99%, 95.4%, and 87.2%, respectively. In the 2nd stage of the project, we will investigate the effects of micro-aeration combined with anaerobic digestion on the degradation process, aiming for near-complete degradation of these compounds. In conclusion, this study will provide insights for coffee processors regarding the treatment of wastewater to not only mitigate the environmental impact but also harness the potential for biogas production, thereby promoting ecological sustainability and resource recovery.

Evaluation of Biochemical Methane Potential (BMP) for Anaerobic Digestion of Chain-Elongation Effluent and Milk Powder

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Biochemical Methane Potential (BMP) assays are commonly employed by biological and environmental engineers to assess the feasibility of anaerobic digestion processes for energy recovery from organic materials. However, their applicability to substrates such as chain-elongation effluent and milk processing water remains unexplored. Our study evaluates the BMP of these substrates over 15 days using 250-mL serum bottles. The BMP assays were performed in triplicate, including controls, maintaining a substrate-to-inoculum ratio of 1:1, based on chemical oxygen demand (COD), with a total COD concentration of 0.8 g/L. The composition of each tested substrate was characterized before and after BMP assay. In addition to the substrate and inoculum, the bottles were supplemented with a solution of minerals, vitamins, and trace metals. The pH was then adjusted to 7.15, to establish optimal growth conditions. The bottles were then sealed and sparged with nitrogen gas to create an anaerobic environment before incubating at a mesophilic temperature. During incubation, methane production was measured regularly using gas chromatography. The chain elongation effluent and milk processing water exhibited a high BMP value, indicating potential suitability for large-scale anaerobic digestion. The implications of these findings are significant in advancing sustainability efforts, particularly in the context of leveraging biogas production for energy generation.☐Further research is warranted to explore the mechanistic underpinnings of substrate-specific methane production and to refine BMP assay protocols for diverse substrates, thereby facilitating the development of efficient anaerobic digestion systems for sustainable energy production.

Improving Regeneration from Genetically Transformed Flowering Dogwood Embryogenic Cultures

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Powdery mildew, caused by the fungus Erysiphe pulchra, is one of the most serious diseases affecting the popular ornamental tree Flowering Dogwood (*Cornus florida*). Gene editing techniques can be used to confer powdery mildew resistance by inactivating the Mildew Locus O (MLO) gene, but this requires an efficient genetic transformation system. This novel research will fill a critical gap in our knowledge of Flowering Dogwood biotechnology. Previous efforts in the Wilde Lab have genetically transformed embryogenic dogwood cultures, now we are aiming to produce transgenic plantlets. My previous research looked at the RITA® temporary immersion bioreactor system testing germinated embryo production, focusing on the phytohormone gibberellic acid (GA_3). This semester I am concentrating on analyzing the impact of different environmental light exposures on dogwood embryo stress levels by observing anthocyanin production. The starting material will be unwashed callus transformed with the GUS reporter gene and subjected to one of four RITA® treatments to examine the influence of varying light levels. Treatments include full darkness, low light, and a combination of both for different durations of time. The first three treatments have the starting material of GUS-transformed embryogenic callus. The fourth treatment serves as a control group with the starting material being somatic embryos developed from previously plated GUS-transformed callus cultures to provide a control group with somatic embryos in production. Future implementation of my research will optimize the production of plantlets from dogwood cultures transformed with a CRISPR-Cas9 construct that can inactivate the MLO gene to obtain powdery mildew resistance.

Smart surveying: An exploratory study in farmers' perceptions of climate smart practices

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With over two million farms in the U.S., the agricultural industry is a key area to examine how sustainable farming practices can be implemented to minimize climate change. In order to implement these production practices, those who face the day-to-day challenges, farmers, need to have a voice in the process. This study was designed to listen to farmers and address their needs in regards to implementing climate smart production practices. In this research climate smart agricultural practices are defined as farming methods that produce less waste and use resources more efficiently with the goal of monitoring and verifying greenhouse gas benefits. This study used an experimental design to examine farmers experiences when adopting and implementing climate smart practices and their perceptions. Specifically, this study utilized the Poket app that will distribute survey questions to organic farmers (n= 50) and conventional farmers (n=50) in the Piedmont region over the course of 4 months. The app delivered 2-6 questions on a weekly basis to constantly engage with farmers. Participants were incentivized with monetary compensation for their participation to encourage engagement in this study. Given the historically low survey response rates for farmers, this research was exploratory in nature to determine alternative survey practices to engage with farmers. Identifying farmers' understanding and perceptions of these farming practices will establish a baseline of knowledge in this specific area for science communicators and practitioners.

Can we maximize fertility by combining pre-synchronization and increased proestrus length?

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Producers and farmers around the world utilize estrous synchronization protocols to maximize the success of fixed-time artificial insemination to increase the overall production of an operation. The aim of this study is to evaluate the impact of increasing the proestrus length on the fertility of cows that are exposed to fixed-time artificial insemination (TAI) while using pre-synchronization strategies. We hypothesized that the decreased amount of time in between the first GnRH injection and the second prostaglandin F2α (PGF) will increase the fertility in cows after using pre-synchronization leading to higher pregnancy rates than those found in the industry-standard 7 & 7 Day Synch. On day 0, all cows received a CIDR implant and 2-cc injection of prostaglandin (PGF), while age, calving date, body condition score and body weight were collected from all females. On day 7, all cows received a 2-cc injection of GnRH. On day 13, treatment (7 & 6 Synch) cows had their CIDR removed and received a 2-cc injection of PGF and an estrus detection aid patch. CIDR's were removed from control cows on day 14, concurrently with the PGF injection. Both treatments were artificially inseminated 66 hours after CIDR removal and received a 2-cc injection of GnRH at the same time. Pregnancy diagnoses was performed through ultrasonography 30-35 days after TAI. Cows that expressed estrus had greater ($p<0.05$) pregnancy rates compared with cows that did not express estrus (62% compared to 59%). There were no differences between treatments in pregnancy rates ($P>0.10$). In conclusion, cows who show estrus before TAI are more likely to become pregnant, while there were no differences in pregnancy between treatments.

The Effect of Pretreatments on Soil Texture Measurements by Laser Diffraction

Liam Astorga, Environmental Resource Science Major, Department of Crop and Soil Sciences;
Presented in 2023

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Soil texture or particle size distribution describes the proportion of sand, silt, and clay sized particles in soil, and it heavily influences fertility and hydraulic properties. Standard approaches for measuring soil texture are pipette and hydrometer methods, which determine the quantity of different sized particles by their settling time. While reliably accurate, these methods require relatively large quantities of soil and time, therefore determining soil texture can be cost prohibitive. Laser Particle Size Analysis (LPSA) can determine soil size distribution with small quantities (0.5g) of soil in a fraction of the time compared to standard methods. We evaluated the performance of LPSA as an alternative method for determining soil particle size distribution by comparing texture measurements obtained with LPSA to standards from the Agriculture Laboratory Proficiency program for 33 diverse soils. Soils were subjected to two pre-treatments: 1) standard chemical dispersion with sodium hexametaphosphate (HMP) on a shaker overnight, or 2) organic matter removal treatment (OMT) with 30% hydrogen peroxide followed by the HMP treatment. For both treatments, 0.5 g of soil was added into 15 ml test tubes and dispersed in 5 ml of HMP. Each sample was run in duplicate, and if duplicates had greater than 5% differences for either sand or clay a third sample was analyzed. All laboratory duplicates were averaged. The RMSE value for the non-OMT and OMT were 6.1 and 9.8 for clay, 14.1 and 14.8 for sand, and 14.7 and 9.7 for silt. Results showed LPSA over-estimated silt and under-estimated sand. The mean standard value for silt was 37%, compared to 47% for an average of all LPSA tests, and the mean standard value for sand was 41%, compared to 30% for the LPSA. OMT resulted in a higher mean clay percentage compared to non-OMT (26 vs 21%); conversely, the mean silt percent decreased from 50 to 45% after OMT. OMT had essentially no effect on sand proportions. Evaluation of the effect OMT had on LPSA clay results was restricted by the limited quantity of samples with over 20% clay so further testing should include more fine-textured soils. OMT resulted in larger clay proportions by dispersing organically bound particles into their clay-sized components, but improvements in LPSA methods are necessary to better approximate standard texture estimates.

The function of chicken yolk sac tissue in regulating thyroid hormone metabolism and availability during early embryogenesis

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Improved hatchability and overall chick quality are important for the poultry industry. By understanding pathways that regulate chick metabolism during the 21-day embryonic development period, strategies that improve livability and early post-hatch growth can be implemented. The yolk sac tissue (YST) is a multifunctional organ that transports yolk nutrients to the developing embryo. Prior work has suggested that the YST produces somatotropic axis components during embryonic development, indicating that it could regulate growth and metabolism during this time. Since the thyrotropic axis also regulates growth and metabolism in chickens, the purpose of this experiment was to determine if YST plays a role in transport and signaling of thyroid hormones (THs) during embryogenesis. YST was collected on embryonic (E) days 3, 6, 9, and 12. Expression of mRNA for enzymes involved in TH availability, TH receptors, and TH transporters was determined. Deiodinase 2 (DIO2) was decreased significantly after E3 ($p<0.05$). TH receptor alpha (THRA) was found to increase between E3 and E12 ($p<0.05$). The TH transporter transthyretin was highly expressed in YST at all ages. Since DIO2 helps increase availability of bioactive TH, its early expression suggests that YST can activate TH stored in yolk and transport it to the embryo with transthyretin. Increased levels of THRA would maintain TH signaling even in the face of decreased bioavailable TH later in development. Together, these data suggest that YST plays an active role in regulating chicken embryonic growth and metabolism by facilitating transport and signaling of THs from the yolk.

Implementing On Farm Milk Culture Techniques for Commercial Dairy Farms to Aid in Mastitis Detection

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Dairy cattle are at risk of developing mastitis, an inflammation of the mammary gland commonly caused by bacterial infection. In addition to impacts on health and productivity, mastitis decreases profitability due to antibiotics and discarded milk. Antibiotics are judiciously, yet commonly, administered to cows displaying signs of clinical mastitis (CM), cows at the end of their lactation (dry cows), and cows with elevated cells in the milk (somatic cell count, SCC) called subclinical mastitis (SCM). However, in some of these situations, the absence of culturable bacteria suggests that antibiotics may not be necessary. Hence, producers may consider culturing milk samples on-farm to expedite and refine decision-making. The objective for this study was to implement on-farm milk culture (OFMC) to increase knowledge regarding mastitis pathogen prevalence, reduce antibiotic usage, and improve economic standing. Milk samples were collected with aseptic techniques from cows experiencing CM (n=16) and SCM (n=20) mastitis, dry cows (n=22), and fresh cows calving in (FRESH, n=32). Samples were refrigerated (4°C) or frozen (-20°C) until processing. Samples were cultured up to 48 hrs (37°C), following which presumptive identification of growth was conducted. During collection or at processing, milk conductivity and SCC was determined. The most predominant pathogen identified in any group, including FRESH, was staphylococci (82.46%) followed by streptococci (10.53%), which is consistent with existing literature ($p<0.05$). Regarding antibiotic reduction, if the manager utilized OFMC and only treated quarters of cows with microbial growth for CM, SCM and DRY groups, they would see a 63.32% reduction in antibiotics during our 3-month study ($p<0.0001$). Based on current costs for antibiotics labeled for CM, SCM, and DRY cows, this reduction would equate to a savings of $1,055.64 over 3 months. When factoring in the cost of milk no longer discarded due to antibiotic withdrawal (herd average of 73 lbs milk/day at a milk price of $27/hundred lbs of milk), the farm would realize $4,139.10 increased profits. Taken together, implementing OFMC would directly result in over $5,000 coming back to the facility to redistribute to other farm related expenses. Among all groups, the average SCC of infected quarters was higher than uninfected quarters (1,104,970 ±175,830 SEM vs. 575,671±38,378 SEM, $p<0.0001$).

The Role of Host Plant Genetic Background on Endophyte Vertical Transmission in Tall Fescue

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Tall fescue (*Festuca arundinacea*) is an important forage crop widely used in the United States. Tall fescue has a mutualistic relationship with an endophyte that resides within the lower part of the stem. The endophyte is a fungus (*Epichloe sp.*) that has formed this symbiotic relationship by producing various alkaloids that aid with plant defenses and overall plant health in exchange for nutrients. Alkaloid production in endophytes varies based on the strain and the genetic background of the host plant, with some being non-toxic to herbivores, while others can have detrimental consequences. Most types of the endophyte reproduce asexually, meaning they must be transmitted vertically to the new seeds of the host plant, rather than sexually. Vertical transmission is often imperfect, however high transmission is essential to tall fescue producers. Several strains of endophytes with varying alkaloid profiles have been sourced from tall fescue collected from their center of origin. Their transmission rates were determined in their original host by testing for endophyte presence in progeny seed using an antibody test. In this project, each isolated strain of endophyte was isolated from its native type of tall fescue and inoculated into two endophyte-free tall fescue cultivars, Prosper and GALA 1402. This allowed us to compare original host transmission rates to transmission rates in a uniform background. We found that the host and endophyte genetics do not contribute significantly to the transmission rates of endophytes in novel uniform hosts when compared to their native hosts. These findings will provide grass breeders and producers with insight into which strains of endophytes to use in their plant populations to foster high transmission rates.

CBD Market Size

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The CBD market size was measured through analyzing the demand and supply for CBD oil. A questionnaire was used to calculate the current demand percent of consumers purchasing CBD oil. Furthermore, measuring the percent of purchase through month and year. The data results concluded 248 mg per month per person of CBD purchased and 2979 mg of CBD purchased last year. The number of US consumers using CBD is 103,758,824 consumers and 309,058,602,165 mg total of CBD demanded in the US per year. The data additionally measured the amount of hemp plants per acre needed to meet the demand for consumers. It takes 1500 hemp plants per acre and 750-975 lbs of CBD oil per acre. The total mg being produced currently is 340,194,300-442,252,590 mg. In conclusion the market size shows an overproduction of the supply of hemp then what is being demanded.

Anthocyanin Levels in White Lighting Versus Red and Blue Lighting

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Increased anthocyanin levels, of horticultural commodities, are a desired trait for their antioxidants and richer colors. Higher levels of anthocyanins may be able to increase crop value with lower energy costs. With the continued increase in the use of red and blue lighting across greenhouses, the effects on anthocyanin are not well studied. Ideally, the red and blue lighting will contribute to higher levels of anthocyanins. A higher anthocyanin content would encourage the use of energy-efficient lighting by creating superior commodities. I examined and grew two varieties of lettuce, (*Lactuca sativa*) Rex and Rouxai. 16 of each variety were grown under white light and 16 additionally under red and blue lights. The Rouxai displays a deep cherry color from high levels natural of anthocyanin while the Rex displays a bright green head of lettuce with much lower levels. Using hyperspectral imaging the levels of chlorophyll and anthocyanin can be accurately identified non-invasively. Levels of anthocyanin can be compared between white lighting and red and blue lighting. The results of the study are currently unavailable as plant harvest occurs the day after this abstract is due. Data analysis and drawing conclusions will all be made in the following week.

The effect of *Elaeagnus umbellata* (autumn olive) on levels of inorganic nitrogen in forested riparian areas

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Historically, autumn olive was planted in forested areas to aid in nutrient retention and reduce erosion in riparian areas. However, these non-leguminous nitrogen-fixers are invasive to the Southeastern United States and spread rapidly in forests. If nitrogen mineralization is suppressed (reduced plant-available nitrogen), and therefore too low for native woody vegetation to flourish, invasive species can outcompete native ones. To determine how autumn olive effects soil fertility, we compared plant-available nitrogen (NO_3 and NH_4), pH, loss-on-ignition carbon (LOI), and soil moisture in soils that have autumn olive, soils that had autumn olive removed in the last year, and soils that have no evidence that autumn olive existed. With these distinctions serving as treatments, we sampled 0-15 cm and 15-30 cm at three different locations within each treatment. Each sample was a composite sample and there were three replications done at each site, totaling 54 samples. We studied autumn olive in the historic Beech Haven property in Athens. This land is currently Athens-Clarke County (ACC), the ACC Office of Sustainability is currently in the process of restoring the land. These restoration efforts include invasive species removal and native species plantings. To analyze the data, we used JMP to generate a variance analysis of normally distributed means. We also compared means using a paired t-test and ANOVA to determine statistical significance. In samples taken across treatments at both depths, the greatest concentrations of NO_3 existed where treatments where autumn olive is present, suggesting the presence of autumn olive does influence the amount of plant-available nitrogen in soils. Additionally, samples taken at both depths in areas of historical autumn olive also had significantly greater concentrations of NO_3 than areas where autumn olive never existed. Because we found no differences in carbon measured as LOI carbon, the plant available nitrogen presents in greater amounts where autumn olive is or was present suggests that autumn olive is mineralizing nitrogen. These areas would benefit the ACC Office of Sustainability if they choose to plant native species there, as increased nitrogen mineralization suggests native vegetation planted in these areas may flourish due to increased soil fertility.

Assessment of Treadmill Exercise Rehabilitation Treatment on Neural Stem Cell Engraftment and Differentiation in a Piglet TBI Model

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Traumatic brain injury (TBI) has an alarmingly high incidence among the most vulnerable members of our community, posing a serious threat to the lives of children and the elderly. With no FDA approved, restorative therapies available there is a severe need for research of novel therapeutics for TBI. Induced pluripotent-derived neural stem cells (iNSCs), a potential regenerative therapy, have been shown to survive and differentiate into major neural cell types in TBI brains, which correlated to the improved recovery of TBI-related neural deficits. Piglets' resemblance to young children in terms of neural development and brain structure makes them an ideal translational model for researching TBI therapies that are being considered for use in human medicine. This study's goal is two pronged: to assess if human iNSCs can survive, differentiate, and enhance recovery after being cerebrally transplanted into a piglet TBI model, and how treadmill exercise may amplify the effects of iNSCs in aiding physical rehabilitation. Controlled cortical impact was used to surgically induce TBI, and PBS (PBS+/Ex-, n = 5) or DiR-labeled iNSCs (iNSC+/Ex-, n = 6) were then transplanted after five days. Following transplant, a separate cohort of PBS treated (PBS+/Ex+, n=6) and iNSC treated (iNSC+/Ex+, n=6) animals received twelve weeks of structured treadmill exercise. Before transplantation, iNSCs are DiR-labeled to enable fluorescence microscopy detection of the transplantation location in ex vivo brains. Twelve weeks after transplant, animals were euthanized for brain necropsy and analysis. We have detected DiR-fluorescence in the brain tissue as a qualitative sign of iNSC survival in both iNSC+/Ex- and iNSC+/Ex+ groups. Quantification of the human cell marker HNA via immunohistochemical examination of brain tissue from iNSC+/Ex- group shows that 4.7x104 ± 8.9x103 HNA+ cells were present at the time of sacrifice. Moreover, co-localization of HNA with neural cell markers NeuN (4.1x104 ± 8.8x103) and GFAP (2.5x104 ± 3.9x103) produced quantifiable evidence of iNSC differentiation into mature neurons and activated astrocytes, respectively, in iNSC+/Ex- group. Future directions for this study will be to compare the above quantification of immunohistochemistry for iNSC+/Ex- animals to their study counterparts who received structured exercise after iNSC transplant to determine the potential effects of physical rehabilitation on iNSC survival and differentiation.

Maize Seed Endophytes Resistance to Antibiotics

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Seed endophytic bacteria have been found to have a wide array of benefits to plants especially in the areas of growth promotion, induction of plant defense mechanisms, production of anti-herbivory compounds, nutrition acquisition, and tolerance to biotic and abiotic stresses. There is currently a lack of research that provides further information on maize seed endophytes, especially in their relationship to antibiotic treatment. The purpose of this research is to test several genotypes of maize seed endophytes and their resistance to exposure of the antibiotic Rifampicin. We observed the presence of endophytic resistance to Rifampin using samples collected from research plots of maize from the strain of TX40J (Mini Maize A). They were ground and a slurry was created that contained the bacterial components of each seed sample. DNA extraction was then used to identify the types of bacterial strains each endophyte community was categorized as. Thirteen different genus were identified each with varying associated strains. These strains were plated on both a control plate containing no added rifampicin and a plate containing an added Rifampicin stock concentration of 1000. Plates were incubated for a total of 24 hours and qualitative results were taken. We found that in most of the trials conducted, growth was seen on the majority of plates with bacillus being the only genome that had no observed resistance to the rifampicin. To confirm these results, plates of the same samples were repeated, and the same observations were observed. This suggests that in maize seed endophyte communities there is a natural antibiotic resistance to rifampicin. It was observed in twelve out of the eighteen genus that there was natural resistance to the chosen antibiotic. The resistance by the maize seed endophytic bacteria to the antibiotic rifampin found in this study has applications in agricultural processes where antibiotics used may continue to be used without reducing the presence of natural endophytes.

The impact of non-essential amino acid supplementation to reduced-protein diet on growth, amino acid digestibility, and protein synthesis in broilers

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Our environment is experiencing negative effects as a result of the nitrogenous waste that is coming from the animal-ag industry, especially poultry. Poultry consume large quantities of protein, much of which is excreted to the environment. The experiment aimed to determine the impact of supplementing different non-essential amino acids, glycine, serine, or a combination of the two on broiler chickens' growth performance, ileal amino acid digestibility, and mRNA levels of genes for protein synthesis and degradation in the muscle and liver. A total of 120 male broiler chicks were allocated to 4 treatments on day 0. The birds received a common starter diet from day 0 to 7. On day 7, birds started receiving four dietary treatments, which included 1. adequate-protein diet (ACP), 2. reduced protein (RCP) + glycine, 3. RCP + serine, or 4. RCP + glycine +serine. All RCP diets were supplemented with the required essential amino acids. Each treatment had six replicates, with five birds per replicate cage. On day 21, the breast muscle and liver tissues were collected and snap-frozen in liquid nitrogen and analyzed for mRNA expression levels of key protein synthesis and degradation markers. Ileal digesta were analyzed for amino acid digestibility. The experimental treatments did not affect weight gain, feed intake, or FCR. Ileal digestibility of threonine, an essential amino acid ($P < 0.05$), and serine ($P < 0.05$) was higher for ACP and RCP + serine diets compared to RCP + glycine + serine and RCP + glycine. Ileal lysine digestibility was higher ($P < 0.05$) for RCP + serine and ACP diet and tended to decrease for birds receiving RCP + glycine and low CP + glycine + serine diets. Ileal glycine digestibility was lower ($P < 0.05$) for RCP + glycine + serine compared to the other three diets. There was no difference between treatments for mRNA expression levels of protein synthesis and degradation genes (Trim36, EIF4EBP1, mTOR, and FBXO32) for breast muscle and liver S6 kinase. In conclusion, supplementing non-essential amino acids to birds receiving reduced protein diets helped maintain the growth performance of broiler chickens and produced no differences in mRNA expression of protein synthesis and degradation genes. However, ileal amino acid digestibility was increased with serine, compared to glycine supplementation. These findings suggest that supplementing non-essential amino acids, especially serine, in a reduced protein diet is essential in broiler chickens.

Impact of Systemic Insecticides on Natural Enemy Longevity in Peaches (*Prunus persica*)

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Insect pest management in peaches (*Prunus persica* Batsch) relies heavily upon broad spectrum and systemic pesticides, like imidacloprid, which have the potential to negatively affect many naturally occurring beneficial arthropods over time. Research has unveiled extrafloral nectar (EFN) to play a major role in attracting and providing alternative food for natural enemies, which is important for providing biological control (BC) services. Specifically, EFN is known to regularly recruit a variety of species belonging to the order: Hymenoptera (notably members of Family: Formicidae and the Parasitica group) which either predate or parasitize the present peach pests. In addition, lady beetles (Family: Coccinellidae) are well known for switching to nectar as an alternative food source suggesting probable attraction of the beetles to EFN. Previous research, conducted by the Blaauw Lab, has detected the presence of pesticides in the EFN of peach trees suggesting a potential impact on naturally occurring enemies of major agricultural pests, such as the devastating San Jose scale (*Comstockaspis perniciosus* Comstock). This project is a continuation of previously conducted research on the direct impacts of a systemic insecticide on the longevity of a commercially available agent for scale BC: scale destroyer (*Lindorus lophanthae* Blaisdell). In order to test the objective, past methods were scaled from BC agents isolated in bioassay chambers to direct the application of the beetles onto living trees given various treatment intervals of imidacloprid. Conducted in a greenhouse, ten treatments comprising five replicates per tree were used with two being controls: untreated tree with leaves and untreated tree without leaves. Beetles were applied to the individual tree branches via pre-filled mesh bags and mortality was then evaluated over the subsequent nine-day period. Analysis of beetle mortality showed exposure to contaminated EFN resulted in death increasing with time and then plateauing at the 72-hour mark for treatment (Nov-7) and above. Post-plateau, the mortality rate was steady, concluding at the 192-hour mark. Unexposed beetles experienced higher longevity than the treated group suggesting systemic insecticides do pose a risk to EFN-reliant species. Going forward, further scaling of the study to an orchard setting is needed in order to assess the broader impacts of insecticides on natural enemy longevity in peach systems.

Inquiline Community within Pecan-Phylloxera Galls

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Galls induced by arthropods are niches that oftentimes bear sophisticated multi-trophic interactions among a plethora of species, including insect herbivores and their related natural enemies. The identity of and interactions among arthropod gallers (gall formers) and inquilines (other species inhabiting galls) are often poorly studied and many gall systems persist to be ecological 'black boxes'. This is particularly true for tall tree systems since elevated stratum (>15m) is chronically under-sampled. In pecans, knowledge is sparse relating to leaf galls. Thus far, it's understood that galls are induced by pecan phylloxera (*Phylloxera spp.* Boyer de Fonscolombe) and that the hickory shuckworm (HS) (Cydia caryana Fitch), can use these galls as oviposition sites. Therefore, the central objective of this study is to identify the major actors and the potential ecological roles they are playing within the Phylloxera gall micro-environment in pecan trees. Our study was conducted in an experimental pecan orchard at the USDA Southern Fruit and Tree Nut Research Station, Byron GA. Two assessments (August and September) were performed during the 2022 pecan season where 24 galls (12 fresh-looking galls and 12 mature-looking galls) were randomly collected in each canopy stratum (lower, middle, and upper canopy) of a subset of 10 mature pecan trees (five received pesticide treatment; five untreated) were divided in three strata (lower, middle, and upper). Galls were placed in ice chests and transferred to a -20 °C freezer in the lab. From each set of 24 galls, 20 were dissected and content was recorded and 4 were sent to molecular sequencing. Dissected galls yielded a wide variety of arthropods. Galls were primarily inhabited by an apparent assemblage of parasitoids and hyperparasitoids comprising all life stages. Also, multiple inquiline predators composed the community with a clerid (*Phyllobaenus verticalis* Say) being dominant to the general species pool (aeolothrips, chrysopids, anthocorids, and spiders) at a ratio of 1.7:1. Surprisingly, only a single gall contained HS, and three had remnant exuvia. Interestingly, many beneficial species are interacting within galls during their life history; further molecular analysis will aid in establishing their potential roles within these galls.

Analyzing the effect of consumption of endophyte-infected fescue seeds on insulin response in horses

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The growing issue of laminitis due to insulin dysregulation has caused increased concern in the equine industry. Laminitis is a consequence of improper circulation and inflammation in the hoof and coffin bone, which can result in severe long-term health effects that may eventually require euthanization of an affected animal. Given this, prevention over treatment is often prioritized to effectively combat equine laminitis. Feeding low-carbohydrate grains to horses in an attempt to lower blood glucose levels is the primary management practice regarding the prevention of the disease. However, little to no research has been conducted to suggest causes of laminitis pertaining to consumption of different forages. This study is designed to determine the impacts of consumption of a cool season forage source, tall fescue grass, on equine laminitis. Tall fescue is the most prevalent pasture grass in the United States, and is primarily infected with a fungal endophyte that produces ergot alkaloids. A potential mechanism of action for development of laminitis in animals consuming endophyte-infected fescue is related to its potential impact on insulin regulation. The objective of this study is to determine the effects of consumption of endophyte-infected fescue seed (E+) as compared to endophyte-free fescue seed (E-) and novel-endophyte fescue seed (NE) on insulin response in horses. Horses (n=15) were selected based on a preliminary glucose challenge test to ensure that no individuals currently exhibit insulin dysregulation. Horses were then divided into three treatment groups (E+, E-, NE) and are being fed an ad-libitum bermudagrass hay diet. Fescue seed will be supplemented daily for a 28d period, with the intake level determined by the amount needed of E+ to simulate an overall dietary consumption of 1 ppm ergovaline. Glucose challenge tests are/will be performed at d0, d14, and d28 of the feeding trial, with the parameters of interest being blood glucose and insulin values. Results of this study should elucidate the potential role of tall fescue ergot alkaloids in development of insulin resistance and equine laminitis.

Interactions between *Epichloe coenophiala* endophyte and Gray Leaf Spot Disease in Tall Fescue

Chloe Dela Cerna, Agriscience and Environmental Systems Major, Department of Crop and Soil Sciences; Presented in 2023

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Tall fescue (*Festuca arundinacea*), often referred to as the "Wonder Grass", is a cool-season forage used by many livestock farmers worldwide due to its endophytic relationship with the fungus *Epichloe coenophiala*. *E. coenophiala* is a systemic, seed-transmissible endophyte that is attributable to the innate high productivity and persistence of tall fescue, as it provides the grass with a natural tolerance to stressful conditions such as pest and drought tolerance. However, because of the toxic ergot alkaloids produced by the endophyte, *E. coenophiala* is also associated with episodic livestock toxicosis, a condition where livestock who graze endophyte-infected grass develop symptoms such as lameness, gangrene of the feet, and reduced conception rates. Currently, there are "novel endophyte" varieties of tall fescue that exist on the market, which contain a non-toxic variety of the endophyte that enables the grass to have the same high persistence and stress tolerance of toxic tall fescue varieties, but without the possibility of fescue toxicosis for grazing animals. In order to further characterize how *E. coenophiala* helps the persistence of tall fescue, and how growers can further harness the benefits of this endophyte when establishing their pasture, we seek to understand how the presence/absence of this endophyte affects tall fescue's ability to withstand disease. Specifically, we are interested in understanding the effects of *E. coenophiala* with Gray Leaf Spot, a devastating fungal disease caused by the fungal pathogen *Magnaporthe grisea*. GLS infects grasses by producing microscopic spores on the upper and lower surfaces of infected leaves, spreading the disease when these spores disperse throughout the air. Gray Leaf Spot is an especially common problem in Georgia, because of the warm, humid environment. For our project, different accessions of tall fescue from the endophyte-free, toxic-endophyte, and non-toxic endophyte categories were used. Some seeds received a heat and humidity treatment to kill the endophyte. Seedlings of both treatments were inoculated with *M. grisea*, then sent back to the greenhouse to continue to grow out and be scored for GLS infection. After being scored, we found that fescue seedlings with an endophyte presence showed more resistance to GLS than fescue with no endophyte. The knowledge gained from this project will help us to create better fescue varieties, by seeing how specific endophyte strains differ in disease tolerance.

Optimizing a protocol for transcription factor mapping in the *Arabidopsis thaliana* genome at molecular resolution

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The 7% of the human genome that does not code for functional genes are known as cis-regulatory elements, which function as gene regulators that can modify the expression of certain genes. These cis-regulatory elements bind to transcription factors, such as promoters and enhancers and can cause a gene sequence to be over or under expressed. A challenging dilemma that has presented itself in the world of epigenetics is the inability to quantify these transcription-site binding regions at a high-resolution level. Our goal is to create a method of DNA "footprinting" that would allow us to quantify these regions on a single molecule level, and optimize it to be used in plants. Because *Arabidopsis thaliana* is the model genetic organism for plants, we are crafting our protocol for A. thaliana, but with the hopes of expanding its use to other plant species. Our technique involves utilizing EcoGII, a DNA methyltransferase derived from *Escherichia coli* that adds methylation to adenine regions detected in a genomic sequence, to artificially methylate leaf tissue that has been crosslinked and chopped with a lysis buffer solution to extract and isolate nuclei. Using DpnI and DpnII, two restriction enzymes derived from *Drosophila melanogaster*, we are able to assess the methylation ability of the EcoGII methyltransferase. DpnI enzyme will cleave at GATC regions where A is methylated, and DpnII enzyme will cleave at GATC regions where A is unmethylated. Using PCR amplification and gel electrophoresis to visualize the cleaving patterns in the nuclei samples, we can assess how effectively methylation occured. In samples where methylation occured successfully, DNA libraries were created and prepared for ChIP-sequencing, a novel method of sequencing that allows for the mapping of transcription factors in alignment to the genes they regulate. Being able to effectively map the distribution of transcription factors in the *A. thaliana* genome would allow for a better understanding of how plant cells differentiate during development, which has the potential for applications into breeding or genetic modification of crops for more sustainable, persistent, and tolerant varieties.

Evaluation of the impact of genetic selection on fertility and zona pellucida proteins in broiler breeders

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Improving the understanding of the molecular mechanisms of hen fertility will allow for the development of a targeted approach to improving broiler breeder fertility. The standard assay for assessing hen fertility is the sperm-penetration assay, which counts the number of sperm hole penetrations around the germinal disc (GD) region of the inner perivitelline layer (IPVL). Following ovulation, the IPVL is the sole protein barrier that sperm must bind and penetrate for successful fertilization. The IPVL consists of zona pellucida (ZP) proteins. Poultry-specific antibodies for the three different ZP proteins, ZPB1, ZPC, and ZPB2, previously reported to be linked to poultry fertility were created. These antibodies have allowed for quantitative Western analyses to reveal ZP protein differences between genetic lines of turkey hens that differ in fertility and differences in the IPVL overlying the important GD region in both chicken and turkey. These results indicate ZP protein abundance is not static, and thus subject to change because of genetic selection, and that differences in ZP protein abundance at the GD region of the IPVL can be reflective of improved hen fertility in a genetic line. The current study used quantitative Western analyses for ZP protein abundance in the IPVL of Athens Canadian Random Bred (ACRB) hens, a heritage broiler line maintained since the 1950s. The ACRB line continues to have good fertility and hatchability compared to modern broiler breeder lines. The IPVL was isolated from 24 oviposited ACRB eggs. Following sonication and protein quantification, quantitative Western blot analyses was performed for ZPB1, ZPB2, and ZPC. Like previous reports, ZPB2 was more concentrated in the GD region of the IPVL for the ACRB hens. However, unlike our previous report with higher ZPB1 in the NGD region of modern broiler breeders, there were no differences in the relative concentration of ZPB1 between GD and NGD regions of the IPVL. Thus, genetic selection for broiler production may have led to a decrease in relative ZPB1 concentration in the GD region and this change may relate to the decreased fertility of modern broiler breeders compared to the ACRB legacy line.

Renal regulation of calcium and phosphorus homeostasis during early and mid-peak egg production in laying hens

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In laying hens, calcium and phosphorus are vital for eggshell mineralization and the kidney plays an important role in regulation of calcium and phosphorus homeostasis, by action of vitamin D_3, which regulates expression of calcium and phosphorus transporters in this tissue. Therefore, it is important to understand how vitamin D_3 metabolism and the expression of these genes interact to maintain homeostasis. This study sought to determine 1) expression levels of the calcium and phosphorus transporter genes at early and mid-peak production and 2) how expression levels change at specific time points during the egg formation cycle. Kidney was collected from hens at 25 and 43 weeks of age at different time points after egg laying (1:30, 6, 15 and 21 hours). Levels of mRNA related to calcium and phosphorus uptake and utilization, and vitamin D3 metabolism were measured in kidney by qPCR. Data were analyzed by two-way ANOVA and Fisher's LSD test when ANOVA indicated significance ($P \leq 0.05$). Changes in mRNA expression of calcium transporters were influenced by age. Specifically, there was an increase in the expression of NCX1, TRPV6, and the calcium chaperone Calbindin 1 (CALB1) at 43 weeks compared to 25 weeks. Conversely, mRNA expression of phosphorus transporters Pit-1 and Pit-2 were not influenced by age, but by time point, with elevated expression at 15 hours after egg laying. Changes in gene expression at peak egg production indicate greater renal reabsorption of calcium for eggshell formation, while simultaneously excreting phosphorus as waste generated from bone breakdown.

Green Consumerism and how it is affected by political ideology

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The southeast is infamously known for being one of the more apathetic regions when it comes to the national urgency to combat climate change. Many residents that live in this area question if climate change is even taking place or believe climate change is not accelerating due to human causes. Through this research, we can confirm, dispel, or further detail this conclusion. We hope to gain a better understanding of the level of importance individual beliefs on green consumerism and political ideology have on determining the amount of attention climate change is given for a specific region. By being able to determine the level of demand for green consumerism and for policies that combat climate change, we can determine the level of importance climate change is to residents of the southeastern United States. Specifically, we seek to: 1) Determine the demand for green consumerism from the southeast region; 2) Determine the level of priority for policies that combat climate change on both the state and federal level from elected officials from the southeast region; and 3) Determine the overall importance in combating climate change from the southeast region. Through conducting an online survey completed by 906 participants, we believe we have gained these answers. The participants were asked a series of questions related to the importance of additional information regarding our food products. In our findings, we discovered: 1) 57% of participants agree or strongly agree that the inclusion of travel mileage associated with an online food product is important; 2) 59% of participants agree or strongly agree that the inclusion of water inputs associated with an online food product is important; 3) 57% of participants agree or strongly agree that the inclusion of CO_2 emissions associated with an online food product is important; 4) 74% of participants agree or strongly agree that the inclusion of a local food label associated with an online food product is important; 5) 37% of participants identified as republicans; 6) 30% of participants identified as democrats; and 7) 22% of participants identified as independents. We were able to come to conclusions that included: green consumption in non-partisan, there is a demand for additional information on our food and further labeling could harm current producers.

Developing an Egg Injection Protocol for Use in Developmental Biology Research

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Avian eggs are long-standing models for developmental biology research. They are often used to investigate the effects of prenatal exposure to various chemicals. Of these chemicals include hormones, which provide a mechanism by which parents can influence the development of their offspring. These hormone-mediated maternal effects have received increasing attention in the last decade and avian eggs provide excellent systems in which to study them. Researchers who manipulate hormone levels in eggs may do so by injecting known amounts into them. Although used frequently, we lack a standardized method for exogenous egg injections. Techniques vary across studies, which include injection location, the solvent transporting the dissolved hormone, sanitization procedures, and the material used to seal the injection location. To begin designing a protocol for egg injections, we investigated the effects of different types of sealants on embryo mortality. We injected 215 eggs obtained from captive Japanese quail (*Coturnix japonica*) with 10uL of autoclaved peanut oil. After each egg was injected, they were sealed using either Vetbond Tissue Adhesive™, paraffin wax, Parafilm™, industrial cyanoacrylate, or Krazy Glue™. Eggs were then incubated for 14 days. Eggs were then opened to assess embryonic development. Embryos that were not fully developed were classified as mortalities. We observed trends of survival across sealant groups but they were not statistically significant. Data analysis, results, and plans for future research will be discussed.

Hypophosphatasia: Characteristics Between Multispecies Models

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Hypophosphatasia (HPP) is a rare genetic bone disease characterized by abnormal bone and teeth development from defective bone mineralization. It affects under 20 people in every million and is caused by a mutation in alkaline phosphatase (ALPL/TNSALP gene) in osteoblasts. The TNSALP enzyme converts PPi to Pi, which then bonds with calcium to aid in bone mineralization. HPP can be induced in animals (sheep and mice) by disabling the ALPL gene. Mouse models of HPP have previously been used to test enzyme replacement therapy.The purpose of this project is to identify and compare the defining characteristics of hypophosphatasia across these three species. Furthermore, HPP models at UGA will be compared to previous research on the mouse strain. Hypophosphatasia in humans has been sorted into seven different phenotypes ranging from perinatal to adult. The severity and inheritance of hypophosphatasia is diverse, with most phenotypes exhibiting both autosomal recessive and autosomal dominant inheritance. Mice with ALPL-/- inherit hypophosphatasia and exhibit symptoms similar to infantile HPP. Mice with ALPL+/- do not inherit the disease, but they experience premature bone aging. In the Mortensen lab, identification of their genotypes is done through DNA extraction of mice toes, PCR, and gel electrophoresis imaging. ALPL-/- mice have significant weight loss and are euthanized at 14 days at their humane endpoint. Information on their body condition score (BCS), proportion of their weight to healthy mice, and behavioral symptoms of HPP are recorded at 10, 12, and 14 days of age. Data collected from February 2017 to April 2022 showed that there were 126 cases of mild HPP and 39 cases of severe HPP. Severe HPP was listed if the mouse's weight was under 80% of a healthy mouse, BCS was under 2, or 3 or more behavioral symptoms (abnormal movement, ruffled fur, hunched back, irritability, or isolation) was observed. On average, the BCS was 2.77 for 10 days, 2.74 for 12 days, 2.80 for 14 days. Muscle weakness in ALPL+/- versus ALPL+/+ mice 14-15 months of age was tested recently in the lab as well. Based on this data, HPP in this mouse model is milder than infantile HPP and mouse models from previous studies. Producing reliable mouse models opens opportunities for testing stem cell therapies or other treatments, and understanding the translational gap between animal models and humans is critical towards that.

Public Opinions on Greenhouse Operations in Their Area

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A large part of the green industry is the use of controlled environments. Food and ornamental producers will often use greenhouses to expand their growing season and allow them to provide their customers with a constant supply of plants regardless of the weather. As more companies implement the use of controlled environments it is important to consider how the public might respond to byproducts that arise from their use. Issues such as chemical use, excessive use of power, and the impact on water quality are all concerns that can be brought up. In this national survey, we asked 4416 people how concerned they were about living near a greenhouse operation, the importance of greenhouse practices, and issues that can affect their personal lives. They were asked to rate their concerns on a scale of 0-100, with 0 being extremely unimportant, 50 being neither unimportant nor important, and 100 being extremely important. Thirty five percent of people surveyed lived within ten miles of a greenhouse (19% lived 1-5 miles away and 16% lived 6-10 miles away). People were most concerned with chemical use, supporting the community, and paying workers a livable wage. Overall, most people were focused on the wellbeing of their community and protecting their local environment. Knowing what concerns the public has can help industry take positive steps toward environmental protection and community development while maintaining good relations with the community in which they operate.

On-Farm Mastitis Diagnosis and Risk Assessment in Dairy Heifers

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Mastitis, an inflammation of the mammary gland, renders milk unfit for consumption and may require therapeutics. In addition to lactating dairy cows, heifers may experience mastitis unseen to the naked eye, known as subclinical mastitis (SCM). Currently, detecting SCM is labor-intensive, costly, and difficult to prevent. Research aimed at finding non-invasive, rapid ways to identify SCM would expedite decision-making. Moreover, identifying anatomical characteristics associated with heifer mastitis risk may aid in refining management and breeding strategies for mastitis prevention. Our objective was to a) determine if viscosity of heifer mammary secretions can be used to diagnose SCM and b) investigate the association of teat pigmentation with mastitis. Mammary secretions and teat pigmentations were scored from dairy heifers 60-90 d prior to calving (n=27). Secretions were also collected for diagnosis of SCM and kept on ice until culturing. Plates were incubated for 48 hours at 37°C and observed for growth indicating infection. Secretions were assigned a score based on viscosity as follows: 1, thick and unmoving; 2, sluggish but moveable; 3, thin and watery. Teat appearance was scored based on %pigmentation as follows: 1, 0-25%; 2, 26-50%; 3, 51-75%; 4, >75%. Infected quarters had a higher teat pigmentation score compared to uninfected quarters (1.029±0.171 SEM vs. 0.534±0.098 SEM, $P=0.02$). Quarters with no teat pigmentation (score 0) had a SCM prevalence of 23% versus 46.81% prevalence in quarters with any teat pigmentation ($P=0.01$), supported by an odds of 2.891 for pigmented teats to have SCM ($P=0.01$). Similarly, infected quarters had a higher viscosity score compared to uninfected quarters (2.886 ±0.068 SEM vs. 1.069±0.03 SEM, $p<0.001$). Diagnosing SCM by secretion viscosity (score 2 or 3) had a specificity of 93.06%, sensitivity of 91.14%, positive predictive value (PV) of 87.18%, and negative PV of 98.53% ($p<0.0001$). Secretions from a quarter with a 2 or 3 viscosity score was 13.99 times more likely to have SCM than score 1 ($p<0.0001$). In dairy operations with known heifer SCM, observing secretions for selective treatment decisions may prove more beneficial than blanket administration, promoting antibiotic stewardship and improving economic sustainability. Further investigation is needed regarding teat pigmentation and mastitis risk, specifically the role horn fly strikes may play and the possibility of selecting against teat pigmentation.

Who eats the yellow-margined leaf beetle? Field observations and genetic surveillance to identify local predators of a novel invasive pest

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Invasive species have become prevalent and impactful with the rise of globalization and international supply chain networks, threatening agroecosystems as well as native biodiversity worldwide. The yellowmargined leaf beetle, *Microtheca ochroloma* Stahl (Coleoptera: Chrysomelidae), recently invaded the Southeastern United States and has rapidly emerged as a leading pest of organic crucifer crops, yet little is known about which native predators might effectively provide biological control. The objective of this research is to identify potential predators of this understudied invader through both field observation and genetic surveillance. Over two years, arthropods were surveyed on a variety of susceptible *Brassica* species cultivars and a shortlist of commonly associated predators was developed. In a survey of turnip plants in year 1, ladybeetles positively correlated with densities of M. ochroloma, suggesting a numerical response to densities of the invasive pest. Surveys at a different site in year 2 revealed that big-eyed bugs also positively correlated with *M. ochroloma*, while pink-spotted ladybeetles negatively correlated, suggesting a pattern of suppression. Ants (primarily the red imported fire ant) and spiders were commonly observed predators on plants in both years, but neither correlated with densities of *M. ochroloma*. No predators were observed consuming *M. ochroloma* eggs. Molecular gut-content analysis using specially generated *M. ochroloma* primers confirmed the observed predatory links and suggested a density-dependent tracking response from pink-spotted ladybeetles. Our results will enable farmers to bolster these predator populations with fine-tuned habitat management tools and better suppress the spreading pest.

Creating an instrument to quantify mechanical damage and absorptive capacity of different grasses following equine chewing simulation

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Horses are prone to colic, a gastrointestinal disturbance, with one prominent type being impaction colic. Multiple factors predispose horses to impaction colic, with one of the most determining factors being the moisture content of the feedstuff; drier feedstuffs are more easily impacted in the intestine of the horse. Bermudagrass hay is commonly fed to horses who reside in the southeastern United States due to the fact that it grows naturally in this region. Due to its fine-stemmed nature, bermudagrass hay is often associated with impaction colic, though almost no research exists to elucidate potential causes of this unproven relationship. Previous research in our lab demonstrated that horses chew bermudagrass hay at a much-reduced frequency as compared to other commonly fed hays, but what impacts this has on digestion is not known. The objectives of this research are to (1) build a machine to simulate equine chewing patterns, and (2) assess mechanical damage and absorptive capacity of forage following chewing simulation. To create the chewing simulator, a pestle attached to a wheel suspended above the mortar will be used. The mortar is also placed on top of a load cell to allow for the measure of force at which each "bite" occurs. As the wheel turns, the pestle drops down into the mortar and continues in one quick motion, grinding the substance of interest. Forages of interest will be "chewed" at equal pressures, first at a standardized number of chews/kg, and then at the number of chews/kg based on results obtained from previous research in our lab. Mechanical damage and absorptive capacity following chewing simulation will be quantified. Results to date indicate that bermudagrass does have a smaller stem diameter (1.08 mm) as compared to alfalfa, ryegrass, and orchard grass (2.48 mm, 2.5 mm, and 3.34 mm respectively, $p<0.05$), and that horses make fewer chews when consuming bermudagrass (3649 chews/kg) as compared to alfalfa, ryegrass, and orchard grass (4571, 4763, and 4811 chews/kg, respectively, $p<0.05$). Following completion of the chewing instrument, these four treatments will undergo chewing simulation, and. Mechanical damage will be quantified. Samples will then be submerged in artificial saliva, gastric fluid, and pancreatic buffer to test the absorptive capacity of samples following their respective mechanical damage. Results should provide further information on a potential causative relationship of bermudagrass hay to impaction colic.

Effects of Yolk Glucocorticoids on Immune Function in Eastern Bluebird Nestlings

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Amidst global environmental change, birds encounter challenges that may jeopardize their fitness. These stressors can increase levels of glucocorticoid hormones in adults, which are known to depress immune function. In breeding birds, maternal stress can increase glucocorticoid accumulation in eggs, which can impact many aspects of offspring growth, behavior, and physiology. We hypothesized that nestlings exposed to higher doses of prenatal glucocorticoids would also experience altered immune function. We designed a study to evaluate the effects of the primary glucocorticoid in birds, corticosterone, on immune function in wild Eastern bluebird (*Sialia sialis*) nestlings. Eggs were injected with a control solution or exogenous dose of corticosterone. We then analyzed immune parameters of the nestlings, such as bactericidal ability, leukocyte profiles, and phytohemagglutinin (PHA) induced swelling. Nestlings exposed to the corticosterone treatment during development exhibited an attenuated inflammatory response compared to the control group. Additional results will be discussed when available.

Differential Somatic Cell Count Analysis of Holstein and Jersey Heifer Secretions

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Mastitis is the inflammation of mammary tissue primarily caused by bacterial infection. If undetected, mastitis reduces profitability of dairy cows by decreasing milk yield and milk quality. Commonly, milk quality is measured by milk somatic cell counts (SCC), primarily composed of leukocytes. Previous research has explored connections between differential SCC (DSCC), or relative leukocytes proportions, and mastitis as an increase in SCC is attributed to neutrophil (NEU) influx. In heifers, this dynamic is largely unexplored, but is critical as mammary development could be stunted because of mastitis and increased NEU. The main objective of this study was to evaluate DSCC in mammary secretions from pregnant heifers. Mammary secretions were collected from all quarters of Jersey (n=6) and Holstein (n=21) heifers (n=108 quarters) at 45-60 d prior to calving. Secretions were plated on TSA plates with 5% sheep blood and incubated (48 hrs at 37°C). Total SCC were enumerated when possible depending on viscosity, secretions were diluted 1:4 in 7.5% serum albumin, and cytological smears were created. Smears were differentially stained with the Camco Stain Pack yielding results akin to Wright-Giemsa stain. Macrophages (MAC), lymphocytes (LYM) and NEU, were counted to calculate relative proportions (%). In total, 55.56% of heifers had at least one quarter infected, with 32.41% of quarters being infected. Culturing revealed that 51.43% of infections were *Staphylococcus aureus* (SA), 40.00% were "non-aureus" staphylococci (NAS), and 8.57% were miscellaneous infections (Streptococcus-like bacteria and gram-negative bacteria). Regarding SA infections, prevalence was greater in front quarters (68.75%) compared to rear quarters (31.25%), coinciding with previous literature. Interestingly, infected front quarters demonstrated a higher numerical ($P>0.05$) average SCC compared to rear quarters, which may be related to greater SA infections. The DSCC of infected quarters averaged 20.88±1.63% SEM MAC, 27.50±1.26% SEM LYM, and 51.46±2.13% SEM NEU ($p<0.05$). The SA infections had the highest numerical NEU prevalence of 55.99 ±2.80% SEM, followed by NAS at 43.95±3.50% SEM NEU ($P>0.05$). Chronically high NEU in tissues is detrimental to mammary health, aside from the damage induced by the pathogen. Future work should investigate the impact of chronic NEU presence on heifer mammary gland development and future productive life of replacement heifers.

Exploratory investigation into potential effects of *Sericea lespedeza* on digestibility, microbiome profile, and parasitic larval development in an equine system

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Lespedeza is a legume forage that has historically been fed to livestock and has recently gained a resurgence in popularity due to improved varieties such as sericea lespedeza. Lespedeza is a high-quality forage, and its high levels of condensed tannins have been shown to function as a natural dewormer in small ruminants. However, there is limited research into its anthelmintic effects in horses nor its effects on gut microbiome and forage digestion. The purpose of this project is to use an in-vitro fermentation system to elucidate potential effects of sericea lespedeza on development of strongyle eggs into infective larvae and to analyze its effects on gut microbiome and fermentation capacity. Sericea lespedeza (SL), alfalfa (A), and bermudagrass (B) were used in a 24 hr in-vitro fermentation trial using horse fecal fluid as inocula. Volatile Fatty Acids (VFA) production was assessed using a Shimadzu GC-2010 Plus gas chromatograph with a flame ionization detector and a capillary column. 16S rRNA gene sequencing was used for microbiome analysis. Due to small sample size, statistical analyses could not be performed, and all results given are exploratory. Microbiome analysis post-fermentation of SL showed an increased percentage (20%) at the phylum level of Firmicutes and at the class level of Clostridia (45% increase) as compared to A and B. At an order level, *Clostridia lactospiracea*, a family of anaerobic bacteria that ferment plant polysaccharides to produce VFAs, showed greater representation of the total microbiome in SL samples as compared to A or B (50% increase). However, increased VFA production in SL samples was not noted, and in fact, fermentation of SL resulted in VFA production that was approximately 30% lower when compared to A and 15% lower when compared to B. Following the 24 hr fermentation period, samples were incubated at 27 C for 28 d, plated on sphagnum moss, and incubated again for 14 d to initiate larval development of parasite eggs. The Baermann technique was performed, and Lugol's iodine was added. Following centrifugation at 1000g, the sediment was put onto slides and viewed at 40x magnification. Larval development was compared only in A and SL. Larval development was only noted in A samples but was extremely low, indicating the need for modification of these methods. Preliminary results indicate that SL does affect gut microbiome and fermentation, and may also inhibit larval development, but more robust studies are needed.

Evaluating the influence of glucose and non-esterified fatty acids during the transition period on characteristics of cyclicity resumption post partum

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Reproductive efficiency is dictated by a number of factors to include genetics, environment, nutrition and management. Consequently, nutrient partitioning and its effects specifically on the early postpartum period and reproductive success are of specific interest. Therefore, this study aimed to investigate changes in circulating non-esterified fatty acids (NEFA) and glucose during the periparturient period on the days in milk (DIM) at and intensity of the first postpartum estrous event. Holstein (n=22) and Jersey (n=13) cows were enrolled at approximately -14 d before calving (d 0). Blood samples, body condition scores, and milk weights were taken at d -14, d -7, d 0, d 7, and d 14. Serum samples were subsequently analyzed for NEFA (μEq/L) and glucose (mg/dL) concentration. Animals were fitted with the DeLaval activity meter and monitored from day of calving until the first postpartum estrous event using DelproTM Farm Manager. Using the algorithm contained within this system, a ++ or +++ alert and/or 120% estrous intensity (EI) was used to confirm an estrous event with the EI recorded for each event. Normal resumption of cyclicity was considered when an estrous event occurred at ≤ 45 DIM with anything after 45 DIM considered delayed. Data was analyzed using the MIXED procedure of SAS and Spearman's correlation coefficients. Analysis of the data collected revealed NEFA circulation to be significantly lower in the pre versus post partum period ($p<0.05$). Holsteins had higher circulating NEFA concentrations at days -14, -7, 0, and 7 compared with Jerseys ($p<0.05$). Glucose was significantly higher in the pre versus postpartum period and continued to decline from 0 to 7 and 7 to 14 DIM ($p<0.05$) in all animals. Overall, glucose and NEFA did not have any relationship to DIM at first estrous ($P>0.05$). EI was unaffected by glucose, NEFA, and DIM at cyclicity resumption but tended to be higher in Jerseys ($P=0.10$). Though metabolic tendencies were as expected, the differences in breeds related to the transition period and cyclicity resumption warrants further investigation.

Unmanned aerial system-based estimation of canopy volume as a potential selection tool to improve harvest index in cultivated peanut

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Ensuring rapid genetic improvement of row crops to feed a growing population requires improving the speed and accuracy with which plant breeders phenotype breeding lines. In recent years, a great deal of work has been conducted using unmanned aerial system (UAS)-based methods to make accurate and rapid measurements for agricultural research. The objective of this study was to evaluate the potential of UAS-based imagery to estimate canopy volume as a high throughput alternative to weighing total biomass in peanut harvest index (HI) estimation, which is very laborious and thus is rarely measured. The lines chosen for this study included several elite runner cultivars of market significance such as Georgia-06G, Georgia-12Y, Georgia-16HO, and others. Dry vine weight was significantly correlated with UAS-based estimation of canopy volume in 2021 and 2022 (R^2=0.47**, and 0.32** respectively). Ranking for canopy volume was mostly consistent both years, and tracked moderately well with dry vine weights. The results from this trial indicated that combining peanut yield data with UAS-based canopy volume data will be a useful tool for selecting breeding lines with high HI potential. This method showed significant potential for routine use in high throughput peanut breeding programs.

Beneficial Microbes Alleviate Osmotic Stress in Lettuce and not Pak Choi in Hydroponics

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The objective of this study is to evaluate the effects of biostimulants on salinity stress in leafy greens grown in deep water culture (DWC) hydroponics. Three trials (Spring, Summer, and Fall 2022) were conducted applying two salinity treatments; one with no salinity (control) and one with added NaCl; 150, 40, and 80 mM, for each trial, respectively. Six biological treatments were applied to each salinity treatment; a control where no product was applied, Lactobacillus (TeraGaniX EM-1; Effective Microorganisms) at 7.488 g/L, Bacillus/Pseudomonas (Root Life; Key to Life) at 0.264 g/L, Trichoderma (RootShield WP; Arbico Organics) at 0.30 g/L, Bacillus (Hydroguard; Botanicare) at 0.528 ml/L, and Glomus (Endomycorrhizal Inoculant; Bioorganics) at 0.472 g/L. Designs were randomized with three replications for 36 experimental units on each trial. 10-gal containers were used with 8 gallons of nutrient solution with 150 mg/L nitrogen (15-5-15 CalMag; JR Peters), each with a 15″ × 20″ floating raft cut from unfaced extruded polystyrene foam insulation boards. 'Rex' lettuce (*Lactuca sativa*) and 'Red Pac F1' pak choi (*Brassica rapa* subsp. *chinensis*) transplants were grown on 1″ × 1″ × 1 ½″ Rockwool plugs transplanted in 2″-deep round net cups, and harvested with four weeks. The solution was aerated with 2″ air stones connected to 3/16″ tubing and a 3566 GPH/6.96 psi ½-in aeration pump. Data collected included total leaf area at harvest (LI-3000C meter; LI-COR), chlorophyll and anthocyanin content (CCM/ACM-200plus; Opti-Sciences), fresh and dry canopy and root weight, pH and EC (HI2003-01/HI9813-6; Hanna). Salinity increased EC and decreased plant total leaf area, fresh root and canopy weight, and pigmentation across trials. On Spring and Summer trials, the biostimulants did not influence plant growth, but the interactions between salinity and microbes influenced pH and the fresh root and canopy weight ($p<0.05$). These studies outlined the ineffectiveness of the selected biostimulants in alleviating osmotic stress in DWC hydroponics. In the Fall, glomus positively affected lettuce fresh weight and leaf area ($p<0.05$). Overall, microbes had different effects on plant growth and quality parameters based on the crops, seasons, and the magnitude of the abiotic stress. The potential of using microbes or their metabolites in hydroponics needs further investigation to identify adequate growing conditions to keep these microorganisms alive in the fertilizer solution.

The Environmental and Economic Consequences of Fast Fashion: How SHEIN Altered the Fashion Industry

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This study aims to identify factors contributing to SHEIN's success and raise awareness around both the economic and environmental impact of the fast fashion industry. Earlier this year, SHEIN officially became the largest fashion retailer in the world, producing between 2,000-10,000 articles of clothing daily. At the current rate the fast fashion industry is growing, it is estimated that by the year 2030 the world will be discarding roughly 132 million tons of textiles annually. In this study, I will identify factors leading the college demographic to support the industry, evaluate the environmental and economic impacts of companies such as SHEIN, and create solutions to raise awareness around campus. With roughly half of SHEIN's audience demographic under the age of 30, my study begins by surveying the population of UGA undergraduate students to determine SHEIN's popularity here on campus. Additionally, I investigate eco-friendly alternatives to fast fashion that can be found locally or online. I believe that with proper education and the provision of alternatives, we can see both a shift in where Athens students choose to shop as well as the frequency students are shopping at.

The Window of Opportunity to Best Induce Root Formation in the Stem Cuttings of Key Woody Ornamentals

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The successful marketing of new woody ornamental plants is heavily dependent on the development of feasible clonal propagation strategies for commercial production. The propagation of certain plants can pose a significant challenge, and unsuccessful propagation can result in delays or even termination of new cultivar introductions. Our woody ornamental plant breeding programs have successfully propagated over 60,000 plants in the past decade. Through our experiences, both successful and unsuccessful, we have learned that the timing of stem cutting collection is of utmost importance. The timing (and type) of woody stem cuttings have a significant impact on the rooting ability of different taxa. For newly selected Acca, Chimonanthus, Ilex, Magnolia, Osmanthus, Ulmus, and Viburnum, the highest rooting percentages were achieved from semi-hardwood cuttings collected during late spring and summer. We found that woody *Ilex decidua* cuttings collected in early June provided a 72.73% percent success in substantial root formation, whereas cuttings collected in early August provided a 12.12% percent success in substantial root formation. *Myrica (Morella) rubra*, or yumberry, is a dioecious evergreen shrub with edible fruit native to China. Yumberry shrubs may be a valuable asset in commercial ornamental production in the future, however vegetative propagation of this shrub has proven difficult in the past. We found that semi-hardwood cuttings of *Myrica rubra* taken in the spring were the most successful, and we obtained 46.78% success in substantial root formation in one instance. Future studies may be necessary to further optimize yumberry propagation. *Viburnum* 'Mohawk 18' is a deciduous, compact shrub with pink flowers. We found that hardwood cuttings collected in late October provided a 51.51% success in substantial root formation, whereas cuttings taken in early and mid June provided 48.49% and 0% success in substantial root formation respectively. In addition to timing, several other factors should be considered when propagating woody ornamental plants, including the source of stock plants, hormone application, plant materials, hormone cofactors, and other environmental factors. We have summarized our results from newly bred and selected clones. With careful attention to these factors, successful propagation and commercial production of newly developed woody ornamental plants can be achieved.

Assessment of a proprietary neuroprotective agent on brain volumetric changes and cerebral blood flow in a piglet traumatic brain injury model

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Traumatic brain injury (TBI) has the greatest incidence of death or disability in children, with 50,000+ hospitalizations in the U.S. per year. Pediatric TBI survivors often struggle with lifelong physical, emotional, and cognitive impairments. Treatment currently focuses on managing symptoms to facilitate a return to normal activities without repairing brain tissue. Therefore, there is significant interest in developing neuroprotectant therapies that have the potential to reduce edema, inflammation, and tissue death after a TBI and ultimately, restore function. The objective of this study was to determine if treatment with a novel neuroprotective agent mitigates acute inflammatory responses and improves brain recovery and increases cerebral blood flow in a piglet TBI model. Castrated, male pigs underwent controlled cortical impact surgery to induce TBI and received a subcutaneous injection of a low dose (LD) neuroprotectant (n=4), high dose (HD) neuroprotectant (n=4), or placebo (n=4) every 8 hours for 5 days. Lesion volume and midline shift were assessed via T2 weighted (T2W) imaging, intracerebral hemorrhage was assessed via susceptibility weighted angiography (SWAN), cerebral blood flow was assessed via arterial spin labeling (ASL), and white matter integrity was assessed by diffusion tensor images (DTI) at 1, 7, and 42 days post-TBI. Based on preliminary data, lesion volume and midline shift in TBI pigs were significantly ($p<0.05$) reduced among the low dose treatment group compared to the high dose or placebo groups at 7 days post-TBI. Additionally, SWAN showed that placebo and high dose treatment groups had greater hemorrhage volume 1-day post-TBI than the low dose group; this group also experienced significantly ($p<0.05$) increased cerebral blood flow at 7 days post-TBI. Finally, DTI showed significantly ($p<0.05$) greater white matter preservation in the low dose treatment group than the placebo group at 1- and 7 days post-injury. This preliminary data suggests that the neuroprotectant agent is beneficial in preserving neural tissue after injury, but its effects vary based on dosage. Across all analyses, the low dose treatment group exhibited greater benefit from the neuroprotectant agent than the placebo and high-dose groups. This data yields promising results that, if ultimately translated successfully to the clinic, could lead to enhanced survival and increased recovery in pediatric TBI patients.

Determining the effect of organic fertilizer application methods on tomato nutrient uptake, plant health, and yield

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Organic farmers are constantly looking for new growing practices within the restrictions of the USDA's organic certification guidelines in order to more efficiently use their inputs. However, the efficacy of these practices is often not well researched. In organic production nutrients are not applied in a pure form and typically must undergo mineralization in order to be available to the plant, unlike with conventional salt-based fertilizers which are immediately available in solution. While foliar application is well studied with conventional fertilizers, whether organic fertilizers can mineralize and be taken up by foliar surfaces remains largely understudied. The objective of this project is to compare nutrient uptake, plant growth, and yield between soil-based and exclusively foliar application of several common liquid organic fertilizers to tomato plants in greenhouse production. To test this hypothesis, tomato plants were grown under greenhouse conditions with excess P and K and fertilized on a constant N basis with either dilute fish emulsion, compost tea, or a mixture of compost tea and molasses. These treatments were applied either to the potting media directly, to the foliage such that the media is protected from fertilizer drippage, or the foliage only, and the plants were monitored weekly for height, leaf chlorophyll, and number of fruit; fruit weight and aboveground biomass were also recorded at the conclusion of the study. The aforementioned variables were analyzed using Generalized Linear Mixed Models (GLIMMIX). Fruit count was significantly greater using a soil application of fish emulsion (3.5 fruit/plant) than the control and the compost-molasses mixture (1.38 fruit/plant). All foliar-exclusive treatments had significantly less total yield weight than the soil-applied fertilizers. However, there was not a significant difference between the fertilizers applied to the soil and those applied to the foliage but allowed to drip onto the soil. No statistically significant trends in aboveground biomass were found. These results imply that N mineralization and subsequent foliar uptake of foliar-applied organic fertilizers are insufficient to meet plant needs. However, in this study the fruit set/yield was poor due to winter light conditions, and the fruit were harvested at the green mature stage, so additional research is needed before concrete recommendations to growers can be made.

Organic Garbanzo Germination Trials in the Southeastern United States

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Garbanzo beans (*Cicer arietinum*) are rarely cultivated for market in the Southeastern United States. Additionally, garbanzos are known to have low germination rates around 60-75%. With the hot and wet climate of the Southeast and the documented low germination rates, many organic farmers would likely avoid this crop choice to avoid unnecessary risk. For this reason, it is important to trial garbanzos in the Southeastern region of the United States to inform growers of practices that will aid in successful cultivation. Seed soaking has been suggested by small-scale organic growers to speed up germination time to limit disease such as damping off. This study aimed to clarify the effects of soaking before planting and to assess the germination success in a controlled environment as well as outdoors in the Southeastern United States during the early Spring. Styrofoam 128-cell flats were filled with moistened organic Pro-Mix. Seeds were planted one inch deep and covered with dry Pro-Mix before watering in. Each treatment group consisted of 64 plantings divided into quadrants of 16 plantings. The first study assessed two treatment groups: indoor and outdoor, while the second study assessed six treatment groups: unsoaked, 30-minute, 2 hour, 4 hour, 6 hour, and 8 hour soaking times. Trays were watered every one to two days and germination was tracked in each quadrant over a span of 11 days. Water content increased by 30%, 52%,67%, 93%, and 95% with 30 min, 2 hour, 4 hour, 6 hour, and 8 hour respectively compared to the unsoaked seed. Significant differences in seed germination timing were determined with soaking. By day six, 0 hour and 0.5 hour treatments were significantly higher (94% germination) than the 6 and 8 hour treatments (75%). This trend continued until day 11. This data suggests that seed soaking of chickpeas delays seed germination and reduces total germination of the crop. For our inside versus outside study, outside significantly delayed germination for days 5,6 and 7 with 82% germination inside compared to 33% germination outside. While we expected a direct impact of temperature on germination, this data suggests that the timing of planting in the Southeast needs further study. Finding a planting time that is appropriate for crop growth but also takes into consideration germination timing is necessary. It may be beneficial for small-scale growers to consider transplants, but this will be highly dependent on the needs of the farm operation.

Fluctuating Asymmetry in Long Bone Traits of Broilers with Different Growth Rates

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Modern broiler chickens grow fast and can attain a weight of around 6.6 pounds in 42 days. Over the last 80 years, broilers have been genetically selected for production traits like breast meat yield and lower feed conversion ratio. However, disproportionate growth of muscle and bone mass can result in skeletal instability in meat broilers. This study investigated fluctuating asymmetry in bone (humerus) morphology as affected by different growth rates. Seven hundred and twenty Ross-708 male chicks were used for the study in an environmentally controlled house. They were randomly assigned to three treatments: Standard (T1), Average (T2), and Slow (T3) in floor pens. After 2 weeks of age, Standard was provided ad-libitum feed whereas the Average and Slow were pair-fed with 90% and 80% of the feed intake of the Standard. Each treatment consisted of 8 replicate pens with 30 birds/pen. The right and left humerus were collected from 2 birds/pen when the Standard and the Slow reached 4kg target weights i.e., 46 days and 56 days respectively. For morphological measurement, the length of the humerus and diameters at proximal, middle, and distal diaphysis were taken. Each diameter was taken as an average of anteroposterior and mediolateral diameters. Since the birds were fed restricted, there was a difference in body weight between the treatments at both sampling points where Standard had higher body weight than the other groups. Asymmetry was not observed for any morphological traits of humerus at the 4kg target weight. Longer humerus were observed in the Standard than the Slow group at day-46 ($p<0.01$). Similarly, middle diaphysis was wider in the Standard than the Slow at day-46 ($p<0.01$). The distal diameter was greatest in the Standard compared to other groups at day-46 ($p<0.01$). However, at day-56, no difference in the length and diameter of the humerus were found between the treatment groups. From this experiment, we conclude that broilers have symmetrical humeri in their body despite any developmental stress that may have been imposed by faster growth. The difference in results between day-46 and day-56 suggests that the length and diameter of humerus in broilers are influenced by body weight rather than the growth rate.

The effect of low or adequate phosphorus with or without phytase on growth, bone development, and mineral metabolisms markers in broiler chickens

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Phosphorus (P) is an essential mineral in poultry due to its role in bone's structural development and integrity. The experiment focused on phytase supplementation in the early life of broiler chicks, when they require larger quantities of P for skeletal growth. However, most of the P supplied to the birds is obtained from the feed as phytate-inositol hexakisphosphate (phytate). Phytate is the storage form of P in plants, and although large quantities can be incorporated into feed, the birds cannot readily use the P, and rock phosphate needs to be added to the diet. As a result, large quantities of P are excreted and contributes to P loading in the environment. Phytase increases phytate digestibility by cleaving the phosphate groups and increasing the quantity of usable P. The experiment investigated the effect of dietary non-phytate phosphorus (nPP) level or phytase supplementation to a low-nPP diet on growth performance, bone mineral accretion, intestinal mineral transporters, and protein synthesis markers in broiler chickens. 72 chicks at zero-day old were assigned into 3 dietary treatments with 6 replicates and 4 birds per cage. The birds received 3 corn-SBM experimental diets from d 0 to 16. The diets were: (D1) low nPP without phytase, (D2) low nPP with phytase, and (D3) adequate nPP without phytase. Birds and feed were weighed on d 0 and 16. Two birds per replicate were randomly chosen and euthanized on d 16. The left tibia bone, jejunal, and liver samples were collected to analyze bone ash or gene markers for mineral absorption and protein synthesis, respectively. For P analysis, tibia bones were divided into epiphysis (fast-growing) and diaphysis (slow-growing) regions. The was no significant effect of treatments on weight gain, feed intake, or gain: feed ratio. Epiphysis and ash weights were lower ($P < 0.05$) for broilers receiving the low-nPP diet. The P concentration in the diaphysis showed no significant difference between diets. Epiphysis bone P concentration was greater ($P < 0.05$) for broiler chickens receiving low P compared to those receiving an adequate P diet. Phytase supplementation had no effect on the mRNA level of jejunal transporters: ATP2B1, Calbidin D28K (Ca transporters), NPT2 (phosphate transporter), or liver protein synthesis gene (PBKAB2). In conclusion, adding phytase to low nPP diets triggered changes in tibia and ash weights, which could enhance bone development in low-phosphorous diets in the early life of chicks.

Breeding and Stem Cutting Propagation of *Ilex* 'Magland'

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Since their introduction to the US in the late 1800s, *Ilex cornuta* and *I. pernyi* have been subject to branch mutations and hybridization. In 1962, a hybrid seedling was created by crossing *I. cornuta* 'Burfordii' and *I. penryi* 'Red Delight'. Further crossing this hybrid seedling with *I. latifolia* resulted in the cultivar *Ilex* 'Mary Nell' in 1981. Fourteen years later, a branch mutation with oak-shaped leaves was selected from 'Mary Nell' and named *Ilex* 'Conaf'. In 2002, a small-leaved mutation with 2-3 pairs of teeth were identified from 'Conaf' and named *Ilex* 'Magland'. Over the course of 200 years of breeding and selection, this cultivar has gained popularity in the market. To vegetatively propagate *Ilex* 'Magland', we collected stem cuttings from both vigorous growing and regular branches in December 2022, and treated them with 8,000 mg/L of liquid KIBA and powder IBA. After three months on the mist bench, the stem cuttings rooted well. Rooting hormone had a significant effect on rooting percentage and quality. The rooting percentages ranged from 83.3% to 100% under IBA treatments, while the control group without IBA application only had a 33.3% success rate. The root quality was significantly better for hormone-treated cuttings (rated 4.08 to 4.58 on a scale of 1 to 5) than untreated cuttings (rated 1.38), which were not acceptable for transplantation. Among the application methods, double dips in a liquid solution containing 5,000 mg/L KIBA and Hormodin #2 (3,000 mg/L IBA) yielded better rooting percentage and root quality than powder IBA (Hormodin #3). Although we air-dried the stem cuttings for at least 15 minutes after a 10-second liquid KIBA dip, the effect was similar to no rooting hormone application for regular stem cuttings. To produce high-quality *Ilex* 'Magland' liners, it is recommended to collect vigorous stem cuttings and treat them with double-dipped rooting hormones at 8,000 mg/L.

Georgia's Green Waste Landfill Capacity and Commercial Compost Market

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A landfill's life can be expanded by diverting yard clippings such as leaf and limbs from landscaping companies to a commercial composting facility. We analyzed and synthesized collected data from multiple primary sources to determine the current market success of composting in Georgia to pursue a potential tax incentive for landscaping companies to compost. The composting market in Georgia is gradually expanding to provide a higher volume of landfill space for the amount of total waste produced. As of 2021, there are sixteen private and public composting facilities throughout the state to potentially compost over 16,000 tons of organic waste consisting of yard trimmings and food waste. On average, around 7.78 million tons of waste is produced annually in Georgia. Of this amount of waste, 27% is organic and from this estimate, around 0.80% are yard trimmings such as leaf and limb. The calculated amount of yard trimmings sent to our landfills is a rough estimate given the limited access to up-to-date data. The importance of a tax incentive for landscaping companies in relation to the rough estimate of yard trimmings in our landfills may deem insignificant in total composition; however, compost sales for leaf and limb waste generate greater amounts of revenue compared to compost sales for organic waste. Therefore, pursuing an initiative to create a tax incentive for landscaping companies to compost their yard clippings waste will create a new revenue stream for them and their communities to benefit from. Assuming the tax incentive is successful, communities throughout Georgia that support and invest in the infrastructure to accommodate a composting market will benefit from greater employment opportunities for technical-skilled workers, promoting their economic growth. Based on the results of the present secondary research, Georgia generates an annual average total revenue amount of $2,200,240 from leaf and limb compost sales, amounting to 135% higher than the revenue generated from organic waste compost.

Assessment of a delayed match to sample cognitive test in normal pigs

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Traumatic brain injury (TBI) is a leading cause of death and disability in children aged 0-14, with an average of 7,000 deaths and 60,000 hospitalizations per year often resulting in long-term functional impairments such as memory deficits. Porcine models are often used to characterize effects of TBI on cognitive function and assess the efficacy of therapeutics because of their similar anatomy and physiology to the human brain. However, a challenge remains in evaluating the success of treatments in restoring memory capacity, as there lacks a sensitive and specific cognitive task for pigs. However, combining clicker training and a delayed match to sample (DMTS) cognitive task may create a more robust tool to assess and quantify cognitive function in pigs. The objective of this study was to determine if healthy piglets can be trained to perform a pig specific DMTS task to evaluate learning and memory. Male piglets (n=5) were clicker trained to perform the DMTS task through five progressive stages: charging the clicker, learning the touch command via targeting, positive shape targeting, positive and negative shape discrimination, and reversal. In this test, pigs are trained to target a positive, correct shape (i.e., pink heart) in a sample trial. Then, in a subsequent test trial, pigs are presented with the same positive shape and a negative, incorrect shape (i.e., pink star). To make the correct choice, pigs must retain information about the shape presented in the sample trials and target the positive shape. In reversal trials, the positive and negative shapes are spatially reversed. Successful completion of the DMTS task is determined by 10 consecutive correct choices. Pig A did not successfully learn the touch command, while Pigs B and C learned the touch command but did not successfully target the positive shape. Pigs D and E were able to successfully target the positive shape over the negative shape in 100% and 68% of total trials, respectively. When the images were reversed, only Pig D successfully targeted the positive shape in 25% of the reversal trials. These preliminary results suggest pigs can be trained to perform the DMTS task. Although additional studies are needed to improve training acquisition and performance, this test could potentially bridge the gap in evaluating piglet cognition and the effects of treatments, not only for TBI, but for other neurodegenerative diseases as well.

Factors that Affect Corn Price Volatility

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This research analyzes agricultural commodity price volatility, specifically in corn futures markets. Agricultural products have relatively price-inelastic supply and demand functions as compared to other commodities. This means that small changes in the quantity, or expected quantity, of an agricultural commodity can have a proportionally large impact on the price of that commodity. Price volatility in agricultural markets is linked to oil price volatility due to biofuel production, macroeconomic factors through total demand, and exchange rates that affect trade. Volatility also affects farmers through potentially higher costs to use risk management options. A vector error correction (VEC) model is used to determine relationships between chosen variables of US Corn futures prices, Crude Oil WTI futures prices (oil prices), the Dow Jones Industrial Average (DJI), and the US Dollar Index (USD). The VEC model is chosen as it investigates relationships between variables over time, using past values (lags) to predict future values. Relationships are represented as a system of equations, with each variable's past values contributing to the prediction of its future values, as well as the values of other variables in the system. The difference between weekly high and low values (trading range) are used as a measure of volatility for the chosen variables. Eight lags are included in the system of equations to account for two months' worth of past values in the prediction of future trading ranges. We find that oil, DJI, and USD trading ranges may granger cause corn. However, there is no simultaneity in the results. It is also unlikely that corn trading ranges granger cause the other variables. We find that an increase in the oil price trading range increases the corn price trading range for around 5 weeks (about one month) by calculating the impulse response. Both DJI and USD trading ranges did not have a significant impact on the corn price trading range. None of the variables presented any long-term impact on the corn price trading range. This research provides valuable insights for policymakers and stakeholders in the agricultural sector, highlighting the importance of understanding the factors of commodity price volatility. It provides valuable information to farmers who use the markets to hedge risk and realize more consistent yearly incomes. Information on factors that affect volatility allow them to make more accurate and dependable risk management decisions.

Transplantation of induced neural stem cells reduces tissue damage and improves cerebral blood flow in a piglet traumatic brain injury model

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Traumatic brain injury (TBI) is a leading cause of death and disability in children. Cases of severe TBI often lead to negative lifelong effects such as impairments in cognition, behavior, and motor function. Unfortunately, there is a lack of effective treatments for TBI. However, transplantation of induced pluripotent-derived neural stem cells (iNSCs) following TBI have the potential to reduce tissue damage and repair the brain through neuroprotective and cell replacement mechanisms. iNSCs can secrete anti-inflammatory and other healing factors as well as differentiate into neurons, astrocytes, and oligodendrocytes, potentially regenerating lost or damaged tissue. Therefore, the objective of this study was to determine if treatment with iNSCs improves tissue recovery and increases cerebral blood flow in a piglet traumatic brain injury model. Castrated, male pigs underwent controlled cortical impact surgery to induce TBI and received an intraparenchymal injection of iNSCs (n= 6) or PBS (n=5) at 5 days post-TBI. Sham animals (n=6) received no TBI. Brain lesion volume, midline shift, and atrophy were assessed via T2 weighted (T2W) imaging and cerebral blood flow was assessed via arterial spin labeling (ASL) at 12 weeks post-transplantation. T2W imaging revealed lesion volume was significantly ($p<0.05$) decreased in iNSC-treated pigs compared to non-treated pigs. Midline shift was significantly ($p<0.05$) decreased and ipsilateral hemisphere volume at 12 weeks post transplantation was significantly ($p<0.05$) increased in iNSC-treated pigs in comparison to non-treated pigs, indicating reduced cell death and tissue atrophy. In addition, ASL imaging revealed cerebral blood flow was significantly ($p<0.05$) increased in iNSC-treated pigs compared to non-treated pigs. Therefore, this study illustrates the ability of iNSCs to enhanced brain tissue recovery and increase in cerebral blood flow following TBI and lays the groundwork for a potential treatment that can restore function in TBI patients.

Investigating Athens Restaurant Week Marketing Impact on Visitor Volume

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In 2022, the Athens, GA Convention and Visitors Bureau (Visit Athens) organized and advertised "Restaurant Week" which focused on increasing demand for local restaurants. Themes of weekly peaked and stagnant traffic patterns that developed over the course of the month sparked a ground theory approach to investigate traffic patterns among the restaurants. Using SafeGraph data to analyze the foot traffic patterns at restaurants during the summer months assisted in determining if marketing campaigns for Athens Restaurant Week were successful. SafeGraph data has been used to analyze consumer demand patterns in previous hospitality and tourism research, and this research used the data to compare the participating Athens Restaurant Week 2021 and 2022 establishments to non-participants to further analyze the event's influence on restaurant consumer demand. To better compare raw visits among those who participated in Restaurant Week and those who did not participate in the event, a paired samples t-test was conducted. No statistically significant difference in raw visitor count was discovered between those who participated ($M=81.4$ $SD= 119.5$) and those who did not participate ($M= 65.9$ $SD= 60.6$); $t(15)= .647$ $p=.264$. Though the research shows that there was no statistical difference in visitor volume between participating restaurants and non-participating restaurants, a mean difference did exist between the two groups. The results showed that mean scores are still higher for Restaurant Week participants. However, a limitation to the research is the small sample size. A larger sampling of businesses is needed to explore the relationship between Restaurant Week marketing efforts and the volume of visitors at participating restaurants.

In Ovo Nicotinamide Riboside Feeding Effects on Post-Hatch Pectoralis Major Muscle Weight and Muscle Fiber Morphometrics

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Nicotinamide riboside (NR) is a vitamin B3 analog which the UGA Muscle Biology Laboratory has demonstrated over multiple studies in ovo feeding increased hatched chick pectoralis major muscle (PMM) weight, decreased muscle fiber cross-sectional area (CSA), which increased muscle fiber density. While these results were encouraging, in ovo NR feeding effects on post-hatch PMM growth and muscle fiber morphometrics remains unknown. The objective of this study was to determine in ovo NR feeding effects on Cobb 700 PMM weight, CSA, and muscle fiber morphometrics. Fertilized Cobb 700 eggs (N = 3,000) were placed on incubation trays, trays were weighed and assigned to one of four treatments: eggs injected with 0 (0NR), 250 (250NR), 500 (500NR), or 1,000 (1000NR) mM NR at incubation day 10. At hatching, chicks were sexed and males were randomly allocated to 32 pens (N = 18/pen) which contained ad libitum access to feed and water. At day 48 post-hatch, 3 birds per pen were randomly selected, euthanized, and PMM were removed, weighed, cut in half, and blotted for muscle CSA measurement. The center portion of the PMM cranial area was collected, cryopreserved, cryosectioned, and wheat germ agglutinin was used to identify muscle cell walls. There was no treatment effect ($P = 0.22$) for PMM CSA, but there were treatment effects for PPM weight, fiber CSA, and fiber number ($P < 0.05$). Birds injected with 0 mM NR had less PPM weight than all NR inject birds ($P < 0.02$), who did not differ from each other ($P > 0.26$). Birds injected with 0 mM NR had larger muscle fiber CSA than 500NR and 1000NR ($P < 0.03$) and tended to have larger ($P = 0.07$) muscle fiber CSA than 250NR birds. All NR injected birds did not differ in muscle fiber CSA ($P > 0.49$). Birds injected with 0 mM NR had less ($P < 0.01$) muscle fiber number than 500NR and tended to have less muscle fiber number than 250NR and 1000NR birds ($P < 0.09$). All NR injected birds did not differ in muscle fiber number ($P > 0.18$). These data suggests in ovo feeding NR to Cobb 700 broilers during embryogenesis increased day 48 post-hatch PMM weight due to an increase in smaller muscle fibers.

Effects of Environmental Enrichments on Mating Behaviors in Broiler Breeder Hens

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The broiler breeder industry faces several welfare problems like feed restriction during rearing and injury during mating. Feed restriction has been known to negatively impact breeder behavior because of the hunger related frustrations whereas injury during mating can lead to decreased fertility, egg production, or even mortality. As the purpose of breeders is the production of fertile eggs, frequency of mating activity among broiler breeders is of prime interest to producers. In this study, we investigated the effects of environmental enrichments on broiler breeders reared under one of two feeding program (skip-a-day or every-day) during the pullet phase and the impact it had on their mating behaviors during the laying period. Birds were reared under one of four treatments:(S/E/E: skip-a-day feeding during rearing, enrichment during rearing and lay; S/E/N: skip-a-day feeding during rearing, enrichment during rearing but not during lay; ED/N/N: fed every-day during rearing, no enrichment during rearing and lay; S/N/N: skip-a-day feeding during rearing, no enrichment during rearing and during lay). Mating behavior was categorized as either successful, unsuccessful due to the female, or unsuccessful due to the male. A frequency behavioral-sampling method was used to record the occurrence of mating behavior between 18:00 to 21:00 at 30 wk of age. Data was analyzed using SAS and Kruskal-Wallis test with significance at $P \leq 0.05$ while trends were noted at $P \geq 0.05 \leq 0.10$. For mating success, a trend was observed between S/E/E and S/N/N ($P = 0.06$), with S/E/E having a higher mating success. The S/E/E group had less unsuccessful mating due to the male than the S/N/N group (8.7% vs. 31.2%, $p<0.02$). A trend was also noted for the S/E/N group to have less unsuccessful mating due to the male than the S/N/N group (12.2% v 31.2%, $p<0.07$). The S/E/E group had the lowest average for unsuccessful mating due to the male out of all the treatments. Interestingly, while not significant, birds with access to environmental enrichments were observed to have fewer mating attempts but an overall higher success average than those without enrichment. In conclusion, the addition of environmental enrichments to broiler breeders could positively impact mating behavior.

Effects of Nicotinamide Riboside Dose on Finishing Barrow Mitochondrial DNA Expression and Fatigue Onset

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Naturally, nicotinamide riboside (NR) can be obtained from yeast, bacteria, and milk, and literature demonstrates NR supplementation increased mitochondrial biogenesis in myopathic models and time to exhaustion during fatigue performance tests. The objective of this study was to determine NR supplementation effects on pig ambulatory muscle mitochondrial DNA content and subjective fatigue onset during a performance test. Over 10 blocks, finishing barrows (N=100; initial body weight 95±5 kg) were assigned to one of five treatments: a conventional swine finishing diet containing 0 (CON), 15 (15NR), 30 (30NR), 45 (45NR) mg/kg body weight/day NR, or barrows supplemented 45 mg/kg body weight/day by oral drench (DRE) during the final 11 days of feeding. At supplementation termination, barrows were subjected to a performance test where they were moved around a circular track until subjective fatigue was determined. After performance testing, barrows were harvested and one gram of the tensor fascia latae (TFL), biceps femoris (BF), and semitendinosus (ST) were collected for mitochondrial DNA gene expression by quantitative real-time PCR. Treatment did not affect ($P=0.57$) barrow speed, but tended to affect ($P=0.06$) distance. Control barrows moved less distance than 15NR and DRE barrows ($p<0.05$) and tended to move less ($P=0.07$) distance than 45NR barrows. Control and 30NR barrows did not differ ($P=0.27$) in distance traveled and all NR barrows did not differ from each other ($P>0.11$). There was a Treatment × Muscle interaction ($P=0.01$) for mitochondrial DNA gene expression. Treatment did not affect ST expression ($P>0.49$). Drench barrow TFL had greater expression than all other barrows ($p<0.05$), which did not differ ($P>0.37$). In the BF, 45NR barrows had greater expression than CON, 15NR, and 30NR barrows ($p<0.02$), but did not differ ($P=0.60$) from DRE barrows. Drench barrows had greater expression than CON and 15NR barrows ($p<0.02$), but did not differ ($P=0.20$) from 30NR barrows. Gene expression of 30NR barrows was greater ($p<0.01$) than CON barrows, but did not differ ($P=0.11$) from 15NR barrows. Control barrow expression did not differ ($P=0.34$) from 15NR expression. Increased 45NR and DRE barrow BF mitochondrial DNA expression and increased DRE barrow TFL mitochondrial DNA expression, alongside the increased distance during performance testing, suggests NR in finishing feed may delay subjective fatigue onset through mitochondria biogenesis.

Metabolomic analysis reveals linkage between chemical composition and sensory quality in different varieties of honey

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Honey has a distinct flavor characterized by various volatiles and non-volatiles from diverse origins. In this study, metabolomics combined with sensory analysis was performed to identify relationships between chemical profile and sensory quality of honey. Metabolomic analysis was conducted using GC−MS (volatiles), LC−MS/MS (flavonoids), and HPLC−UV/RI (organic acids, sugars). Sensory evaluation included quantitative descriptive analysis and consumer test. The results showed that sucrose (sweetness) was responsible for a positive hedonic perception, while organic acids and flavonoids (sourness, astringency, bitterness) negatively affected consumer acceptance. Volatiles with floral notes (e.g. decyl formate) were preferred, but others with off-flavors (e.g. 2-methylbenzofuran) were not preferred by consumers. Flavor familiarity was strongly correlated with the consumer acceptance of honey, indicating that the balance between volatiles and non-volatiles is significant for honey flavor quality. This work demonstrates the role of key flavor compounds in honey quality, and may be applicable to the quality control of honey.

The Impact of Air Temperature on Potential Satsuma Mandarin Production Loction

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The goal of this project was to determine the range at which satsuma mandarin (*Poncirus trifoliata*) production could be sustained in the state of Georgia. The methodology includes collecting daily weather data, which contains minimum temperature was collected from different sites throughout the state. The dates for this data are dependent on when the weather station was installed, but most of the sites have complete yearly data from 2003 to 2022. After retrieving the data from each of these sites, the next step was to calculate on which dates would harm come to the satsuma plants at different stages of development. The three stages of the fruit tree's harvest life were categorized as blooming (March to April), fruiting (May to August), and harvest ready (September to October). The months November to February were not necessary to calculate as none of the stages occur during these months. To derive this data, a function was used to assign the value of a data point based on temperature with respect to the month number. If the month was before or after the established range of the seasonal date, the point was ignored with a blank. However, if the data point did fall within that range, the function would determine if the minimum temperature at that date was less than or equal to the temperature which that stage begins to become harmed. The temperature for harm for each stage was determined to be 32°F for blooming, 25°F for fruiting, and 25°F for harvest. If below these temperatures, the function assigns the value "1," otherwise the function assigns the value "0." Other calculations included in the study were "tree upper" and "tree lower," which refers to the temperature that the trunk and leaves from the tree are affected respectively (14°F for lower and 25°F for upper). For these calculations, all days were used to determine the potential effect temperature has on trees. By removing the month identifier part of the function, the data is given values based simply on if that day goes below or is equal to the establish threshold for tree death throughout the year. The values given were also, "0" for above the threshold and "1" for below or equal to the threshold. After completion, the values are compiled for each year, and it is determined how many days would the trees be in danger. Once all locations are calculated, the range of areas that are fit for production are determined. The more north the location, the worse off the health of the tree becomes.

Analysis of the Avian Inner Perivitelline Layer in *Anas platyrhynchos* Eggs

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Improving the understanding of the molecular mechanisms of hen fertility will allow for the development of a targeted approach to improving fertility in different avian species. Hen fertility can be evaluated with the sperm-penetration assay that determines the number of sperm hole penetrations at the germinal disc (GD) region of the inner perivitelline layer (IPVL). The IPVL is a protein barrier containing zona pellucida (ZP) proteins, and sperm must bind and penetrate the IPVL after ovulation for successful fertilization. Poultry-specific antibodies for three different ZP proteins, ZPB1, ZPB2, and ZPC, were developed, and these proteins have been reported to be associated with poultry fertility. These antibodies have allowed for quantitative Western analyses of the IPVL in both chickens and turkeys, which have shown differences in the ZP proteins at the GD and NGD regions of each species and between different turkey genetic lines. This project sought to evaluate the differences of ZP proteins in the duck IPVL. Like all other previously studied avian species, there is a predominance of sperm hole penetrations at the GD region in duck. However, there have been no reports concerning the IPVL in duck. Predicted protein sequence for duck ZP proteins had greater than an 80% identity match with chicken ZP proteins, suggesting that the custom ZP antibodies designed for chickens should also work for the duck IPVL. The IPVL was isolated from eight different oviposited duck eggs at the germinal disc and non-germinal disc regions before each isolated region underwent sonication and protein quantification using the Lowry assay. Quantitative Western blot analyses were then performed for the ZPB1, ZPB2, and ZPC proteins. Like previous reports in chicken and turkey samples, ZPB2 was more concentrated in the GD region of the duck IPVL. Additionally, there were no differences for either ZPB1 or ZPC between the GD and an NGD region. The greater protein concentration of ZPB2 in the GD region, compared with the NGD region, suggests that ZPB2 may be integral for sperm binding at the GD region and that this increased abundance of ZPB2 at the GD region may be consistent among all avian species. Furthermore, this provides important insight concerning the molecular mechanism of avian fertilization and could provide better comprehension concerning avian species that exhibit diminished fertility.

Evaluating Impacts of Pre-Weaning Vaccination and Creep-Feeding on the Fecal Microbiota in Weaned Beef Calves After a *Mannheimia haemolytica* Challenge

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Bovine Respiratory Disease (BRD) is a major issue that US cattle feedlots face. It accounts for 70-80% of morbidity, 40-50% of deaths, and an estimated loss of $1 billion annually. Weaning is a critical point for calf health due to many environmental, dietary, and management-related stressors calves are exposed to that compromise their immune system leaving them susceptible to respiratory diseases. *Mannheimia haemolytica* has been identified as one of the most common BRD associated bacteria. Preweaning management strategies (i.e., creep-feeding, vaccination) can be implemented to reduce the risk of BRD. Creep feeding calves prior to weaning modulates their microbial populations and thus, reduces the dietary stress after weaning. Vaccinating calves prior to weaning introduces an inactive form of a virus to the calf's immune system, allowing the immune system time to develop anti-bodies to the virus, protecting the calf from future infections. The objective of this study is to evaluate effects of creep feeding and vaccination on the fecal microbiota and energy in calves after a *M. haemolytica* challenge to determine the relationship between the microbial populations and the calf's immune system. Forty-eight steer calves (N = 48) were split into 4 groups: creep-fed and vaccinated (CF-V), creep-fed and non-vaccinated (CF-NV), non-creep-fed and vaccinated (NCF-V), and non-creep-fed and non-vaccinated (NCF-NV). Fecal samples were collected -7 days, challenge (0 d) and weaning day (-1 d), and 7-, 14-, and 28-days post challenge. DNA extraction and 16S rRNA gene sequencing were performed to determine microbial populations. Volatile fatty acid (VFA) analysis was performed via gas chromatography to determine energy concentrations. Creep-feeding increased weight and improved average daily gain ($P = 0.008$). Phyla occupying smaller niches contributed to differences with 3/24 phyla detected having significant treatment x time effects ($P < 0.050$). One species, Lactobacillus mucosae, was increased in CF-V calves prior to weaning ($P < 0.001$). The portion of acetate and acetate: propionate ratio increased in NCF calves, but the portion of propionate and butyrate increased in CF calves prior to weaning ($P < 0.001$). This study found creep feeding calves increased *L. mucosae* and the portion of butyrate prior preweaning while improving growth which could indicate a healthier gut, which helps their immune system defend against *M. haemolytica* infection during the stress of weaning.

Prevalence and diversity of Rickettsia species in ixodid ticks from Baird's tapirs (*Tapirus bairdii*) from Costa Rica

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Rickettsial tick-borne pathogens are the causative agents of severe and potentially fatal spotted fever group (SFG) and typhus group diseases in dogs and humans. Despite the public-health importance of SFG Rickettsia, there are relatively few data on the prevalence and diversity of rickettsial pathogens in ticks from in Costa Rica. The aim of this study was to characterize the SFG Rickettsia prevalence and diversity in ixodid ticks collected from Baird's tapirs (*Tapirus bairdii*) from Costa Rica. Ticks were collected from tapirs captured for research purposes or were found road-killed from July 2021-May 2022. Ticks were morphologically identified, and the species were confirmed through PCR and sequencing of the 16S rRNA gene. Ticks were individually tested for SFG Rickettsia spp. using a nPCR targeting the 17-kDa gene. Species identification was determined using bidirectional sequencing of the 17kDa and/or ompA gene targets. To date, 174 ticks have been collected from 7 tapirs; species included *Amblyomma colebes*, *A. ovale, A. tapirellum, Dermacentor latus, Ixodes tapirus,* and *Rhipicephalus microplus*. Thus far, 4 of 22 A. ovale have been positive for Rickettsia; Two were positive for *Rickettsia parkeri*, a human pathogen, and two were positive for *R. belli*, a presumably non-pathogenic Rickettsia. The remaining *A. ovale* and other tick species are currently being analyzed. These data indicate that tapirs are infested with a high diversity of ticks and that *A. ovale* is infected with *R. parkeri*, a zoonotic pathogen, which may be a concern given the recent incursion of tapirs into small farms.

Why Do People Buy the Plants They Buy?

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During the COVID-19 pandemic the green industry saw a massive influx of first-time plant buyers. Many people chose to fill their time during the lockdowns and long hours at home with gardening, a hobby that could safely be done in and around their home. The goal of this study was to look at how plant buying and gardening habits changed throughout the pandemic. Additionally, the study aims to determine what traits are most important when consumers are deciding what plants they want to buy. A national survey of 1642 consumers was conducted asking about their gardening habits from 2019 to 2022. Participants were asked which plants they grew over a number of categories such as annual flowering plants, vegetables, herbs, flowering perennials, flowering and non-flowering shrubs, and trees. There was an increase in all growing categories from 2019. Garden sizes increased overall (13.3%) for participants that gardened before 2019. Participants were asked about the factors they consider and how important those factors are when buying plants. When looking at industry related factors such as brand, variety, and various label features, price was the most important factor reported with a score of 66 (0= not at all important, 50= slightly important, 100= extremely important). In terms of plant characteristics, attributes such as bloom color, growth habits, tolerance to diseases and weather, and pollinator friendly were assessed. Heat tolerance (64), disease tolerance (63), and bloom color (63) were most important. Interestingly, the factor rated least important when asked in both sections dealt with awards received by the plant (awards the plant has received (40) – industry section and received awards (for being Top Performer) (43)- plant section). This information will be very valuable for the industry to be able to understand what new and returning customers value and how to keep them happy with the products that they continue to produce.

Effects of In Ovo BIO D Supplementation on Broiler Chick Pectoralis Major Morphometics and Muscle Fiber Size and Density

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Vitamin D_3 is associated with increased body weight (BW) weight and breast meat yield in broiler chickens. It is also associated with improving bone health and preventing the occurrence of leg disorders. Numerous studies demonstrated in ovo feeding with various compounds can affect embryonic muscle growth and development. Therefore, the objective of this study was to determine the effects of in ovo Vitamin D_3 supplementation on hatched-chick pectoralis major muscle and fiber morphometrics. Fertilized Cobb 500 broiler chicken eggs (N = 50) were weighed, stratified by weight, and within each two-egg strata, randomly assigned into one of two treatments. Treatment were eggs being in ovo fed 0 (CON) or 2 (BIO) mg 25-hydroxy vitamin D_3 in 100 µL of 0.9% sterile saline solution at incubation day 10. Eggs were incubated at 37˚C and 40 ± 4% relative humidity, and rotated hourly for the first 18 days. At day 18, eggs were removed from trays, relocated to hatching boxes and relative humidity was increased to 60 ± 2% until hatching. After hatching, the pectoralis major muscle was removed, morphometric measures were collected, and the muscle was embedded for immunohistochemistry. Muscle fibers were visualized for morphometric measurement using WGA-Alexaflour 594. There were no treatment effects for all whole muscle and muscle fiber measures ($P > 0.17$). Results indicate in ovo feeding 2 mg of 25-hydroxy vitamin D_3 did not improve embryonic muscle development and growth. This leaves incentive to research this area further to identify areas of implementation. A next step in this research would be to increase the amount of vitamin D_3 administered as a treatment to see if any significant changes are observed.

Weed diversity increases predators in zucchini crops but not on tomatoes

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The “Enemies Hypothesis” proposes that greater plant community diversity supports stronger natural enemy populations. Resources such as weedy non-crop plants can provide sustenance and refuge for arthropod predator communities when prey populations are low, elevating their ability to suppress arthropod pests. At the same time, diversity in non-crop plants could affect pest insects directly by creating confusion for specialist herbivores as they search for their host plants (i.e. The “Resource Concentration Hypothesis”). In 2021, we evaluated diversity (Shannon index) among weed communities and predatory insect communities on tomato zucchini crops on 37 organic farms in the Southeast. We found that predatory insect abundance increased with diversity among weeds in zucchini crops, consistent with our hypothesis. However, predatory insect abundance was not affected by weed diversity in tomato systems, where trichomes limit the mobility of most predators. Herbivore pests also had contrasting responses to weed diversity across the two crops; herbivores on zucchini increased with weed diversity, while herbivores on tomato decreased, consistent with the resource concentration hypothesis. Clearly, non-crop diversity has differing effects across crops, and across trophic levels. This suggests that crops should be evaluated on a case-by-case basis to determine the optimal strategy for managing diversity among non-crop plants.

Harvesting Microalgae Using Thermoresponsive Surfaces

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Microalgae is a promising candidate to use for biomass fuel production to reduce greenhouse gasses and have a renewable and reliable source of energy as the developing world becomes more energy hungry. Currently, algae are harvested either from flocculation, if in a liquid media, or scraping, if grown on a biofilm. Both methods have proven to be expensive and less effective since the strong adhesion of algae to the biofilm reduces yield from scraping, and flocculants are too expensive to use commercially. Thermoresponsive polymers are known to exert mechanical force due to conformational change, thus we propose to implement a dual polymeric domain surface, capable of binding and then physically removing the strongly adherent algae. TIN order to to this, silica wafers were spin-coated with SU-8, cured under a photomask, and grafted with N-Isopropylacrylamide (PNIPAAm), which acted as a thermoresponsive surface with a lower critical temperature of 25°C. Our results show that under biologically viable conditions, algae will attach to the SU-8 domain with and without a photomask. We expect the algae will detach from the SU-8 domain when the PNIPAAm expands at its lower critical temperature. This study proves that biofuels can be produced in a more efficient way and paves the way for more research to enable this technique to be used in the industry.

The Effect of Iodine Supplementation on the Growth of Nursery Pigs

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Iodine (I), an essential trace element, is needed for growth in both humans and animals. This study examined the effect different levels of dietary iodine supplementation had on piglets' growth performance. Weaned nursery piglets (N=100; 13.4 ± 5.0 lbs; 21 ± 3 d old) were assorted into blocks based on weight and sex; pens 1-5 contained 4 barrows, while pens 6-25 contained 2 gilts and 2 barrows. The pens (n = 5 pens/ treatment) within each block were randomly assigned a dietary treatment. Treatments consisted of one with no supplemented iodine (CON), 0.14 mg/kg (NRC), 1.4 mg/kg (NRC10), 14 mg/kg (NRC100), and 140 mg/kg (NRC1000). The diets were fed in 3 phases (d 0-10, d 10-21, d 21-35). The piglets' body weights were recorded on d 7, 10, 21, 28, and 35. The feed intake of each pen was recorded at the end of each phase on d 10, 21, and 35. Both average daily gain and the gain to feed ratio were impacted by dietary treatment. NRC10 (417 g/day) and NRC100 (435 g/day) pens had a greater weight gain on average than CON, NRC, and NRC1000 pens. NRC100 (0.48 g: 1 g feed) pens also had the greatest gain: feed ratio. Although there was a trend, statistically speaking, the difference in data was not significant ($P < 0.05$), so a conclusion on the effect iodine supplementation has on growth performance cannot be made.

Evaluating the influence of heritable metabolic and biological factors during the periparturient period on resumption of cyclicity postpartum

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Genetic, metabolic, and environmental variables have large implications for the reproductive success of dairy cattle. While some of these factors are well documented, the interplay of genetic and environmental influence is still in need of further discovery. Therefore, the aim of this study was to investigate a heritable metabolic marker for energy partitioning, insulin, and a heritable biological factor for fertility, anti-Müllerian hormone (AMH), and their influence on resumption of cyclicity postpartum. For this study, Jersey (n=13) and Holstein cows (n=22) were enrolled -14 d before calving (d 0). Blood samples, milk production, and body condition scores (BCS) were collected at -14 d, -7 d, 0 d, 7 d, and 14 d. Blood samples were analyzed for NEFA (µEq/L), Insulin (µg/L), and glucose (mg/dL) with insulin sensitivity calculated using the RQUICKI method, with a lower value indicative of higher insulin resistance. All cows were fitted with a DeLaval activity meter and monitored from day of calving until first estrus. An estrous event was determined using the program algorithm with a ++ and +++ and/or estrous intensity (EI) of > 120% with EI and DIM recorded for the event. As expected, glucose values decreased in the postpartum period while NEFA levels rose ($p<0.05$). Insulin levels decreased postpartum in all animals ($p<0.05$). Concurrently, RQUICKI rose during the post-partum period with d -14, d -7, and d 0 values all being lower than those at d 7 ($p<0.05$). Interestingly, Jerseys had higher insulin concentrations at all time points ($p<0.05$) compared with Holsteins though there was no breed impact on RQUICKI. The d 14 RQUICKI tended to have a negative correlation with estrous intensity ($P=0.08$); however, there were no indications that glucose, NEFA, or RQUICKI had any impact on DIM at first estrous event ($P>0.05$). Finally, AMH was higher in animals that had a normal resumption of cyclicity (214% ± 31.7) compared with delayed (110% ± 25.1) ($p<0.05$). Further work is needed to fully elucidate the findings in this study.

Investigating the functional role of thyroid hormones on insulin-like growth factor binding protein expression during avian muscle development

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The somatotropic and thyrotropic axes are two endocrine systems both known to influence growth and engage in crosstalk to regulate skeletal muscle growth and metabolism. The thyrotropic axis includes biologically active triiodothyronine (T3) that binds thyroid hormone receptors (THRs) to regulate gene expression through thyroid response elements (TREs) on the DNA. The somatotropic axis consists of the insulin-like growth factor (IGF) signaling system. Insulin growth factor binding proteins (IGFBPs) regulate IGF-IGF receptor type 1 (IGFR1) interactions to influence cellular proliferation, differentiation, and apoptosis. Identification of putative TREs in select IGFBPs suggests that IGFBP expression may be regulated by THs. Previous results showed that T3-induced regulation of IGFBP2 and IGFBP3 increases gene expression at concentrations slightly higher than would be found in circulation. The purpose of this study was to determine if T3 at more biologically relevant concentrations can alter IGFBP expression. Quail muscle clone 7 cells were treated with T3 at 0, 0.2, 0.4, and 1 ng/µl for 0.5, 6, and 24 hours. Total RNA was extracted and will be converted to cDNA. Gene expression of IGF receptors and IGFPBs will be measured by performing quantitative polymerase chain reactions. Results will indicate whether T3 can alter IGFBP gene expression. This may have implications for the effect of plasma T3 on IGFBP expression in avian muscle cells and consequently, overall skeletal muscle growth and metabolism.

Weed Seedbank Analysis

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Converting derelict pastureland can be a difficult task for farmers to do as these fallow lands are commonly dominated by perennial weed species, especially Bermudagrass (*Cynodon dactylon*) which can be difficult to kill and persist in organic farming systems. Overgrowth of weed species within agricultural fields can cause significant harm to crop yields. Estimating the weed species diversity within these fields is important for the in-season management of these weeds. We evaluated the weed seed density, diversity, and community composition in a derelict pastureland within UGA's Horticulture Farm. Weed seedbank diversity was measured by species richness, evenness, and the Shannon-Weiner index. The experiment was set up in a randomized split plot design with 4 repetitions. Each plot received 1 of 4 of the following groundcover treatments: no treatment, silage tarp, crimson clover (31 lbs per acre), or cereal rye (82 lbs per acre). The silage tarp and cover crops were used to suppress weed growth and weed seedbanks. Poultry litter is easily accessible for organic producers and can increase microbial activity, which can help increase weed seed degradation. Half of each plot was treated with poultry litter (4000 lbs per acre) while the other half received no poultry litter. The use of cover crops, like poultry litter, can increase microbial activity which can increase weed seed degradation. Soil samples (~2 kg) were collected from each split plot and placed into greenhouse trays within the greenhouse. At weekly intervals emerged weeds were identified by species and pulled. This continued for 5 weeks. The weed density, diversity, and community composition were analyzed and compared between all treatments after all the data was collected from the 5-week trial. Aboveground weed biomass was significantly reduced by the tarp treatment compared to cover crop treatments.

Changes in expression patterns of genes related to cyclic eggshell mineralization in the shell gland of laying hens at early and peak egg production

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The shell gland is a specialized tissue responsible for the calcification of an eggshell approximately every 24 hours after laying hens reach sexual maturity. This incurs a massive demand for calcium (Ca) and phosphorus (P), which is partially derived from the hens' bone. As hens age, they produce thinner eggshells; however, the mechanisms responsible are unclear. Therefore, the objective of this study was to examine the expression of calcium and phosphorus genes responsible for shell calcification at two ages within early (25wk) and peak (43wk) lay. Shell gland tissue was collected at 1:30, 6:00, 15:00, and 21:00 hours (h) after egg laying. Total RNA was extracted, and reverse transcribed to cDNA then analyzed via O43. An interactive effect of age and time was indicated ($p<0.0015$) for the Ca chaperone CALB1. Expression of this gene peaked on 43wks at 15:00h, which is the time of peak eggshell calcification. Expression of the calcium transporter ATP2B1 significantly increased ($P\leq0.05$) between 1:30h and 21:00h. Carbonic anhydrase 2, an enzyme responsible for bicarbonate production necessary for shell calcium carbonate formation, and SLC26A9, a bicarbonate transporter, were significantly increased ($P\leq0.05$) at 6:00h and 15:00h. Expression of several P transporters (SLC20A1, SLC20A2, and SLC34A2) was elevated at 15:00h and/or 21:00h, likely due to P requirements for cuticle development at the end stage of eggshell formation. Together, these results show that hens utilize certain Ca and P transporters at different periods to optimize eggshell and cuticle formation, and this likely influences eggshell quality.

The Effect Of Dietary Iodine Supplementation On Growth Performance Of Weaned Pigs

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Iodine, a trace mineral, is an essential component in swine diets to promote growth and thyroid hormone synthesis. This study examined the impact of varying dietary iodine supplementation on weaned pig growth performance. Weaned piglets (N=100; 5.95 + 0.108 kgs; 21 + 3 d old) were sorted by weight into pens. Pens (n=5 pens/ treatment) within a block were randomly assigned a formulated dietary treatment: 0.0 mg/kg (CON), 0.14 mg/kg (NRC), 1.4 mg/kg (NRC10), 14 mg/kg (NRC100), and 140 mg/kg (NRC1000). Diets were fed in three phases (d 0-10, d 10-21, and d 21-35). Piglets were weighed weekly. Overall Average Daily Gain (ADG), Average Daily Feed Intake (ADFI), and Gain:Feed (G:F) were calculated to evaluate the impact of different levels of dietary iodine on growth performance. ADG, ADFI, and G:F were also evaluated on a phase basis. Growth performance was analyzed as a randomized complete block design via PROC GLM in SAS using pens as the experimental unit and weight as the blocking factor. Statistical significance was set at a $P < 0.05$. ADFI was the primary focus for growth performance. There were no significant differences observed for ADG, ADFI, or G:F between the diets and the different phases ($P > 0.10$). For overall ADG, there were numerical differences between diets such as NRC100 (435 g/d) performing the best while NRC (400 g/d) showed the least growth performance, but no statistical significance was seen ($P = 0.76$). For overall ADFI, NRC 10 (918 g/d) has the higher growth enhancement compared to NRC (874 g/d) which has the lowest. However, no statistical significance was seen for the overall ADFI ($P = 0.94$). G:F also exhibits numerical differences between diets but no significance statistically was detected ($P = 0.54$). For our study, there was no level of iodine that had a significant impact on the growth performance of pigs. More research should be required to find an effective level of iodine that provides an increased level of growth performance.

Microbiological Testing of Continuous Flow High-Pressure Homogenization Treated Blueberry Juice Compared to the Control Group During 45 Days of Cold Storage

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Fruit juices are a popular food product with the average American consuming about 18.1 liters of juice per year. The average consumption of juice per capita has been declining over the last decade as people are growing more concerned about sugar consumption and clean labels. Sugars are added to juices to prevent microbial growth which is a sign of quality deterioration. One way of minimizing the need for added sugars and antimicrobials is by finding a treatment process alternative to heat treatment that will better maintain juice properties and have a bactericidal effect. Heat treatments in fruit juices are known to damage the quality of the juice and reduce the nutritional value. High pressure processing is a possible alternative to thermal processing that can effectively kill microbes without the use of added sugars and appeal more to health-conscious consumers. In this study, the blueberry juice was treated with combinations of three pressures (200, 250, and 300 MPa), two inlet temperatures (4, and 22 °C), and three flow rates (0.75, 1.125, 1.5 L/min) using a pilot scale continuous flow high pressure homogenization system and compared with thermal treatments that carried out at 75, 85, and 95 °C with 15 seconds residence time. To study the shelf-life of all treated samples as well as untreated control samples were stored at 4 °C for 45 days. All samples were tested for microbial growth after 1 day, 15 days, 30 days, and 45 days and compared. Among 18 high pressure treatments, all samples showed lower microbial populations during 45 days of cold storage than the untreated control samples except for treatment 7 (200 MPa, 1.5 L/min, 4°C). Treatments 2 (250 MPa, 1.125 L/min,4 °C), 6 (300 MPa, 1.125 L/min, 4°C), 9 (300 MPa, 1.5 L/min-4°C), and 14 (250 MPa, 1.125 L/min, 22°C), all contained microbial and yeast and mold populations below the detectable limit during 45 days of cold storage, and significantly ($p < 0.05$) lower than the control sample as well as all of the thermally treated samples making these treatments the best options for a safe high pressure treated juice.

Assessment of a Novel Neuroprotective Agent on Cognition and Motor Function in a Piglet Traumatic Brain Injury Model

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Every year, over half a million children aged 0 to 14 suffer from a traumatic brain injury (TBI). TBI can lead to functional impairments in areas such as learning and motor function due to disruption of normal brain development after injury. Currently there is a lack of effective treatments for TBI as rodent models are not the most adequate representation of success to human trials. Neuroprotective therapies have been an area of interest for TBI research as they have the potential to reduce inflammation, edema, and tissue damage after injury. The objective of this study was to determine the effect of a proprietary neuroprotective agent on mitigating acute inflammatory responses and improving functional recovery in a piglet TBI model. Castrated, male pigs underwent controlled cortical impact surgery to induce TBI and received a subcutaneous injection of a low dose (LD) neuroprotectant (n=4), high dose (HD) neuroprotectant (n=4), or placebo (n=4) every 8 hours for 5 days. Changes in cognition were assessed using the three-chamber social recognition test (SRT) and changes in motor function were assessed using a semi-automated GaitFour mat between 1 and 42 days post-TBI. Piglets in the placebo group exhibited greater motor function deficits through decreased velocity and cadence, decreased step and stride lengths in both the right front and hind limbs, and an overall decrease in mean pressure compared to the low and high dose piglets on 2, 5, and 7 days post-TBI. In the SRT, LD and HD piglets exhibited improvements in social cognition by interacting with a novel pig in greater frequencies and for longer durations than a familiar pig on day 3 and 8 post-TBI, whereas the placebo pigs spent more time with a familiar pig. These results indicate that the use of this novel neuroprotective agent results in improvements in motor function and cognition in a piglet TBI model and provides promising evidence of a therapeutic that may someday be able to restore function in pediatric TBI patients.

Effects of Maternal Nutrition During Gestation on Lamb Muscle Collagen Content

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Tenderness is one of the top three attributes consumers consider when determining quality of cooked-meat palatability. Recent studies concluded maternal nutrition during gestation can alter prenatal skeletal muscle growth and development which impacted offspring meat tenderness. Specifically, meat of lambs who's dams were overfed during gestation produced meat that was more tender than lambs from mothers fed adequate and nutrient deficient diets. Because collagen is a major determinant of cooked meat tenderness, the objective of this study was to determine maternal nutrition effects on collagen content and solubility. Dorset ewes (N = 46) pregnant with twins were fed 100% (CON), 60% (RES), or 140% (OVE) of NRC requirements from gestation day 30 ± 0.14 until parturition. Male offspring (CON, n = 12; n = 11; OVER, n = 13; RES, n = 18) were euthanized at day 84 and longissimus muscle was harvested for collagen analyses. Soluble and insoluble collagen were extracted by hydrolysis and extracted hydroxyproline content was utilized to quantify collagen content. There was no treatment effect on soluble and insoluble collagen content, and percent soluble and insoluble collagen ($P > 0.19$), but there tended to be a treatment effect ($P = 0.15$) for total collagen content. Meat from the RES treatment had more ($P = 0.05$) total collagen than OVE meat, but RES meat did not differ ($P = 0.66$) from CON meat. Meat from the OVE lambs tended to have less ($P = 0.18$) total collagen than CON meat. Overfeeding pregnant ewes will produce offspring with muscle that possesses less total collagen, which may contribute to these lambs producing more tender meat.

Determine the relative consistency of ZP proteins in the IPVL of oviposited chicken eggs

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Improving the understanding of the molecular mechanisms of hen fertility will allow for the development of a targeted approach to improving broiler breeder fertility. The standard assay for assessing hen fertility is the sperm-penetration assay, which counts the number of sperm hole penetrations around the germinal disc (GD) region of the inner perivitelline layer (IPVL). Following ovulation, the IPVL is the sole protein barrier that sperm must bind and penetrate for successful fertilization. The IPVL consists of zona pellucida (ZP) proteins. Poultry-specific antibodies for the three different ZP proteins, ZPB1, ZPC, and ZPB2, previously reported to be linked to poultry fertility were created. These antibodies have allowed for quantitative Western analyses to reveal ZP protein differences between genetic lines of turkey hens that differ in fertility and differences in the IPVL overlying the important GD region in both chicken and turkey. These results indicate ZP protein abundance is not static, and thus subject to change because of genetic selection, and that differences in ZP protein abundance at the GD region of the IPVL can be reflective of improved hen fertility in a genetic line. Although differences exist between genetic lines, no research has looked to determine if the relative abundance of different ZP proteins around the GD region and a non-germinal disc region remain consistent within an individual. Twelve eggs from a single hen were collected over a period of two weeks and kept at 4°C until the IPVL could be isolated and sonicated. Following protein quantification, the GD and NGD regions of the IPVL were compared for relative expression of ZPB1, ZPB2, and ZPC. Like previous results, the relative abundance of ZPB2 was greater in the GD region while both ZPB1 and ZPC were greater in the NGD region. Importantly, the relative concentrations of the three different proteins remained consistent for all eggs laid in the hen's clutch. These preliminary results indicate that the relative abundance of ZP proteins remains consistent with an individual and thus would be an ideal marker for genetic selection for improved hen fertility.

Tolerance of Common Carpetgrass (*Anoxopus fissifolius*) to Postemergence Herbicides

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Common carpetgrass [Axonopus fissifolius (Raddi) Kuhlm.] is a stoloniferous warm-season turfgrass that shows potential as groundcover in solar panel farms due to its ability to tolerate reduced light environments. Field research was conducted on a common carpetgrass rough at the Pine Hills Golf Course in Winder, GA during the summer of 2022 to determine potential postemergence herbicide options for weed control in carpetgrass. Treatments were initiated on 24 June 2022 and consisted of MSMA at 2.3 kg ai ha^{-1}, dicamba + iodosulfuron + thiencarbazone at 0.18 kg ai ha^{-1}, metsulfuron at 21 g ai ha^{-1}, carfentrazone + 2,4-D + MCPP + dicamba at 0.34 kg ai ha^{-1}, halauxifen-methyl + fluroxypyr + dicamba at 0.23 kg ai ha^{-1}, penoxsulam + sulfentrazone + dicamba + 2,4-D at 0.34 kg ai ha^{-1}, mesotrione at 0.18 kg ai ha^{-1}, carfentrazone at 25 g ai ha^{-1}, and MCPA + fluroxypyr + dicamba at 1.4 kg ai ha^{-1}+ O35,. A non-treated check was included. Carpetgrass phytotoxicity was 11 and 73% in response to dicamba + iodosulfuron + thiencarbazone and MSMA, respectively, 2 weeks after treatment (WAT), with corresponding NDVI of 0.68 and 0.37. Phytotoxicity increased to 46% 4 WAT in response to dicamba + iodosulfuron + thiencarbazone and decreased to 56% in response to MSMA. At 8 WAT, phytotoxicity was 19% in response to MSMA with NDVI of 0.72. No other treatment resulted was significantly different than the non-treated throughout the experiment. Additionally, greenhouse research was conducted at the Athens Turfgrass Research and Education Center in Athens, GA during the winter of 2022. Carpetgrass plugs (10.8 cm) were transplanted into 1 L pots containing a native soil and allowed to mature for a month before being cut to a height of 5.1 cm. The same treatments were applied to pots that were evaluated in the field. Percent phytotoxicity was rated visually 4 WAT. Percent growth reduction (GR) was calculated 4 WAT by removing all fresh biomass above 5.1 cm and comparing biomass (g) of each treatment to the non-treated check within the same trial replication. MSMA resulted in % phytotoxicity of 84% while all other treatments exhibited ≤ %33 phytotoxicity. MSMA and dicamba + iodosulfuron + thiencarbazone resulted in % GR of 85 to 89%, while metsulfuron and fluroxypyr + dicamba resulted in 48% and 65% GR, respectively. Less than 30% GR was observed in response to all other treatments 4 WAT. Future research should further evaluate carpetgrass tolerance to commonly-used preemergence herbicides.

Influence of early life phytase supplementation on growth, P digestibility, jejunal transporters, liver protein and degradation genes in broilers

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The study investigated the influence of phytase supplementation in the early life of broiler chickens on growth performance, ileal phosphorus (P) digestibility, and mRNA levels of jejunal mineral transporters and liver protein synthesis. Both plants and animals obligately require P for growth and also bone development for animals. Phytate is the principal storage form of P in plant seeds used in broiler diets. Phytate P is poorly available to poultry; therefore, inorganic P is supplemented to meet the dietary P requirements. This leaves the unused portions of the supplemented P and the indigestible phytate P to be excreted, resulting in high concentrations of P in the manure. Phytase is an enzyme represented as a subgroup of phospho-monoesterases that hydrolyze phytate thus increasing plant P digestibility and reducing the quantity of supplemental P. The objective of the experiment was to test whether broiler chickens' responses are influenced by whether they received phytase in their diets early in life. A total of 180 male broiler chicks were allocated on day zero to two corn-soybean meal diets (with or without phytase). On d 16, the birds in each diet were further divided into three semi-purified diets with increasing levels of soybean meal as the only source of P. All six diets were supplemented with phytase. Diets 1 to 3 were without phytase in early life, whereas diets 4 to 6 were supplemented with phytase in early life. Birds and feed were weighed on d 0, 16, and 21. Birds were euthanized on day 21, ileal digesta were collected for digestibility measurements, and the jejunum and liver were collected for mRNA analysis. Birds that received phytase were heavier ($P < 0.01$), but feed intake and FCR were not affected by phytase. On d 21, birds that received phytase in early life were heavier and had higher feed intake ($P < 0.01$) but no phytase effect on FCR. Phosphorus digestibility was marginally greater in birds that received phytase in early life but not significantly different. The mRNA level of transporters for P, Ca, and Zn were downwardly ($P < 0.05$) expressed in birds that received phytase in early life. There was no treatment effect on liver mRNA levels of protein synthesis and degradation genes. Based on the results of the experiment, providing phytase in early benefited the growth of broiler chickens and reduced P excretion, but the effect on phytase on day 21 was independent of whether phytase was supplied in early life or not.

Quantification of chewing frequency in horses consuming bermudagrass hay as compared to three other popular equine forages

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Colic is a major cause of death in horses, and a major health concern for their owners. Impaction colic, which occurs when feedstuffs become impacted in a section of the large intestine, is typically blamed on the horse's diet. Fine-stemmed forages such as bermudagrass are attributed to increased risk of colic because they are regarded to be more easily impacted in the horse's bowels. Bermudagrass is the most common hay grass in the southeastern United States; it thrives in the warm, humid climate and is fed in many southeastern states because to its low cost and ease of access. Furthermore, because many horses in the Southeast are fed bermudagrass at some time through pasture or hay, bermudagrass is detected in the digestive tracts of the majority of horses submitted to a veterinary clinic for surgery. There are various elements to consider, such as the finer stemmed forage's digestibility and higher fiber content, however there is no concrete evidence or research to back up the claim that bermudagrass promotes colic. The mouth is where the horse's digestive system begins, where the teeth bite and crush the feed. The chewing movement encourages saliva production which assists in particle size reduction and works as a lubricant, enabling food to travel down the throat easier. There have been minimal studies directly linking bermudagrass hay with an increased risk of colic, though there is an unproven allegation that the fine-stemmed nature of bermudagrass results in decreased chewing rates. The aim of this study is to determine the chewing rate of bermudagrass as compared to three other common equine forages to observe its potential to increase the likelihood of impaction colic. Eight horses were given 0.75% of their body weight in hay twice daily to test chewing frequency when consuming bermudagrass, alfalfa, ryegrass, and orchardgrass hays. Horses received treatments in a randomized order and were acclimated to each type of hay for one week prior to a two day data collection using an automated halter with pressure sensors in the noseband (RumiwatchTM). Data was calculated as chews/kg and statistically compared using Mintab version 21 (State College, PA) with treatment as a fixed effect. Results indicate that horses chew bermudagrass hay considerably less as compared to orchardgrass, alfalfa, or ryegrass ($P \leq 0.001$), which potentially causes reduction in saliva production and increased risk of impaction colic.

Behavioral Analysis of Commercial Turkeys Reared Under Chronic Heat Stress Challenge

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Majority of the commercial turkeys in the United States are grown in the Southeast region which is known for its hot climate from May to September. Modern turkey strains have higher metabolic activity and, in turn, generate considerable amounts of body heat during summer months, resulting in heat stress. The goal of this project was to characterize behavioral changes in turkey toms under chronic cyclical heat stress. The specific objectives of the project are to quantify the frequency and duration of normal behaviors (resting, feeding, drinking, foraging, preening) and heat stress-related behaviors (elevated wing, panting) in tom turkeys under heat stress. Day-old male turkey poults were acquired from a commercial hatchery and reared until 18 weeks of age. Eight floor pens with individual temperature control were randomly allocated to 2 treatments – control (C1) and experimental (E1). Each treatment consisted of 4 replicate pens with 15 birds per pen. Feed and water were provided ad libitum. Heat stress challenge was started at 5 weeks of age for all birds. A chronic heat challenge model was applied by increasing the ambient temperature to 90 ºF daily from 8 am to 4 pm. C1 was heat stressed for 10 days whereas E1 was heat stressed until the end of the experiment. Behavior was recorded using continuous recording at 6, 10, 12, 14, and 16 weeks of age. Instantaneous scan sampling was used to calculate the proportion of birds exhibiting different behaviors from lights on to thirty minutes after lights off at four 15-minute intervals every other hour. Behavioral observations included resting, feeding, drinking, foraging, preening, elevated wing, and panting. The data was analyzed using non-parametric Kruskal-Wallis test and P value less than 0.05 was considered significant for the effect of treatments. Percentage of toms feeding, drinking, and foraging was not different between C1 and E1. Resting was more frequently observed in C1 compared to E1 at weeks 10, 14, and 16 ($P \leq 0.05$). Preening, a comfort behavior, was observed less in E1 than C1 at weeks 10, 12, and 16 ($P \leq 0.05$). Greater percentage of toms in the heat stress group (E1) was observed to use coping behaviors such as elevated wing and panting throughout the experiment ($P \leq 0.05$) . These results indicate turkeys subjected to chronic heat stress perform less comfort behaviors and spend more time indulging in behavioral responses to cope with heat stress.

Assessment of induced neural stem cell therapy on behavior using an open field test in a piglet model of traumatic brain injury

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Traumatic brain injury (TBI) is one of the leading causes of death and disability in young children, affecting more than half a million children. Children who sustain a TBI are more susceptible to developing long-lasting cognitive, behavioral and motor function deficits. Induced pluripotent stem cell-derived neural stem cells (iNSCs) have been found to have neuroprotective and neuroregenerative properties and may have the ability to restore functional deficits by reducing cell death and improving white matter integrity. The objective of this study was to determine if the administration of iNSCs would mitigate behavioral impairments in a piglet TBI model. A moderate/severe TBI was induced by controlled cortical impact in 4-week-old piglets. At 5 days (d) post-TBI, treated animals received an iNSC transplantation (TP) and control animals received a PBS injection in the motor cortex. Sham animals underwent craniectomy only. All treatment groups were double blinded and designated as either treatment A (n=3), B (n=4), or C (n=1) until the completion of the study and all behavioral results are analyzed. Open field testing was conducted to measure changes in behavior and overall activity level and was performed pre-TBI, 2d post-TBI, 2d post-TP, and 1, 2, 3 , 4 , 8 and 12 weeks (wk) post TP. Preliminary behavioral analysis revealed that ground sniffing, a measure of exploratory activity, was decreased for Group B at 2d, 1wk, 2wk, and 3wk post-TP compared to Group A. Urinating and defecating, a measure of anxiety, was increased for Group A at 2d post-TBI, and 2d, 1wk, and 2wk post-TP compared to Group B. Group A pigs exhibited increased balancing behaviors, indicative of instability, at 2d post-TBI, and 2d, 1wk, 2wk, 3wk, 4wk, 8w post-TP compared to Group B. Group A pigs traveled more distance and moved at a higher velocity in the open field arena at 2 D post-TBI, and 2d, 1wk, 2wk, 3wk post-TP compared to Group B and Group C. Preliminary results suggest that pigs in Group B were overall less active, exhibited fewer anxiety-related behaviors, and exhibited fewer compensatory balancing behaviors compared to Group A. However, data analysis in additional pigs is still needed to determine if iNSC treatment has an effect on behavioral changes following TBI.

A Comparison of Russell Bermudagrass Hay Stage-of-Harvest to Equine In-Vitro Digestibility

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Bermudagrass is one of the most prominent livestock forage species, spanning nearly fifteen million acres across the Southeast. Despite its popularity, bermudagrass hay has the stigma of causing impaction colic in horses. Impaction colic is the blockage of the intestine, usually requiring veterinary care. Surgical intervention may be needed in severe cases. Therefore, veterinarians do not recommend feeding bermudagrass hay to horses. Equine nutritionists see a potential to feed bermudagrass hay if it is high quality. Hay quality is determined by a variety of factors, including acid detergent fiber (ADF) and neutral detergent fiber (NDF) concentrations. Current guidelines suggest that ADF and NDF values in hay should not exceed 40% and 60%, respectively. It is common for both bermudagrass and other warm season forages to exceed the maximum value for NDF. Despite this, it is speculated that the fiber in warm season grasses is more digestible than that of cool season grasses, such as Timothy or Orchardgrass. Studies have shown that bermudagrass has a longer retention time in the digestive tract than cool season grasses, possibly allowing for more digestion of this fiber. Current guidelines may need to be altered to represent this difference. The objective of this study is to use in vitro digestibility methods to examine the digestibility of bermudagrass. Results will be compared to current recommendations to provide guidance on the maximum recommended NDF levels for bermudagrass hay in equine diets. To accomplish this, microbes were obtained from fecal samples collected from five different horses fed bermudagrass hay on a dormant pasture. Fecal fluid was used to digest a series of forage samples representing different maturities of bermudagrass, harvested at four, five, six, seven, and eight week intervals. Initial results show a change in pH in fecal fluid for all forage samples, indicating that fermentation of samples was successful. Volatile fatty acid production, dry matter disappearance, and NDF disappearance are currently being analyzed. Results should provide research-based recommendations for selecting appropriate hay for horses.

Chicken Yolk Sac Tissue as a Source of Endocrine Factors During Early Embryogenesis

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In the meat-producing chicken industry, embryonic development accounts for approximately one-third of the life of the bird. Understanding the factors that control development during this period is critical for improving post-hatch growth performance. In birds, the yolk contains nutrients and growth factors for embryo development prior to the development of a functional endocrine system, with the yolk sac tissue (YST) serving as the intermediary between the two. The extent to which the YST aids in embryo growth prior to development of its hormonal systems is unclear. Therefore, the purpose of this study was to understand how the YST contributes to endocrine function during early embryonic development. Embryos were harvested at embryonic (E) days 3, 6, 9, and 12, and the YST was collected. Total RNA was isolated, and RT-qPCR was used to determine if YST produces factors within the somatotropic axis that play a role in the regulation of growth and metabolism. This axis includes growth hormone, insulin-like growth factors (IGFs) 1 and 2, and their associated receptors and binding proteins. A one-way ANOVA followed by Fisher's test of least significance were conducted to analyze expression patterns in the YST over time. Insulin-like growth factor binding protein 1 (IGFBP1) increased in expression during early embryogenesis from E3 through E9 ($p \leq 0.05$) and remained constant through E12. Similarly, IGFBP7 increased from E3 to E6 ($p \leq 0.05$) and remained elevated through E12. IGFBP3 exhibited a similar pattern, with differences approaching significance ($p=0.07$). In clear contrast, insulin-like growth factor binding protein 2 (IGFBP2) decreased in overall expression from E3 to E9 ($P \leq 0.05$) and remained low on E12. Given that IGFBPs can serve to increase or reduce availability of IGFs, their differential expression patterns suggest an involvement in early regulation of these hormones originating from within the YST. Although IGF1 was not detectable at the ages studied, IGF2 was expressed in the YST and appeared to drop in expression over time, though the difference was not significant ($p=0.06$). This suggests that the YST may serve as an early source of IGF2 as well as proteins that regulate its function. Together, these results suggest that the YST is a likely contributor of somatotropic signals for the developing embryo and plays an important role in supporting early embryonic growth and metabolism.

Advertisement Recall in Floral Marketing Strategies

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Market research is one of the most important aspects of developing a marketing strategy. It is important for brands to understand what advertisements will have the most impact on their consumers in terms of value proposition and brand perception. A survey was conducted with question about demographic information, as well as several different ads for a floral company. There were six advertisements that could be shown: 1. Static graphic of roses. 2. Static graphic of tulips. 3. Static clipart graphic. 4. Animated graphic of roses. 5. Animated graphic of tulips. 6. Animated clipart graphic. The phrase “Give flowers to show you care” was placed over the images. Participants were shown either one of these advertisements, or no advertisement. There were also questions regarding how participants felt about the ads and which platform the ads were viewed on. Questions were later asked about whether participants recalled what advertisement they were shown. They were asked to select if they saw roses, tulips, or clipart graphics. There were also options for those who did not see an ad, and those who did not remember the ad. There was also a question regarding what device the participants were using and whether the ad loaded to account for technical errors. The results found that those who were older than 50 were more likely to recognize which flower they saw. Women were also more likely to be able to identify the type of flower they saw, as well as those who received a higher education. The way that participants took the survey also mattered. Participants who took the survey on a smartphone or tablet were less likely to recall the advertisement they saw than those who took it on a laptop. This could indicate that the formatting of the survey needs to be more adaptable to different platforms. Participants who guessed incorrectly were more likely to guess roses as the correct answer. Participants who did see roses were also more likely to answer correctly. Roses are obviously a more popular flower, which shows that many participants had a hard time identifying or remembering other types of flowers.

These findings are important to help us critique the ways we do market research and conduct market surveys. Formatting the surveys to account for people taking them on smartphones or tablets, and eliminating floral graphics would likely be beneficial to future surveys.

Impact of 1-α hydroxycholecalciferol on Bone Formation in Laying Hens

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Genetic selection for higher egg yields in commercial layers has placed stress upon the physiological regulation of calcium (Ca) and phosphorus (P), and the result of this is often compromised skeletal health. Medullary bone is a labile Ca source that supplies the majority of Ca for eggshell calcification and develops between 18 and 31 weeks of age. Improper formation of medullary bone can lead to excessive Ca withdrawal and weakening of structural cortical bone. Efficient utilization of Ca uptake for bone formation requires the active form of vitamin D3. Our hypothesis is that supplementing a more biologically active vitamin D3 metabolite, 1-α hydroxycholecalciferol (AlphaD3), will increase activity of vitamin D3 in the body and improve bone development. At 18 weeks of age hens were allocated to either a control or AlphaD3-supplemented diet. Eight hens were sampled at 18 weeks before diets were allocated, and 16 hens were sampled at 31 weeks (n=8/diet). Kidney, shell gland, keel, tibia, and humerus samples were collected from each hen. Gene expression for vitamin D metabolism and Ca uptake and utilization was analyzed by RT-qPCR in kidney and shell gland. Bones were analyzed using dual-energy x-ray absorptiometry (DEXA) and keel scoring to assess skeletal health and composition. Additionally, at 25 and 43 weeks of age, eggs from 10 hens per diet were collected over three consecutive days and evaluated for eggshell quality parameters. At 31 weeks of age, DEXA results indicated that AlphaD3 improved bone mineral density of the tibia compared to the control diet ($p \leq 0.05$). At 43 weeks of age, hens supplemented with AlphaD3 had increased egg specific volume (ml/g) ($p \leq 0.05$) which suggests a higher eggshell quality. At 31 weeks of age, keel scoring did not result in significant differences between AlphaD3 and Control diets but did have a significant increase in deviation incidence (%) compared to baseline at 18 weeks of age ($p \leq 0.05$). These results, along with the RT-qPCR data for the tissues, will provide information on the role that dietary vitamin D3 supplements play in improving Ca and P utilization and thereby bone health in commercial layers.

Cultivation and Genetic Characterization of Multiple Lines of Apios americana

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Apios Americana a member of the Fabaceae plant family, is native to North America east of the Mississippi River. Like many other legumes, A. americana establishes a symbiotic relationship with rhizobia bacteria. These bacteria are capable of converting atmospheric nitrogen gas to plant-available forms. Unlike most other Fabaceae, A. americana produces rhizomes, modified stem tissues that serve as storage organs. Its tuber is also unusually dense in protein and micronutrients like iron. Although A. americana is cultivated only as a specialty crop today, it has a long history of human use by many indigenous cultures. It was also adopted by English and other European colonizers as an important food source during winters. Despite its former widespread use, it is not well characterized genetically, nor is much information about its cultivation widely available. A. americana does not have any major pests and could be a valuable genetic resource for diversifying the food system, which would make our agriculture more resilient in the face of challenges like climate change and emergent plant pathogens introduced from other regions in the world. In this project, we are cultivating a diverse set of A. americana accessions from the US National Collection in both field and green house conditions. Field grown plants will be grown on a trellis system at a plot in the J. Phil Campbell Research Center. Tissue obtained from these plants will be sequenced to construct a genomic map and distinguish genetic differences between the different lines sourced from a range of locations throughout the range of the plant.

White Clover Genetic Gain of Herbicide Resistance Over Five Generational Cycles

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White clover (Trifolium repens) is an important legume forage that is primarily used in pasture mixtures with grasses to improve their quality. 2,4-dichlorophenoxyacetic acid (2,4-D) is a synthetic auxin herbicide that is commonly applied to fields to control broad-leafed weeds. One of the obstacles to the establishment of white clover, especially in grass mixtures or following a grass pasture, is the application of herbicides that control broadleaf weeds. However, commonly used auxin herbicides also kill all pasture legumes. Therefore, we developed 2,4D resistant white clover through EMS mutation and recurrent phenotypic selection. In this study, we analyzed the genetic gain/cycle of five cycles of white clover generations (Cycle 3 to Cycle 7) in the greenhouse. We also analyzed the mechanism of 2,4D resistance in white clover through a malathion test. A rate of 4 lb ai/ac of 2,4-D was applied to the clover trays after four weeks of growth. After another four weeks, the number of survivors and the dried biomass were recorded. The number of survivors and dry biomass was again recorded after 8 weeks of treatment. The Cycle 6 generation was sprayed with 100g/ha of Malathion. Malathion affects the contact angle on the plant leaf and can change the metabolic effects of chemical sprays. The realized genetic gain for percent survivors in cycle 6 was the largest compared to the previous generations' populations. Moreover, the realized genetic gain from cycle 3 to cycle 7 has increased 23% with an average of 5.75% per cycle. In the case of the malathion test, 26% of plants survived when treated with 2,4D + malathion whereas 36% of plants survived when they were sprayed only with 2,4D. This indicates that the resistance to 2,4D herbicide is due to metabolism instead of the amount of herbicide uptake.

The effect of iron injection dosage and dietary iron supplementation on the growth performance and blood parameters of nursery pigs

Julia Brooks, Animal Science Major, Department of Animal and Dairy Science; Presented in 2022

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Pigs are iron deficient at birth; therefore, producers supplement this mineral in order to maximize swine health and growth potential. The objective of this study was to observe the effects of different dosages of iron given by injection (at birth), and by diets during the nursery phase. At birth, 48 piglets from 9 litters were paired within their litter based on birthweight, and given either 100 or 200 mg iron in the form of iron dextran. At weaning, (~21d) piglets were blocked by weight and birth iron treatment to 4 dietary levels of iron (80, 100, 120, or 140 ppm), resulting in a 2 x 4 factorial with 2 blocks and 8 pens/block). The nursery diets were randomly assigned within block (n= 3 piglets/pen). Piglets were fed in three phases (P1: d0-7; P2: d7-21; P3: d 21-35). Piglet body weights and feed intake were recorded weekly. Blood samples were taken via orbital sinus on d 0, 7, 21, and 35 to analyze for hematocrit (%) and hemoglobin concentrations (g/dL). Growth performance data were analyzed as a 2 x 4 factorial in PROC GLM of SAS, using pen as the experimental unit. Hematological parameters were analyzed as a 2 x 4 factorial with repeated measures. There was no significant interaction between iron dosage at birth and dietary iron concentration in the nursery for any parameter measured ($P \geq 0.05$). There was no impact of iron dosage at birth or dietary iron in the nursery on any growth performance parameter measured but averages for overall ADG, ADFI, and G:F were 314 g/day/pig, 537 g/day/pig, and 0.59, respectively. On d 0, piglets receiving 200 mg iron at birth had increased ($P \leq 0.05$) hemoglobin concentration and hematocrit (13.1 g/dL; 42.3%) compared to piglets receiving 100 mg iron (11.3 g/dL; 38.9%). On d 7, piglets that received 200 mg iron had increased hemoglobin concentrations (14.1 g/dL) compared to piglets that received 100 mg iron (12.9 g/dL). There were no additional significant hematological responses to iron given at birth or during the nursery for the remainder of the study. Based on the results of this trial, we would recommend to producers that pigs should receive 200 mg of iron within 24-48 h after birth, and 100 ppm of supplementary iron in the nursery diet. However, further studies will need to occur in order to accurately represent what the best recommendation for iron supplementation during the nursery phase.

Leigh's Syndrome Induced Pluripotent Stem Cell Differentiation into Ectoderm, Endoderm, and Mesoderm

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Leigh's syndrome (LS) is a devastating mitochondrial disorder that arises due to mutations in mitochondrial DNA. This results in decreased levels of ATP production and abnormal development in tissues that have high energy needs like cells in the nervous and cardiovascular systems. Ultimately, abnormal development in these critical systems leads to death in children with LS. Our team has recently generated human induced pluripotent stem cells (iPSC) from skin cells of LS patients as a potential model to study LS and to screen novel therapeutics. LSiPSCs are potentially capable of forming any cell type in the body, which will allow for the study of specific cell type deficits in vitro and the development of cell type specific therapeutics. However, it is unclear if LSiPSCs can differentiate into the major three germ layers- ectoderm, endoderm, and mesoderm. The objective of the study is to determine if LSiPSCs can differentiate into all three embryonic germ layers. Healthy control cells BJ iPSCs and four patient-derived mitochondrial-diseased LSiPSCs (LSPSC-SBG1, LSPSC-SBG2, LSPSC-SBG3, and LSPSC-SBG7) were maintained in NutriStem hPSC xeno-free medium on iMatrix coated plates. Spontaneous differentiation of iPSCs was induced over a 21-day period by changing the media from NutriStem hPSC iPSC medium to a differentiation media composed of Dulbecco's Modified Eagle Medium/Nutrient Mixture F-12, KnockOut Serum Replacement, Glutamax, Non-Essential Amino Acids, and beta-mercaptoethanol. Cellular imaging was taken every 7 days to track germ layer differentiation. After 21 days, RNA was isolated from differentiation cultures and qRT-PCR was performed to identify ectoderm, endoderm, and mesoderm layer gene expression. Imaging results demonstrated that iPSCs underwent successful differentiation. iPSCs that typically display a large nucleus to cytoplasmic ratio, cobblestone growth pattern, and large nucleolus showed a significant change in growth patterns with cell clustering, neurite extensions, and increased in pigmentation. In addition, we anticipate gene expression results will demonstrate an increase in βIIITub, OTX2, and FGF8 ectoderm gene expression, Gata4, sox17, and alpha-fetoprotein endoderm gene expression, and Brachyury, Hand1, and MIXL1 mesoderm expression. These preliminary results suggest that LSiPSCs are capable of spontaneous differentiation into ectoderm, endoderm, and mesoderm and are potentially a robust LS cell model.

Effect of reducing crude protein & replacing with AA in soybean diets on growth, digestibility, & markers of nutrient transporters in broiler chickens

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The aim of the experiment was to investigate a strategy to reduce N excretion to the environment. Because protein supplies amino acids (AA) for animal growth but intact protein results in considerable loss of N to the environment, it was proposed to use less intact protein and supplement with AA as a means to reduce N pollution in poultry farms. Therefore, a total of 540 Cobb male broiler chickens were used in a 42 day experiment to study how reducing levels of crude protein will affect growth performance, AA digestibility, and expression of peptide and AA transporters in the chickens. A total of two diets consisting of a corn-soybean meal (SBM) positive control (PC) diet and one additional SBM diet with reduced intact protein but balanced with supplemental AA was used. On day 18, jejunal tissue was collected and snapped frozen in liquid N for later analysis of peptide (PEPT1) and AA (EAAT) transporters. Ileal digesta were collected and analyzed for digestibility markers and dry matter, N, and AA. In comparison to the birds receiving the PC diet, chickens receiving a low protein SBM diet had an overall decrease ($P \leq 0.05$) in weight gained and feed intake ($P \leq 0.05$) but no difference in gain to feed. Chickens receiving the diet with reduced protein and supplemented with AA had statistically significant ($P \leq 0.05$) decrease in ileal digestibility of N and the following AA: Ala, Asp, Glu, His, Leu, Pro, and Ser. However, chickens receiving diets with low protein had significantly ($P \leq 0.05$) higher ileal digestibility of Cys and Thr. The diets did not have statistically significant effect ($P \geq 0.05$) on ileal digestibility of dry matter and the following AA: Arg, Gly, Ile, Met, Phe, Trp, and Val. Additionally, the birds receiving both diets had no significant difference ($P \geq 0.05$) in gene expression of peptide (PEPT1) or amino acids (EAAT) transporter genes; although the birds receiving low-protein diets had marginally greater expression of those transporter genes. In conclusion, supplementing the low-protein diet with the limiting AA did not result in difference in feed efficiency (gain:feed) because the lower weight gain was accompanied with lower feed intake. However, the low protein diet triggered changes in digestibility of multiple AA; decreasing digestibility of mainly non-essential AA and increasing or having no effect on digestibility of most of the essential AA.

Attractiveness of insecticide-treated blueberries with or without a novel adjuvant Combi-protec to adult spotted-wing drosophila

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Spotted-wing drosophila, Drosophila suzukii (Matsumura) (Diptera: Drosophilidae) is an invasive fruit fly of Asian origin. It was first detected in the US in 2008 and since then has emerged as a devastating pest causing severe crop damage to soft and stone fruits. Currently used insecticide-based control programs are not sustainable due their negative effects on non-target organisms and the environment. There is a growing need for novel environmentally friendly strategies to effectively control this pest on a more sustainable basis. Combi-protec is a novel adjuvant consisting of plant extract, proteins, and sugars. When mixed with insecticide solution, this adjuvant acts as a phagostimulant that encourages D. suzukii feeding, resulting in enhanced insecticide uptake. However, the behavioral response of D. suzukii adults to Combi-protec and insecticide spray mixtures with commonly used insecticides is unknown. This study assessed the behavioral response of adult D. suzukii to insecticide solution mixed with Combi-protec and determined the efficacy of insecticides mixed with and without Combi-protec in managing SWD. Two-choice assays were conducted in the laboratory and the number of insects that chose a specific treatment choice were counted 24 hours after insect release. Semi-field bioassays were also conducted to compare the effectiveness of insecticide spray with and without Combi-protec. Data from the behavioral trials were analyzed using a two-sided paired t-test and the efficacy trials were analyzed using PROC GLIMMIX procedure with Tukey HSD. The resulting behavioral response of D. suzukii suggest that Combi-protec alone is neither a repellent nor an attractant, as a statistically insignificant proportion of adult D. suzukii responded to Combi-protec (~27%). Further, D. suzukii preferred blueberries treated with water over Combi-protec (~80%). In behavioral trials conducted with insecticides, there was a slight repellency both when blueberries were treated with Combi-protec and when added to selected insecticides. In the efficacy trials, the addition of Combi-protec to insecticides lead to a reduction in larval counts on treated blueberries compared with insecticide alone. These results suggest that Combi-protec can increased efficacy of insecticides to reduce fruit infestation, however, large field trials should be conducted to determine the best use pattern for this new product.

Impact of Systemic Insecticides on Natural Enemy Longevity in (Prunus persica)

James Cornish, Entomology Major, ; Presented in 2022

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Insect pest management in peaches (Prunus persica) relies heavily upon broad spectrum and systemic pesticides, like imidacloprid, which have the potential to negatively affect many naturally occurring beneficial arthropods over time. Research has unveiled extrafloral nectar (EFN) to play a major role in attracting and providing alternative food for natural enemies, which are important for providing biological control (BC) services. Specifically, EFN is known to regularly recruit a variety of species belonging to the order: Hymenoptera (notably members of Family: Formicidae and the Parasitica group) which either predate or parasitize the local peach pests. In addition, lady beetles (Family: Coccinellidae) are well known for switching to nectar as an alternative food source suggesting probable attraction of the beetles to EFN. Previous research, conducted by the Blaauw Lab, has detected the presence of pesticides in the EFN of peach trees suggesting a potential impact on naturally occurring enemies of major agricultural pests, such as the devastating San Jose Sale (Comstockaspis perniciosus Comstock). The objective of this project was to better understand the direct impact of such a systemic insecticide on the longevity of two commercially available agents for scale BC: golden chalcid (Aphytis melinus) and scale destroyer (Lindorus lophanthae). In order to test this objective, fifteen peach seedlings were treated with imidacloprid and fifteen were left untreated as controls. The EFN was collected from each of the treated and untreated trees over a period of two weeks using 5 μl capillary tubes. Collected EFN was then transferred to 8 mm disks of filter paper, mixed with 5 μl of water, and then placed in separate Petri dish bioassay chambers. The test insects were then placed within the Petri dishes and exposed to the EFN saturated filter paper. Mortality of the insects was then evaluated over the subsequent 24 hour period. Results and conclusions from this experiment will be discussed during the presentation.

Activity level and environmental impacts of horses housed in a novel "track" system as compared to conventional pasture housing

Kayla Costin, Animal Science Major, Department of Animal and Dairy Science; Presented in 2022

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Horses in the United States are typically housed in pastures, stalls, or a hybridization of these methods. However, the development of "equine tracks" is growing in popularity as an alternative. Many horse owners are already implementing equine tracks to improve equine welfare despite the lack of research on this novel management system. Track systems were first introduced as Paddock Paradise in the book, Paddock Paradise: A Guide to Natural Horse Boarding by Jaime Jackson. This system consists of a perimeter track (3-6 m width) with hay stations, water stations, and environmentally enriching stimuli. Tracks are believed to have several positive impacts on the horse related to increased movement which may reduce obesity and related health disorders. But, there may be key disadvantages resulting from concentrating horses to a smaller space, including erosion, environmentally damaging runoff, pugging and poaching, and high cost. Of additional concern, there is no supporting data to indicate that horses move more in a track system as compared to conventional housing, potentially eliminating any welfare benefit to housing horses in a track. To further investigate this, a simple track was constructed at the UGA Livestock Instructional Arena, and eight horses were housed in pairs, fitted with GPS trackers, and rotated through three housing treatments: the track, a small pasture (2 ha), and a large pasture (12 ha). Preliminary statistics run using Minitab statistical software indicate that there were no differences in distance traveled in these three housing treatments ($P=0.377$). Vegetative loss was evaluated using forage hoops to collect and weigh vegetative cover at random points in both the track and small pasture, and erosion was measured using a profile meter to assess changes in soil level both inside and outside the track. Results were analyzed with Minitab software using analysis of variance with time and treatment as fixed effects. Data indicate loss of vegetative cover in the track ($P \leq 0.001$) as well as sediment movement ($P \leq 0.05$) that was not present on in the small pasture or outside the track. Taken together, results indicate that the track system did not increase the movement of the horses, but increased sediment movement possibly indicating erosion. Therefore, the benefit of this track system is not enough to justify the environmental consequences based on data from this study.

Evaluating the relationship between luteal blood perfusion and circulating progesterone in beef heifers

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Transrectal ultrasonography and rectal palpation are the most used tools for diagnosing pregnancy in cattle. These tools rely on the presence of an embryo or fluid in the uterus and are only accurate when utilized at least on days 45 and 28 of gestation. Doppler ultrasonography measures blood perfusion in the corpus luteum and recognizes cows undergoing luteolysis. The main objective of this project was to evaluate the relationship between luteal blood perfusion and circulating progesterone (P4) concentrations. We hypothesized that blood perfusion in the corpus luteum (CL) evaluated via color Doppler ultrasonography is correlated with circulating concentrations of progesterone. Ultrasound videos were taken using color Doppler from heifers 20 days after fixed-time artificial insemination and blood perfusion was estimated based on the percentage of the luteal area with color Doppler signal. Circulating concentrations of progesterone were also collected on day 20 after insemination and measured using radioimmunoassay. Corpora lutea were classified based on area as small (≤ 20 mm2), medium (20-30 mm2), or large (≥ 30 mm2). Additionally, CL were also classified based on luteal blood perfusion as having low (≤ 30%), medium (30-45%), or high (≥ 50%) blood perfusion. Heifers with large CL had greater concentrations of P4 compared to heifers with medium and small CL ($P \leq 0.05$). Heifers with medium CL had greater concentrations of P4 compared to small CL heifers ($P \leq 0.05$). Heifers with high blood perfusion had greater concentrations of P4 compared to heifers with medium and low blood perfusion ($P \leq 0.05$). Heifers with medium blood perfusion had greater concentrations of P4 compared to heifers with low blood perfusion ($P \leq 0.05$). Both blood perfusion ($r = 0.63$; $P \leq 0.01$) and CL area ($r = 0.78$; $P \leq 0.01$) were positively correlated with circulating concentrations of progesterone. In conclusion, there is a positive relationship between luteal blood perfusion and circulating concentrations of progesterone.

A standardized approach for evaluating changes in motor function capability through gait analysis in a pediatric piglet traumatic brain injury model

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In the United States there are 1.5 million cases annually of Traumatic brain injury (TBI) predominantly in children 4 and under - resulting in lifelong disabilities, abnormal cognitive and motor function development, and death. Induced pluripotent-derived neural stem cells (iNSCs), a hopeful therapeutic for TBIs and other neural injuries, may have the potential to provide a patient-specific, regenerative therapy by differentiating and integrating into damaged brain tissue and restoring brain functionality. In pre-clinical TBI models, changes in motor function can be assessed using quantitative gait analysis. However, challenges such as intra-run variability, inter-run variability, and disturbances during testing can skew results and distract from significant treatment differences. In this study, we aimed to evaluate changes in motor function recovery resulting from iNSC transplantation and provide a standardized procedure for collecting and analyzing gait parameters, in order to limit variability due to non-treatment differences. A moderate/severe TBI was induced by controlled cortical impact in 4-week-old piglets (TBI; N=2, one male and one female). Sham animals (S, n=2, one male and one female) underwent craniectomy only. iNSCs were transplanted (TP) in the motor cortex 5 days (D) post-TBI. Gait analysis was performed over a 12 week study period by training piglets to trot down a GAITFour electronic mat that spans 6.1m in length and contains 23,000 sensors capable of picking up spatial, temporal, and pressure measurements. Data collection sessions utilized an average of 15 runs per pig over a 15-minute time frame and changes in cycle stride velocity were measured. During gait data analysis, we sought methods to minimize inter-run variability by cropping runs in sets of 5. In comparison to the cycle stride velocity average amongst all runs within a given day, the first and middle 5 runs showed the least variability and the last 5 runs the most. When accounting for intra-run variability via cropping of first and last cycles, cycle stride velocities minimally increased while trends within pigs remained the same, indicating cycle cropping may only distract from potential treatment differences. In future TBI or neural injury studies measuring motor function capabilities, interferences during gait testing should be minimized and corrections for inter-run variability should be included in standardized gait analysis protocol to normalize results.

Effects of maturity and harvest time on quality of bermudagrass hay in equine diets

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Bermudagrass is one of the most popular forages grown and consumed in the Southeast United States. Although it is a common forage, it is often frowned upon by veterinarians and equine professionals because it has been linked as a potential cause of impaction colic. Bermudagrass has a higher fiber content than many other hays. Current research suggests that the fiber content results in a lower digestibility for horses. Although bermudagrass has the negative stigma associated with colic, it is still widely used in the Southeast because of its affordability. To combat this stigma, nutritionists and forage specialists have developed guidelines to better manage bermudagrass hay crops to help minimize risk of impaction. It is recommended that bermudagrass is harvested between three to five weeks during the growth phase of the grass. Research has shown that, the longer the grass is left to grow, the value becomes less digestible to the horse due to higher NDF (neutral detergent fiber) levels. An NDF greater than 65% is considered unfavorable for horses, as it becomes less nutritious. It has been shown that the digestibility of a forage decreases by half a percentage unit for every one percentage unit increase in NDF. Both warm and cool season grasses and legumes use the same NDF scale, which is potentially problematic due to differences in the makeup of the NDF fraction of different forages. The objective of this research is to develop a researched based recommendation for bermudagrass hay producers to see how maturity affects NDF values and hay digestibility. To test the NDF values of bermudagrass as it matures, plots of bermudagrass were planted and harvested at different intervals. Plots measuring 1.5X1.5 m were harvested at four, five, six, seven, and eight-week intervals. Samples were dried for 48 hours, grinded twice, and fiber digestibility was determined using near infrared reflectance spectroscopy (NIR) and wet chemistry. Data was analyzed using Minitab version 21 (State College, PA) with maturity as the variable of interest. Preliminary results indicate that week of maturity does not influence NDF values of bermudagrass hay ($P=0.183$), but cutting does, with later cuttings being more digestible than earlier season cuttings ($P\leq0.0001$). These results are contrary to commonly accepted recommendations for bermudagrass hay harvesting and warrant further investigation.

A Quest for a Universal Flu Vaccine: Evaluation of VacSIM® Delivery of a COBRA rHA Vaccine

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The impact of influenza continues to be a prominent global health concern affecting the economy, healthcare systems, and research expenditures. The recommended prophylactic is through annual vaccination with trivalent/quadrivalent vaccines and although the vaccine is updated frequently for each season's predicted strains, effectiveness is limited due to the hypervariability of influenza strains. In this study, we evaluated the efficacy of a novel vaccine delivery platform consisting of COBRA and VacSIM™. COBRA is developed as a series of layered consensus sequences consisting of historical and present influenza strains derived from phylogenetics analyses. Additionally, as a subunit vaccine, VacSIM is administered to allow for gradual release compared to the commonly used AddaVax. As a two-step deliverable, it has the ability to protect against past and present strains with the potential against future strains which would alleviate the need for annual vaccination. A prime/boost vaccination study was performed followed by a two-month challenge to assess the efficacy of VacSIM, COBRA rHA, and CpG compared to conventional vaccination with AddaVax. In our study, the results demonstrated increased survival, decreased weight loss, and stronger antibody titers of the VacSIM + COBRA + CpG group compared to controls and AddaVax. As a follow-up, the effectiveness of the vaccine will be assessed through quantification of antibody titers, viral load assays, hemagglutinin inhibition assays, and assessing cross-reactivity properties. This poses the potential of COBRA + VacSIM to be used as a competent vaccine delivery platform not only for influenza but possibly for other hypervariable viruses.

Investigating the use of Ultrasound Technology for Diagnosing Intramammary Infections in Dairy Heifers

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Intramammary infections (IMI) are a costly disease to the dairy industry heifers may acquire mastitis in the animal's life. IMIs represent additional costs associated with reduced milk, shorter productive lives, and increased expenditures for the dairy farmer. The objectives of this study were to 1) describe the use of alternate technology to diagnose intramammary infections, 2) compare ultrasound findings with IMIs determined through culture, and 3) assess IMI cure rates in comparison with these diagnostic techniques post-calving. This study utilized Holstein and Jersey heifers (n=13 animals and n=47 quarters) at the UGA Teaching Dairy Farm two to four weeks before calving. A subset of animals and quarters (n=6 heifers; n=28 quarters) were also collected 1–4 days post-calving for assessment of natural recovery of IMIs. The secretions from individual quarters for pre-calving and post-calving were aseptically collected and placed immediately on ice. Samples are transported back to the lab, streaked onto plates containing four quadrants using a sterile inoculation loop. Plates with quadrants are designed to assist in identifying pathogen types. The plates were allowed to incubate at 37° C and examined at 24 and 48 hours. Ultrasound examinations were taken using a 3-6 MHz linear probe and ultrasonic gel at heifer secretion sampling. The two lateral surfaces of each quarter were examined with fluid and parenchymal characteristics recorded. Of the quarters (n=15) infected as a heifer, only 40% (n=6) cleared naturally. The remaining quarters (n=9) retained the existing infection or changed infectious pathogen categories. A quarter determined to be clean as a heifer (n=13) was highly correlated with maintaining a clean quarter (n=12) as a cow ($P \leq 0.05$). The common pathogens found in heifer quarters were environmental staphylococcus, 13 of the 15 quarters infected. The remaining two had environmental streptococci. There was no correlation between secretion consistency and pathogen groupings of interest ($P \geq 0.05$). A high degree of inconsistency in the ultrasound assessment of the four quarters within an animal led to unreliable data. The variability was unrelated to ultrasound operator and without trends related to days carrying a calf, infection status, or animal. Researchers concluded that more long-term descriptive characteristics of ultrasound use need to be examined before ultrasound's assessment as a diagnostic tool for IMIs.

Single-molecule footprinting in Arabidopsis thaliana using Methyltransferase EcoGII

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Gene transcription is controlled by proximal non-coding regions, such as enhancers, promoters and silencers, that are known as cis-regulatory elements (CREs). Within these CREs, transcription factors (TFs) bind sequences to recruit RNA polymerase to transcribe nearby genes. However, a topical challenge in the field of genetics is understanding which sequences TFs bind and the dynamics of TF binding in vivo. 'Footprinting' techniques have been developed to measure the in vivo binding of proteins to chromatin. Footprinting exploits the fact that bound proteins shield otherwise open chromatin from enzymatic activity, leaving a depletion of signal, or footprint, over bound DNA. One such technique, single-molecule footprinting (SMF) uses DNA methyltransferases to methylate accessible DNA in cross-linked nuclei in tandem with long read sequencing to provide a high-resolution visualization of the genome occupancy of transcription factors on individual DNA molecules. SMF resolves the co-occupancy of multiple TFs on a single molecule of DNA. The objective of this project was to optimize SMF in Arabidopsis thaliana in order to measure how transcription factors bind to CREs to modulate gene expression. First, A. thaliana leaf tissue was harvested and crosslinked before being cryogenically ground to isolate nuclei. Then, a discontinuous Percoll gradient was used to purify these nuclei from other cellular debris. EcoGII, a DNA methyltransferase that methylates adenosine (A) residues in any sequence context, was next added to the purified nuclei to methylate all open and accessible DNA in the crosslinked nuclei. To verify DNA methylation from M. EcoGII, DNA was digested using two methylation-sensitive restriction enzymes DpnI and DpnII; DpnI cleaves GATC sequences only when A-methylated and DpnII cleaves GATC only when A-unmethylated. PCR amplification of this digestion product followed by gel electrophoresis was used to measure the ability of EcoGII to methylate the purified nuclei. A band of PCR product was visible in the DpnII-digested samples, confirming that EcoGII causes A-methylation of A. thaliana leaf nuclei. However, more assays are needed to confirm that A-methylation is specific to open chromatin and produced TF footprints. SMF in A. thaliana will provide an alternative genomic assay to visualize TF occupancy in the plant genome. Notably, SMF will allow measurement of the dynamic and cooperative TF binding that modulates genome-wide transcription.

Effects of Coprophagy on Bacterial Acquisition and Competition in Triatomine Kissing Bugs

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Triatomine kissing bugs, including Rhodnius prolixus, are the primary vectors of Trypanosoma cruzi, the causative agent of Chagas Disease. These obligately and exclusively blood-feeding insects must take repeated blood meals to successfully develop into adults and reproduce. Other exclusive blood-feeding insects such as bed bugs and Tsetse flies maintain intracellular, endosymbiotic bacteria that provide their host with B vitamins– essential nutrients that are not abundant in vertebrate blood. In contrast, R. prolixus' symbionts exist in the gut and are acquired through coprophagy, the process by which insects ingest infected excrement. Kissing bugs have a limited diversity of bacteria present in their gut but little is known about how these non-symbiotic bacteria are acquired. This project's objective is to ascertain whether various bacterial species can be acquired through coprophagy. To execute this project, the bacterial presence in fecal matter was quantified through serial dilutions and plating. Axenic nymphs (raised from sterilized eggs) were exposed to cardstock saturated in the fecal matter of bugs fed a singular bacterial species, then bugs were fed a sterile blood meal. Following this coprophagic activity, the exposed bugs underwent DNA extractions and quantitative PCR (qPCR) with gene-specific primers to test for the presence of bacteria after a blood meal. We then tested if concentration of fecal matter influenced bacterial titer in the insect. Our results suggest that not only can these bugs pick up bacteria through coprophagy, but some bacteria are more successful at colonizing kissing bugs than others. We also investigated if the time of colonization of bacteria influences bacterial titer and microbiome composition. Further understanding the dynamics that shape the kissing bug microbiome will increase our knowledge of kissing bug physiology.

Identifying and Evaluating Science Social Media Influencers

Benjamin Easter, Agricultural Communication Major, Department of Agricultural Leadership, Education, & Communication; Presented in 2022

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The impact social media has on the diffusion of scientific information is continually growing. In order to assess who is influencing users on these platforms and what factors give them influencer status, the most notable accounts and their most influential posts must be identified, evaluated and defined. My research identifies the most prominent types of accounts and posts being used to spread scientific information on Instagram. My research evaluated ten popular hashtags related to scientific information on Instagram. In my research, I documented the top ten posts from each hashtag from the “Top” section on Instagram. Additionally, I identified the type of post and the type of account responsible for the post and recorded how many likes each post received. After conducting a content analysis of the accounts and their posts from the ten popular hashtags on Instagram, I was able to identify three different types of accounts and three different types of posts. Every account with a post in the top ten of each hashtag was sorted into one of these three categories: personal, organizational and individual page. Furthermore, every post in the top ten of each hashtag was sorted into one of these three categories: informational, exposure or humor. I then determined the total number of each different type of post and account from each category for each of the ten hashtags. In conclusion, individual page accounts and informational posts are the most popular. To summarize, my study reveals the types of accounts and posts science social media influencers use to spread information and ranks their level of utilization. The purpose of the research is to understand the factors that give science social media influencers “influencer status” on Instagram.

The effect of iron dosage on the growth and blood parameters of neonatal pigs

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Sufficient oxygen transportation via hemoglobin is necessary for growth and muscle development of neonatal pigs. Iron supplementation within 72 hours of birth has become standard in the swine industry, but the recommendations as to what concentration is not well defined. The objective of this study was to determine the effect of iron injection dosage on the growth and blood parameters of piglets during lactation. Newborn piglets (N=82, from 7 litters; 1.36 kg) were weighed and then paired by birthweight and given either 100 or 200 mg iron from iron dextran via an intramuscular injection in the neck. Piglets were weighed at weaning (approximately 21d) and were bled from the orbital sinus to determine hematocrit (%) and hemoglobin concentration (g/dL). Data were analyzed using PROC GLM in SAS using piglet as the experimental unit. There were no significant differences observed in weaning weights (P =0.44 or average daily gain (P = 0.37) for the 100mg treatments (5.41 kg; 190 g/day) compared to the 200mg treatment (5.10 kg; 174 g/day) in response to iron dosage. There was a significant increase in both hematocrit and hemoglobin concentration in the 200 mg iron piglets (38.9%, 14.3 g/dL) when compared to the 100 mg iron piglets (34.5%, 11.7 g/dL; $P \leq 0.01$). In order to maximize oxygen carrying capacity of piglets during lactation while not affecting growth, 200 mg iron from iron dextran would be recommended to producers.

Preliminary Results - Effects of Nicotinamide Riboside on Food-Service Style Bacon Oxidation During Extended Frozen Storage

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The objective of this study was to determine effects of feeding pigs increasing levels of nicotinamide riboside (NR) on bacon processing characteristics and palatability. Forty pigs were randomly assigned to 1 of 5 NR treatments: 0, 15, 30, or 45 mg/kg body weight NR daily supplemented through feed administration or 45 mg/kg body weight supplemented by drench administration (n = 8/treatment). All treatments were administered during the final 10 days of feeding, pigs were harvested the following day, and bellies were fabricated, frozen, and stored at -20°C. All pig bellies were processed using a common recipe, and the bacon was sliced, packaged restaurant style, and stored aerobically for 0, 30, 60, or 90 days. Following storage, slices were vacuum packaged, frozen, and stored at -80°C until analysis. Bacon slices were thawed overnight, placed on wire racks, and cooked at 177°C for 9 minutes, with 180° pan rotation halfway during cooking. Half-slices of bacon were presented to 8 trained panelists in prewarmed glass yogurt containers. On 100-point line scales, panelists rated slices for bacon aroma, saltiness, bacon flavor, and off-flavor. There was no treatment effect for percent initial and final brine pickup, post-pickle brine uptake, and belly cooked weight ($P \geq 0.53$). There were no Treatment × Day interactions or Treatment main effects for all panel palatability attributes ($P \geq 0.41$). There were Day main effects for all palatability attributes ($P \leq 0.01$). Day 0 bacon ratings for aroma and saltiness were greater than all other days ($P \leq 0.01$), which were not different from each other ($P \geq 0.14$). Day 0 bacon flavor ratings were greater than all other days ($P \leq 0.01$). Day 30 bacon flavor ratings were greater ($P \leq 0.01$) than day 60, and day 90 ratings did not differ from day 30 or 60 ($P \geq 0.07$). Day 0 off-flavor ratings were smaller than all other days ($P \leq 0.01$). Day 30 off-flavor ratings were smaller than day 60 and 90 ratings ($P \leq 0.01$), which did not differ ($P = 0.64$) from each other. In conclusion, during extended storage bacon aroma, saltiness, and flavor decreased due to increased off-flavor development. Despite no Treatment × Day interactions or Treatment main effects, further analysis of data found one sample from the 30 mg/kg body weight treatment had abnormally elevated off-flavor scores. Analysis of the remaining samples may reveal the hypothesized NR prevention of bacon off-flavor development.

Effects of ionophores compared to plant-based compounds on rumen fermentation in fall-weaned stocker steers in the southeast United States

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Widespread use of antibiotics like ionophores in the beef industry improved cattle growth and efficiency through selective inhibition of ruminal microorganisms. However, prophylactic use of ionophores has drawn consumer concerns over antibiotic resistance, leading to a need to explore alternative compounds. Research utilizing secondary plant metabolites (SPM) suggest they can be used as an alternative to antibiotics. Xtract contains a blend of SPM (eugenol, cinnamaldehyde, and capsaicin) and has potential to serve as an antibiotic alternative. Therefore, the objective of this study was to compare the effect of Xtract to monensin on rumen microbial volatile fatty acid (VFA) production in stocker steers over an 84-day stocker trial period. Seventy-two (n = 72) steers were assigned to one of three groups with twenty-four (n = 24) steers per treatment: no supplementation control (CON), monensin supplementation at a rate of 200mg•hd-1•d-1 (MON), and Xtract supplementation at a rate of 1g•hd-1•d-1 (XTR). All cattle received the same base ration of corn silage-based diet, supplemented with dried distillers' grains at 1.81 kg per head per day. Rumen fluid samples were collected on d 0 and d 84 at the end of the trial to assess differences in VFA profiles. VFA concentrations of acetate, propionate, butyrate, isobutyrate, valerate, and isovalerate were analyzed by gas chromatography. There were treatment effects for acetate, butyrate, and valerate, the acetate to propionate (A:P) ratio, and total VFA concentration ($P \leq 0.025$). Fluid collected from MON supplemented steers had lower acetate, butyrate, and valerate concentrations than steers supplemented with XTR or CON steers ($P \leq 0.001$). The A:P ratio did not differ ($P = 0.649$) between MON supplemented steers and CON steers; however, the A:P ratio from MON supplemented steers was lower ($P = 0.028$) than XTR supplemented steers. Additionally, total VFA concentrations in fluid collected from CON steers was greater ($P = 0.001$) than fluid from MON steers, while total VFA concentrations in fluid collected from XTR supplemented steers did not differ from fluid collected from CON steers ($P \geq 0.145$). These results suggest Xtract did not affect rumen fermentation similarly to ionophores like monensin. Previous research utilizing SPM focused on feedlot diets with greater concentrations of carbohydrates than the diet in this study. More research may be required to find an effective dosage rate for forage-based diets.

TESTING FOR AN IMMUNE RESPONSE TO SHEEP RED BLOOD CELLS IN JAPANESE QUAIL

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When testing the immunological capacity of animals, it is important to test many different facets of the immune response. The production of antibodies in response to a novel challenge is one important immunological assessment. One commonly used and easy way to test for antibody production is to inject the animal with sheep red blood cells, which are innocuous but also represent a novel challenge to the animal. Most animals produce antibodies to these sheep red blood cells in two weeks, and these antibodies can then be measured using a simple hemagglutination titration assay. There have been published reports that Japanese quail are unique in that they do not respond immunologically to blood cells from several different species (sheep, chickens, or partridges), but do respond to chukar red blood cells. Yet, other studies have successfully elicited antibody production in this species using sheep blood. We tested whether injection of sheep red blood cells would elicit antibody production in a breeding population of Japanese quail. We injected 16 quail (8 male and 8 female) with 500ul of a 10% sheep red blood cell suspension. Two weeks after injection, we collected blood from these quail as well as 8 control quail that had not received an injection and thus should not produce antibodies to the sheep blood. We performed a hemagglutination titration assay to test for the presence of antibodies in these samples. None of the samples showed signs of hemagglutination, indicating that, as reported, this species does not respond to sheep blood by producing antibodies. In future work, we will test responses of quail to blood cells from other species.

Bedding Management and its Impact on Bacterial Load and Cow Comfort

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Most dairy cattle are housed in barns to provide a sheltered, cool area, especially during summer heat. Stalls within those barns, which they sleep and lie in, are bedded with sand as it is an inorganic material that is associated lower overall bacterial loads. Without proper bedding management, the beds are less comfortable and could support the presence of environmental bacteria, which may lead to a mammary infection. The objective of this project was to evaluate the pre- and post-impact of bedding management on bacterial load and cow comfort. Holstein cattle (n=85) were enrolled from the UGA Teaching Dairy, with animals being housed in 2 different pens (red and blue pens). The following data parameters were collected: sand bacterial load, % organic matter in sand, bedding hygiene using a 3 pt scoring system, depth of sand from the stall curb, % of cows standing/lying/perching, and stocking density (#cows/beds available). Data was collected for 4 weeks, 2 of the weeks having been 2-4 days after re-bedding with fresh sand (re-bedding before week 1 and 3). Stalls were also grouped by location within the pen (top, middle, and bottom). Data was assessed with GraphPad Prism and significance set at $P \leq 0.05$. We found tremendous variability in bacteria load when considering location within pens, though no obvious relationship was discovered after re-bedding with fresh sand. Overall, there was an abundance of Gram-negative bacteria relative to the streptococci count in weeks 1 and 2. Curb depth was in agreement with time of re-bedding as we saw lower overall depths in weeks 1 and 3. Interestingly, when stocking density was increased the curb depth was greater in the red pen suggesting greater usage of beds. As for cow comfort, % of cows perching and standing may indicate stalls that are uncomfortable which may be a result of improper bedding management. In our study, we found changes in % perching over time in the blue pen regardless of re-bedding. In the red pen, slight changes in % perching did coincide with bedding change. In the short timeline of our study, our most concerning finding was the abundance of environmental bacteria in the bedding. Any bacteria found in stalls could impact mammary health. Future studies may investigate the bacterial loads present on the mammary gland to determine if these levels are changed as a result of bedding management, in addition to evaluating the incidence of mammary infections over time.

Association of Bacterial Counts in the Bedding of Holstein Dairy Cattle with Milk Quality

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Mastitis, or inflammation of the mammary gland, contributes to increased costs and decreased health on dairy operations. Today, the main cause of mastitis is infection with environmental pathogens. These environmental pathogens are primarily found in the soil, manure, and bedding. Unfortunately, presence of environmental pathogens contributes to reduced mammary health, assessed by measuring the milk somatic cell count (SCC). The main objective of this study was to investigate if bacterial loads in sand bedding are associated with mammary health at the UGA Teaching Dairy. Sand bedding was collected every week for 4 weeks from the 2 separate pens (red and blue) housing lactating Holstein cows (n=54). Milk samples were also collected every week from all cows. The SCC was enumerated using a DeLaval direct cell counter. All samples were cultured on agar plates for 48 hours. We found consistently elevated levels of environmental Streptococcus spp. in sand bedding across all collections, while environmental Gram-negative bacteria was elevated in the first 2 collections. Average SCC for cows housed in the blue pen at the initiation of the study was 181,931 cells/mL ± (43,979 SEM) and 208,200 cells/mL ± (64,044 SEM) at the conclusion. Average SCC for cows in the red pen at the initiation of the study was 225,133 cells/mL ± (108,547 SEM) and 152,345 cell/mL ± (57,583 SEM) at the conclusion of the study. We found that the red pen had a higher prevalence of infection (36.3%) compared to the blue pen (25.9%). Interestingly, skin-associated bacteria (termed non-aureus staphylococci), not environmental pathogens, were the most prevalent from cows in either the red or blue pens. Of the cows housed in the red pen, Staphylococcus aureus was the second most prevalent pathogen followed by environmental Streptococcus spp. On the contrary, the second most prevalent pathogen found in samples from cows housed in the blue pen was environmental Streptococcus, and the next most prevalent was Staph. aureus. We found it surprising that other environmental pathogens, such as Escherichia coli, were not identified as a common infecting pathogen. Ultimately, the findings of this study promote a greater understanding of how dairy bedding conditions influence environmental mastitis and mammary health. Identifying increased prevalence of skin-associated bacteria suggests care should be taken while cows are being milked to prevent infection as this is a common location for spread.

Field Observations and Genetic Surveillance to Identify Predators of Emerging Leaf Beetle Invader

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Invasive species have become more common and more calamitous with the rise of globalization and international supply chain networks, threatening agroecosystems and native biodiversity worldwide. The yellowmargined leaf beetle, Microtheca ochroloma (Stal), recently invaded the Southeast and has rapidly emerged as the most devastating pest of many crucifer crops including turnip, bok choi, and napa cabbage. As an understudied newcomer to North American ecosystems, it is largely unknown whether M. ochroloma faces any predatory pressure in its invasive range. The object of this research is to identify potential predators of M. ochroloma native to North America through both field observation and genetic surveillance, enabling development of predator-based biocontrol strategies. During the summers of 2018 and 2021, we surveyed predators and M. ochroloma on a variety of susceptible Brassica rapa cultivars and developed a shortlist of predators most commonly associated with M. ochroloma. Approximately 350 predator specimens were collected and preserved so that their gut contents can be assayed for M. ochroloma DNA. While our field data suggest lady beetles and minute pirate bugs as potential predator controls, molecular gut-content analysis will validate trophic links between M. ochroloma and predators observed in the field. Once key native predators are identified, habitat management strategies may be designed specifically to bolster these predator populations and help farmers turn the tide in their war against this novel pest.

Development of a New Methodology to Utilize Electromyography to Measure Pig Muscle Fatigue

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Electromyography (EMG) is a real-time technology historically utilized to measure human muscle fiber recruitment. While originally designed for humans, the frequency of studies utilizing the technology in horses and pigs is increasing. A common problem in livestock studies is sensors do not remain affixed to the subject during active movement. In a current study being conducted by the UGA Muscle Biology Laboratory, EMG sensors were placed on the tensor fasciae latae (TFL), semitendinosus (ST), and biceps femoris (BF) muscles of 89 finishing barrows. Barrows were briskly moved around a track until subjective fatigue was declared. Across all runs and sensors, 70% of individual EMG remained affixed until subjective fatigue. More concerning, the percentage of trials where all three sensors remained affixed the entire run was 58.43%. A subset of data (N = 19 pigs) from these data was processed with MATLAB. Each pig's data were divided into thirds, Root Mean Squared (RMS; active muscle fiber estimate) values were averaged, and each data point was designated as flawed (EMG fell off) or unflawed (EMG affixed). The majority of TFL sensors became unattached during the second and third periods, ST sensors became unattached during the third period, and BF sensors became attached during the second period. Because of this, flawed data displayed much greater RMS variation. Typical fatigue patterns were seen with unflawed data. The TFL and ST muscles showed a constant decrease in RMS from the first period to the third period, while the BF demonstrated an increase in RMS from the first period to the second period and a decrease from the second period to the third period. Therefore, a subsequent study was conducted in an effort to refine EMG data collection. Finishing barrows (N = 4) were humanely euthanized and half of the barrow's muscles were super contracted pre-analysis. Muscles were stimulated for 20 minutes with an electronic muscle stimulation (EMS) unit and EMG units recorded BF and ST activity. While data processing is still in process, preliminary results from this new protocol indicate EMS may serve as a more reliable means to measure muscle fatigue.

Characterization of rumen, fecal, and milk microbiomes in dairy cows

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Manipulation of dairy cattle rumen and fecal microbiomes may improve feed efficiency and health. Further research is needed to better characterize not only these populations, but also the milk microbiome as it may reveal links that could prevent mammary diseases and promote milk yield and quality. Our objective was to characterize rumen, fecal, and milk microbiomes of dairy cows to identify associations between compartments. Rumen samples were collected by esophageal tubing, fecal samples by digital palpation, and milk by hand expression from lactating Holstein dairy cows (n=51) at the UGA Teaching Dairy. DNA extraction and sequencing were performed. Richness, abundance, and diversity of bacteria were computed. Data was also analyzed according to somatic cell count (SCC), white blood cells that become elevated in milk as a result of inflammation, to determine if milk microbiota may be dependent on mammary health. The SCC groups were low (≤2x105 cells/mL), medium (2x105–8x105 cells/mL), and high (≥8x105 cells/mL). Statistical analyses were performed using Minitab. T-tests were performed for beta-diversity. Milk sample SCC, alpha-diversity indices, and relative bacterial abundances were analyzed by ANOVA. Beta diversity (diversity between compartments) and alpha diversity (diversity within compartments) indicated rumen, fecal, and milk microbiota were all distinct (P≤0.001). Rumen microbiota had greater alpha-diversity than both milk and fecal (P≤0.05). Microbes in the rumen are responsible for digesting multiple different feedstuffs. Low SCC milk corresponded to a more evenly distributed microbiota compared to high SCC milk (P≤0.05). Specifically, we found a 90% decrease in Acholesplasma abundance (P=0.007) when comparing low to high SCC. In contrast, we found a 59% increase in Succinivbrionaceae_UCG-001 abundance (P=0.027) when comparing low to high SCC. In addition to investigating the role of these microbes, ongoing work is focused on exploring relationships between the milk microbiota and milk yield. Future work should focus on understanding why the evenness of a sample is affected by SCC posing the questions, 1) Is the change in evenness a consequence of preceding (or existing) inflammation, or 2) Do the differential microbial populations predispose quarters to inflammation or modify influx of SCC through other mechanisms? Ultimately, we question whether we can identify microbes or populations in the milk microbiota that protect against pathogens.

Effect of Hay Nets on Chew Frequency of Horses Consuming Bermudagrass Hay Diet

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Impaction colic is a gastrointestinal disturbance that is caused by an obstruction of dry feed masses in the bowels of equines. It affects 4.2 out of 100 horses yearly, with a fatality rate of 11%. Impaction colic in the southeastern United States is widely thought to be caused by the consumption of bermudagrass hay leading many veterinarians to warn against the use of bermudagrass hay in equine feeding programs. A typical recommendation from veterinarians and many equine professionals is to feed orchardgrass and Timothy hays, which do not grow locally and typically cost at least double that of bermudagrass, in order to minimize the risk of equine impaction colic. Since bermudagrass hay is much more affordable and accessible in the southeast, development of mitigation strategies to reduce associated risk of impaction colic is warranted rather than complete elimination from the equine diet. Research in our lab recently demonstrated that horses take fewer chews per kg when consuming bermudagrass hay as compared to other popular horse hays. Since chewing promotes saliva production, this reduction in chew frequency potentially contributes to impaction colic. One mitigation strategy could be the use of hay nets which have been shown to slow the rate of consumption of hay. No research has yet demonstrated whether hay nets cause the horse to increase their chewing rate, or whether the slowing effect is just due to restriction in the amount of forage they can ingest per bite. If hay nets do result in an increase in chew frequency, they might be an effective and economical way to reduce risk of impaction colic in horses consuming bermudagrass hay. The objective of this study is to compare chew frequency of horses eating bermudagrass hay in three styles of hay nets (large mesh, small mesh, single hole) as compared to no net (loose hay). Trial data was collected from two horses over four days and demonstrated that horses acclimate quickly to hay nets. No differences were seen in chew frequency from day 1-day 4 ($P=0.49$). Eight horses were then divided into two trials, with the four horses in each trial rotating through treatments in a Latin square design. Each horse was given a 24-hour acclimation period to the hay net treatment, and then their chewing patterns were recorded for the following 24 hours using an automated halter fit with a pressure-sensor noseband (EquiwatchTM). Results of this study should provide research-based guidelines to assist horse owners.

Looking at the optical side of remote insect monitoring: a comparison of different cameras

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One of the up-and-coming ways of remotely monitoring small insects is using a machine learning system (AI) to count the insects on an image. A high-resolution camera is required with a short focal distance and wide-angle lens, which is important for detecting small insects like whiteflies (Bemisia tabaci). One hindrance to the accuracy of the machine learning system is the quality and resolution of images being processed. Since whiteflies are small, they are easily confused with specks of reflected light or water droplets that are likely the result of images collected with low resolution. In this experiment, I compared three different cameras using two different resolutions. Each camera was mounted in a similar position within one of the current University of Georgia remote whitefly monitoring stations (UGAWMS). I used a 1080p and a 1440p setting for all three cameras throughout the experiment taking 1 picture of 10 different 3”x5” sticky cards containing various numbers of whiteflies (n=10/camera configuration). After taking the pictures, I counted the number of whiteflies in each image and compared manual counts with the count conducted by our AI. Although I standardized the distance of the lens from the sticky card, the lens sensor of camera 2 was too close to the sticky cards resulting in distorted and low-quality images. The other two cameras produced clear enough images for processing. I found that the AI was able to estimate the images from camera 3 better based on a stronger linear correlation between the manual and model counts ($F_{2,17}=39.17$, $P \leq 0.0001$; RSE=2.97, adj. $r^2=0.80$). Whereas for camera 1, the error associated with the correlation was nearly double, 5.7, and the adj. $r^2=0.34$ ($F_{2,17}=6.06$, $P=0.01$), which provides evidence of more variation in estimating whitefly counts with camera 1. Although using 1440p images appear to lower the variation, the resolution did not have a significant effect for either camera (Camera 1: $t=-1.58$, $p=0.13$, Camera 3: $t=-0.991$, $p=0.33$). Therefore, our results suggest that using camera 3 improves the precision and flexibility (multiple lenses) of estimating whitefly counts from sticky cards. A problem we still face is that our model using either camera significantly underestimates the number of whiteflies on the cards.

Marker-assisted selection for white mold resistance and identification of new resistance sources through phenotyping

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The objectives of this project are two-fold. 1) Screening white mold resistance among F2 populations using genetic markers. 2) Perform in vitro phenotyping for white mold resistance on six lines with known field resistance or susceptibility. As for objective 1, screening of the F2 lines was conducted with a Kompetitve allele- specific PCR assay (KASPar) using DNA extracted from seeds by a high-throughput extraction method. However, selection of homozygotic individuals were deferred to later generations due to the tetrasomic recombination of the QTL region. As an alternative objective, selective effect of newly developed white mold markers from KhuFu bioinformatic pipeline was evaluated using historical white mold phenotype data collected from the Tifrunner x NC3033 Population. Both the A01 and A04 markers were able to select individuals with better white mold resistance, however, the additive effect of the two regions was not prominent.
For objective 2, six cultivars were tested with three inoculation methods including plug inoculation using an agar plug covered with white mold mycelia (P), a liquid suspension (L), and a 20% suspension (L20%). For the latter two methods, white mold was cultured in a potato dextrose medium and homogenized in water at a volume of 0.5 x and 5 x of the liquid medium respectively. Lateral limbs of each genotype were harvested from 50-day-old plants grown in the greenhouse and enclosed in plastic boxes with wet cotton pads at the bottom to create a high humidity micro-environment. Each genotype had three biological replications. The timing of lesion length measurements was determined by daily scouting of disease progression. P method was the most aggressive in disease progression followed by L and L20%. Lesion lengths for P were taken at 5 and 7 days after inoculation (DAI); 5, 8, 11 DAI for L and 11 DAI for L20%. No significant difference among the cultivars can be found by P method probably due to the strong disease pressure imposed by this inoculation method. However, NC 94022 and GA 12Y were found to have significantly shorter lesions than Marc I and GA09B which is consistent with their field responses to white mold infection. L20% induced too little lesion on the stem and the presence of lesions were not consistent within the biological replications. Therefore, method L measured at 5 DAI holds promise as a surrogate measurement for field resistance to white mold in cultivated peanut.

Hydroponic Production of Lettuce and Pac Choi using Beneficial Microbes to alleviate salinity stress in deep water culture (DWC) systems.

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The objective of this study is to evaluate the effects of different biostimulants on salinity stress on lettuce (Lactuca sativa, 'Rex' pelleted seeds) and pak choi (Brassica rapa subsp. Chinensis, 'Red Pac F1') (Johnny's Selected Seeds, Fairfield, ME) grown in DWC hydroponic systems. A trial was conducted applying the following treatments: two salinity conditions (0 and 150 mM NaCl), six biological treatments [(1) control (no biostimulant), (2) Lactobacillus (TeraGaniX EM-1; Effective Microorganisms, Alto, TX) at 7.488 g/L (1 oz/gal), (3) Bacillus/Pseudomonas mix (Root Life; Key-to-Life, Hagerstown, MD) at 0.264 g/L (1 g/gal) , (4) Trichoderma (RootShield WP; Arbico Organics, Oro Valley, AZ) at 0.30 g/L, (5) Bacillus (Hydroguard, Botanicare, Vancouver, WA) at 0.528ml/L, and (6) Glomus genus (Endomycorrhizal Inoculant; Bioorganics, Traverse City, MI) at 0.472 g/L]. The study was randomly arranged with 3 replications, for a total of 36 experimental units. 36 10-gal containers (Plastic storage stacker tote; Sterilite, Townsend, MA) were used, each having a 15-in x 20-in floating raft cut from unfaced extruded polystyrene foam insulation boards (1-in x 4-ft x 8-ft GreenGuard XPS; Kingspan Insulation, Atlanta, GA). Transplants were grown on 1-in deep x 1-in wide x 1 1/2-in long rockwool plugs (Grodan A0; Grodan, Roermond, Netherlands) for 11 days and cultivated for 28 days in DWC (03/04-04/01) on 1 ¾ in (top) x 1 ¼ in (bottom) x 2-in deep cup nets (Orimerc Garden, Seattle, WA). Containers were aerated by 2-in air stones (Gray; Aquaneat, Washington, DC) connected by 3/16-in transparent tubing to a 3566 GPH 6.96 PSI ½ in aeration pump (EcoAir 7; EcoPlus, Washington, DC). Measurements include leaf size (cm), CO_2 and H_2O gas analysis (assimilation, leaf internal CO_2 concentration, transpiration, stomatal conductance) (TARGAS-1 Portable Photosynthesis System; PP Systems, Amesbury, MA), leaf area at harvest (LI-3000C meter; LI-COR Biosciences, Lincoln, NE), chlorophyll and anthocyanin content (CCM-200plus and ACM-200plus; Opti-Sciences, Hudson NH), root growth, pH and total dissolved salts in the solution (HI2003-01 and HI9813-6; Hanna Instruments, Smithfield, RI). So far the EC was found to be higher in salt treatments while plant size was smaller; pH remained similar between the two treatments (avg: 6.48 no salt, 6.49 salt). Final measurements will be taken on April 1st, and the physiological responses to the microbes by the plants can be studied.

Differences in Microbial Community Composition Between Uterine Horns to the Corpus Luteum in Beef Cows on Day 15 of the Estrous Cycle

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The objective of this study was to evaluate the uterine microbiota composition of cows on day 15 of the estrous cycle. Non-pregnant Bos taurus beef cows (n = 23) were exposed to a pre-synchronization step followed by the 7-d CO-Synch estrus synchronization protocol. On days -10, -3,0 (exogenously induced ovulation), 7 and 14, transrectal ultrasonography was performed to evaluate ovarian structures, ensure synchrony, and determine the side of ovulation. Cows were harvested on day 15 and individual swabs were collected from each uterine horn using aseptic techniques. DNA was extracted and the entire (V1-V9 hypervariable regions) 16s rRNA gene was sequenced. Sequences were analyzed using the QIIME2 Pipeline. Across all samples, 22 phyla, 130 families, 215 genera, and 90 different species were identified. Butyrivibrio, Bacteroidales RF16 group, Clostridia_UCG-014, and Moraxellaceae, had different ($P \leq 0.05$) relative abundances in the ipsilateral compared with contralateral horns, whereas Proteobacteria, Acinetobacter, Bradyrhizobium, Lachnospiraceae FCS020 group, Nanoarchaeota, Woesearchaeales, and Prevotellaceae YAB2003 group tended ($P \leq 0.10$) to differ between ipsilateral and contralateral horns. In conclusion, there were significant differences in the composition of the microbial community of the ipsilateral and contralateral horn of cows on day 15 of the estrous cycle.

Effects of melatonin on oxidative stress and competence of cumulus-oocyte complexes using postmortem ovaries from pregnant and non-pregnant cattle

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Pregnancy outcomes obtained with in vitro produced (IVP) bovine embryos are lower than those of the in vivo counterpart. This has been attributed to lesser oocyte competence due to high levels of oxidative stress (OS) and apoptosis of the oocyte during IVP. Melatonin is a powerful antioxidant in the female reproductive system. We hypothesized that melatonin supplementation during in vitro maturation (IVM) of cumulus-oocyte complexes (COCs) collected from postmortem ovaries from pregnant and non-pregnant cattle enhances the expression of genes associated with OS status and oocyte competence. The objectives are to evaluate the effects of melatonin supplementation during IVM of cumulus-oocyte complexes (COCs) collected from postmortem ovaries from pregnant and non-pregnant cattle on the gene expression profile associated with OS and oocyte competence. A total of 800 ovaries (400 ovaries from pregnant and 400 from non-pregnant cattle) were collected at the slaughterhouse and transported to the IVF laboratory at UGA. Follicles between 2 and 8 mm were aspirated using an 18 G needle coupled to a 20 mL syringe to collect the COCs. Selected COCs (grade 1-2) were incubated at 38.5 °C and 5% of CO_2 in a humidified atmosphere for 22 hours in maturation media containing tissue culture based-medium (TCM) 199, enriched with fatty acid-free bovine serum albumin (FAF-BSA), and supplemented with follicle stimulating hormone (FSH). Melatonin supplementation (0.01 nM) was tested by randomly submitting the COCs to melatonin or control media during IVM. Total RNA extraction was performed using Qiagen kits. Reverse transcription was done using First Strand DNA Bio-Rad® kits. Gene expression profile associated with OS and oocyte competence including different pro-oxidant and antioxidant (SOD1), apoptosis (BCL-2), and oocyte competence (OCT4, SOX2, CDX2) will be assessed using reverse transcription polymerase chain reaction (RT-PCR) utilizing specific primers and probes. We expect that melatonin supplementation will enhance oocyte competence and reduce oxidative status and apoptosis of COCs. If there is a positive effect of melatonin supplementation on oocyte competence, then melatonin supplementation could be a potential tool to improve the reproductive efficiency of the IVF systems in cattle.

Bermudagrass hay may reduce mastication frequency in horses compared to other hay forages

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Colic is a generic term for gastrointestinal disturbances in the horse and a prominent issue within the equine industry. Numerous variations of this condition occur as well as hypotheses predicting their occurrences. Bermudagrass hay is a hypothetical cause of ileal impaction colic, fueling recommendations to avoid this hay variety despite its position as a staple economic forage in the southeastern United States. Reasoning that reinforces these recommendations includes its short-stemmed, fine fiber characteristics, which potentially decreases the need to chew. Horses only produce saliva during mastication, and saliva is key in aiding digestion by lubricating the food bolus. A decreased chewing frequency therefore could inhibit the proper movement of the bolus, causing blockage. The overall aim of this study was to analyze the difference in frequencies at which horses chew bermudagrass hay versus timothy hay. To accomplish this, an automated grazing halter (RumiWatch, Futterungstechnik, Switzerland) with a built-in liquid pressure sensor in the noseband was utilized to calculate chewing frequency. The RumiWatch halter was placed on five different horses during their normal feeding routines, each for three consecutive days. Each day, the chewing frequency was recorded for timothy hay during the morning feeding and bermudagrass hay during the midday feeding. Before and after each feeding, the hay was weighed, and the kilograms of hay consumed were calculated. Number of chews per kilogram of hay consumed was calculated and statistically compared using Minitab Statistical Software Version 21 (State College, PA) with treatment as a fixed effect. Results indicated that horses performed more chews per kilogram hay consumed when eating timothy as compared to bermudagrass ($p = 0.003$). The number of chews was almost doubled when consuming Timothy as compared to bermudagrass (7461.34 versus 4642.79 chews/kg on average respectively). These results displayed preliminary data reinforcing the claim that horses may chew bermudagrass hay less compared to longer stemmed forages and provide support for expanding this hypothesis with further studies.

Protease in low-protein diets modified growth, nutrient digestibility, and gene expression of peptides and amino acids transporters in young broilers

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A total of 360 Cobb 500 male broiler chickens were used in a 42-day experiment. The objective of the experiment was to investigate the role of the protease supplementation of low protein diets based on canola meal (CM) or soybean meal (SBM) on growth performance, nutrient digestibility, and the expression of genes for peptides and amino acid transporters in broiler chickens. The overall aim is to evaluate nutrition strategies to reduce N excretion to the environment; and understanding the modes of action of such strategies. This is important because N excretion by poultry to the environment is an important environmental problem associated with commercial poultry production. For this experiment, the birds were fed same starter diets for the first 10d, before allocation to 3 experimental diets (D). D1 was adequate protein corn SBM diet; D2 was low protein SBM diet but with protease supplementation; D3 was low protein with 10% CM and protease supplementation. Each treatment had 6 replicates with 20 chickens per replicate. Ileal digesta were collected from representative birds per pen on d 18 after euthanasia. Jejunal tissue was collected and stored for peptide, and amino acid transporter analysis. The average gain per bird was higher ($P \leq 0.05$) in the adequate protein diet than other diets. Birds receiving protease supplementation in the corn-SBM or CM had lower ($P \leq 0.05$) feed intake and weight gain. Feed intake was lowest ($P \leq 0.05$) in birds receiving CM diet. Dry matter digestibility (DMD) for the 3 treatments showed no significant difference. The protease enzyme supplementation to SBM and CM diets improved ($P \leq 0.05$) digestibility of N and most of the analyzed amino acids with the exception of non-essential amino acids Asp, Leu, Ser, and Tyr. Aspartic acid, Leu, Ser, and Tyr showed an increase ($P \leq 0.05$) in amino acid digestibility when protease was added to the diet, but there was higher ($P \leq 0.05$) digestibility observed in SBM than in CM diets. Protease supplementation in this study did not significantly influence the gene expression of peptide (PEPT1) and amino acid transporter (EAAT) although their expression was numerically greater in protease-supplemented diets. In conclusion, the addition of protease enzyme triggered positive effects in amino acid digestibility but only marginally influenced peptide and amino acid transporters. Therefore, protease supplementation can help in reducing N excretion to the environment when used in low-protein diets.

Using haptoglobin to assess mastitis in dairy heifers as well as describe changes to its concentration post parturition

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Mastitis is linked to reduced milk production, decreased fat and protein components, higher veterinary costs, and increased milk dumping. Developing ways by which to accurately identify and manage mastitis is critical to an animal's productive life and herd profitability. The presence of acute phase proteins (APPs) can precede clinical signs and allow for more rapid identification of mastitis cases. Earlier identification may allow for more effective treatment and reduced chronic cases. This study had three objectives, 1) to explore the efficacy of using haptoglobin, an APP, to diagnose mastitis in heifers, 2) determine if haptoglobin concentration is related to pathogen type in heifers and cows and 3) correlate pathogen and/or haptoglobin concentration with post-partum mastitis incidence. For this, blood and mammary secretions were assessed for Holstein and Jersey heifers ($n = 6$ blood; $n=28$ mammary quarters) two to four weeks prior to calving and again at 1 – 4 days following calving. Blood and milk samples were collected from additional ($n=7$) animals 1-4 days post calving. Blood was immediately stored on ice, transported back to the lab where it was then centrifuged at 3500 rpm. The serum was pipetted and stored at -20 °C until haptoglobin analysis. Haptoglobin concentrations were later evaluated using a validated ELISA. Heifer secretions and milk samples were collected using an aseptic technique and immediately stored on ice and transported back to the lab. Using a sterile inoculation loop, samples were then streaked on culture plates with four quadrants to isolate and identify potential pathogens. Plates were read at 24 and 48 hours after culture. Haptoglobin as a heifer showed a moderate, positive relationship to days until calving ($r=.75$). Post parturition haptoglobin concentrations were numerically higher ($P \geq 0.05$) than heifer haptoglobin levels. This was likely a result of the body's innate, inflammatory responses following calving. Haptoglobin in heifer samples was not associated with number of infected quarters ($P \geq 0.05$), number of pathogen groupings of interest ($P \geq 0.05$), or mastitis risk post parturition. Using the time around calving to assess the relationship between haptoglobin and mastitis may have too many influencing variables to accurately evaluate that relationship. Further research work with higher animal numbers as well as various APPs would allow for a more complete understanding of any relationship that may potentially exist.

Investigation of the influence of soil pH on the Production of Anthocyanins in Hibiscus

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Anthocyanin flavonoids have antioxidant, anti-inflammatory, and anti-viral properties and are increasingly valued in a variety of food and beverage products. Anthocyanins are secondary metabolites that plants synthesize for protection or other means but are not essential for growth. Often plants upregulate the production of secondary compounds in response to various stress conditions such as herbivory, moisture-stress, and potential exposure to other less-ideal soil conditions. We hypothesized that the production of anthocyanin would vary as a function of soil pH. To test this hypothesis, we grew plants under similar temperature, moisture, and light conditions in 2 gal pots, with the soil pH adjusted by the addition of either $CaCO_3$ (lime) or elemental sulfur to obtain 7 pH treatments ranging from 5.6 and 7.4. After a full growing season of 8 months, the plants reached adult/reproductive stage and were harvested. Plant height, weight, and number/weight of calyxes produced were recorded. The plant calyxes were frozen and then extracted with acidified methanol and total anthocyanin content was measured by the differential pH method at 520nm on a UV-Vis spectrometer. We found no significant differences in anthocyanin concentration ($p \geq 0.05$), plant height (~83.2 cm), or calyx weight (~5.2 g) but we did find plant weight was significantly higher in the 5.6 and 6.8 pH treatments compared to the rest of the treatments. Samples at pH 5.6 were used as a control by not adding any amendment to soil condition. There is a chance that the addition of soil amendments stunted plant growth in other treatments. But this would not explain the growth in pH 6.8, there is another thought that the position on the greenhouse bench was ideal for plant growth in comparison to other positions, potentially more exposure to natural light within the greenhouse or more air circulation. However, further analysis is needed to conclude these findings. Along with a difference in weight, a difference in calyx production was found greater in pH ranges 6.8, 7, and 7.40. The higher pH, the higher the number of calyxes produced. Overall, the analysis found that pH did not play a significant role in the concentration of anthocyanin. But pH potentially affects plant mass and calyx production. Non-ideal soil pH can reduce plant growth and fruit-bearing ability. A reconstruction of the experiment can broaden our understanding of the role pH has on secondary metabolite production and plant growth.

Directed differentiation of Leigh Syndrome induced pluripotent stem cells into neural stem cells

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Leigh Syndrome (LS) is caused by mutations in the mitochondrial DNA resulting in the inability to adequately produce ATP in cells. This limited production of ATP significantly effects cell types that are high energy users such as those of the central nervous system, which often leads to death in LS infants. There is currently a lack of LS disease models which limits the field's understanding of LS and the development of novel therapeutics. Our research team recently developed induced pluripotent stem cells (iPSCs) from LS patient fibroblasts. The objective of this study is to evaluate the potential of LS iPSCs to differentiate into neural stem cells (NSCs) as the nervous system is often drastically affected by LS. Two NSC differentiation medias were used to determine the ability of the LS iPSCs to differentiate into iNSCs. BJ (healthy control cell line), SBG1, SBG2, SBG3, and SBG7 iPSC lines were exposed to E6 media (media 1) for 20 days with daily evaluations and quantification of neural rosettes. The cell lines were also exposed to E6 media with SB431542 and LDN193189 (media 2) to compare with the previous approach. Neural rosettes were observed in the BJ, SBG2, SBG3, and SBG7 iPSC lines when using NSC differentiation media 1 to differentiate, but not SBG1 iPSCs. However, differentiation in media 2 resulted in neural rosette formation in all iPSC lines. The addition of inhibitors resulted in an increase in both the speed at which the rosettes appeared and the total amount of rosettes observed. BJ iPSCs differentiation with media 1 gave rise to an average of 10 rosettes with an average time to appear of 18.78 days while media 2 resulted in and average of 31.33 rosettes after only an average of 2.67 days. SBG1 paired with media 1 yielded no rosettes after 20 days, but differentiation with media 2 resulted in 28.67 rosettes after 1.67 days. SBG2 differentiation in media 1 resulted in 20.67 rosettes with rosettes appearing at 10.67 days compared to 28.33 rosettes and 2.33 days using media 2. SBG3 and media 1 gave rise to 7.67 rosettes after 10.67 days, while media 2 led to 33.67 rosettes and a time of 2 days. SBG7 differentiation in media 1 resulted in 54.67 rosettes after 7 days compared to media 2 which gave rise to 29 rosettes after 2.67 days. This study indicated that LS iPSCs possess the ability to differentiate into NSCs and that the addition of SB431542 and LDN193189 in E6 media promotes this differentiation process.

Comparing Filters with Regards to Water Sampling Efficiency and Handling

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The purpose of this study was to compare three water filtration filters and determine their recovery efficiencies of Cryptosporidium oocysts in surface waters.
Three filters were used: Sawyer MINI hollow fiber filters, Envirocheck, and Rexeed-25 filters. Ten-liter water samples were obtained from a UGA Griffin Campus pond and spiked with Cryptosporidium oocysts. Three samples were tested per each filter type to determine the most suitable to use for surface water testing. The weight, speed, ease of use, and capability of capturing cryptosporidium oocysts was compared for each filter type. Fourteen streams in the city of Griffin and surrounding area were sampled, Time, temperature, GPS, turbidity, and oocyst counts were measured for each site. Turbidity and filtration time was determined in the lab. The presence of Cryptosporidium and Giardia was determined using an IFA assay. Samples were also examined for the presence of Eimeridae using a nested PCR targeting a 500 bo region of the 18S rRNA gene. Rexeed filters were heaviest of the three (665g), envirocheck ((157g) and Sawyer MINI (39.8g)Filtration time for 10L was Rexeed 7-10 min), Envirocheck 6-7 mins, and Sawyer (13-19 min). Turbidity in average ranged from 5-9 NTUs for all water samples tested. Efficiency of capture was highest using the Sawyer filters followed by Envirocheck and Rexeeed filters. Eight out of the 14 samples tested positive for Eimeriidae using PCR, Cryptosporidium spp was found in 12/14 and Giardia spp in 10/14 samples. Comparing the size, weight, ease of use, and effectiveness of the different filter types shows that the Sawyer MINI is the best overall for taking water samples. It is the smallest and lightest, and most importantly captured the greatest percentage of cryptosporidium oocysts. The Envirocheck and Rexeed-25 were more difficult to use, both during filtration and elution. The rexeed-25 are incredibly bulky and difficult to handle. However, the Envirocheck filter does allow for a greater volume of filtration per minute. The presence of Cryptosporidium, Giardia, and Eimeriidae in urban areas of Griffin show a likelihood of fecal contamination. Further studies including molecular typing of each of the pathogens are needed to determine the public health significance of these findings. Identifying the source of the contamination, and the impact it is having on these water sources in necessary in order to safeguard public health and safety.

Can Epichloe endophytes prevent M. oryzae infection of tall fescue?

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Tall fescue is an important cool season forage widely grown in the US and worldwide. Tall fescue harbors a fungal symbiont endophyte that confers resistance to many biotic stressors. Research has predominantly focused on understanding the responses that may arise from environmental conditions, especially climatic concerns and how the endophyte may impact these issues. Fungal diseases can wipe out an entire pasture in a short time under the right conditions. Gray Leaf Spot, Magnaporthe oryzae, is a common fungal pathogen that that affects forage/turf grasses in areas with high moisture content and warm temperatures. This foliage-targeted disease is also known to infect rice, referred to as rice blast, as well as important grains such as rye, millet, and barley. Disease symptoms on leaves present as splotchy lesions with tan or gray centers and brown margins. Evaluation of the gray leaf spot resistance levels of tall fescue/endophyte combinations will enable breeders to select the most resistant tall fescue accessions and endophytes strains for breeding improved cultivars that can be disseminated to ranchers and homeowners. This project aims to evaluate the resistance levels of 23 tall fescue accessions with different endophyte strains inoculated with gray leaf spot infection. Inoculation occurred at the seedling stage by spraying spores suspended in water to simulate the natural spread of M. oryzae spores. After two weeks, , each plant was assigned a severity score based on a prescribed scale of fungal infection. Due to the qualitative nature of the data, scoring was done visually with 3 independent graders to ensure the most accurate, unbiased scores. Data analysis followed to determine the statistical significance of the results. While the strains utilized in this study did not have an obvious effect on any category of fescue (E-, E+ toxic, E+ nontoxic), there was promising statistical proof that some isolates seemed to confer more tolerance than others. These findings set the stage for a larger scale screening of the potential of these strains on a larger scale in common plant genetic backgrounds.

Effects of In Ovo Feeding of Bio-D on Commercial Yield Broiler Hatchability & Chick Body Morphometrics

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The objective of this study was to determine effects of in ovo□feeding of varying doses of 1,25-dihydroxy vitamin D3 (Bio-D; Huevpharma, Bulgaria) on whole body and pectoralis major morphometric development of commercial yield broilers. Two-hundred and four Cobb 500 broiler eggs were weighed, evenly stratified, and allocated across two incubators. Within each strata, eggs were randomly assigned 1 of 3 treatments: 0, 1.2, or 2.4 µg of Bio-D (n = 68/treatment). At day 10 of incubation, the appropriate treatment concentration was mixed into 0.9% sterile saline and injected in the yolk sac of the developing embryo. Eggs were incubated at 37 ± 3ºC and a relative humidity of 40 ± 2% throughout the first 18 days of incubation. Humidity was increased to 60 ± 2% for the remainder of incubation until eggs hatched. Approximately twenty-four hours after incubation day 21, chicks were euthanized via enclosed exposure to CO_2 gas and decapitation (late term dead embryos were extracted from the egg). Body morphometrics were collected including crown-to-rump length, head circumference, and body weight. The right pectoralis major muscle (PMM) was removed, weighed, and measured for depth, width, and length. At day 10 of incubation, 0, 1.2, and 2.4 Bio-D treatments had 2, 2, and 7 infertile eggs, respectively. After injection, 24, 3, and 3% of eggs hatched for the 0, 1.2, and 2.4 treatments, respectively. Body weight and crown-to-rump length averages were numerically smaller for Bio-D injected chicks than 0 chicks. On the contrary, average head measurements were larger for Bio-D injected chicks compared to 0 chicks. Pectoralis major muscle weight averages for 0 chicks were greater than Bio-D chicks. Data showed 1.2 chicks had slightly greater averages for PMM length and width when compared to 0 and 2.4 chicks. Average muscle fiber cross-sectional area (CSA) of 0 chicks was slightly smaller than average CSA of 2.4 chicks. As for 1.2 chicks, their CSA average value was drastically smaller than 0 and 2.4 chicks. This resulted in the average fiber density of 1.2 chicks to be greater than 0 and 2.4 chicks. In conclusion, injecting this form of Bio-D into developing embryo eggs negatively affected hatch rate and whole body and PMM morphometric development.

Effects of Vitamin B3 on High-Yield Broiler In Ovo Myogenesis Lize-Mine Lucas, Dwiyale S. Lorquet, Xiaoxing Xu, and John Michael Gonzalez

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The objective of this study was to investigate effects of in ovo injection of vitamin B3 (VitB) on high-yield broiler pectoralis major muscle (PMM) development. Unincubated Cobb 700 eggs (N = 200) were weighed, ranked by weight, and assigned to 1 of 4 treatments within each strata. Treatments consisted of eggs being injected with 0, 250, 500, or 1,000 mM VitB (n = 50/treatment). Eggs were incubated at 37 ± 3°C and at a relative humidity of 40 ± 2% through the first 18 days of incubation, with humidity increased to 60 ± 2% the final three days. On day 10 of incubation, VitB was mixed into sterile 0.9% saline and 100 μL of each dose solution was injected into the developing embryo's yolk sac. Immediately after hatching, chicks were euthanized using CO_2 exposure followed by decapitation. The right PMM was collected and utilized for whole muscle and muscle fiber morphometric(n = 5/treatment) analyses. There tended to be a Treatment effect ($P = 0.07$) for PMM weight. Embryos injected with 500 and 1,000 mM VitB had greater PMM weights than 0 mM injected embryos ($P \leq 0.02$), but these embryos did not differ ($P = 0.57$) from each other. Chicks injected with 250 mM VitB did not differ in PMM weight compared to embryos from all other treatments ($P \geq 0.23$). There were no Treatment effects for PMM length and width ($P \geq 0.26$), but there was a treatment effect ($P = 0.03$) for depth. Embryos injected with 500 and 1,000 mM VitB did not differ ($P = 0.73$) in thickness compared to each other, but had greater depths than embryos injected with 0 and 250 mM VitB ($P \leq 0.05$). There were no Treatment effects for PMM muscle fiber cross-sectional area and fiber density ($P \geq 0.47$). Injecting VitB at day 10 of incubation slightly increased PMM weight by increasing muscle depth, but this appears to be independent of effects of muscle fiber measures. This result may be due to the small number of PMM analyzed because cross-sectional area and fiber density means are trending as expected.

Effects of green tea extract on gonadal differentiation in Japanese quail

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Green tea extract is a considered to be an endocrine disruptor due to the fact it can inhibit the action of the enzyme (aromatase) that converts testosterone to estrogen. It has been shown as a promise supplemental treatment for breast cancer. One previous study showed that exposure that exposure of embryos to green tea extracts disrupted gonadal differentiation: genetic females differentiated as physically male. We tested whether green tea extract disrupts sexual differentiation in Japanese quail. In a first pilot study, we tested a 350ug/50mg dose (n = 30 eggs) of green tea extract or a control dose (50ug of sterile water, n = 29) by injecting the extract at day 4 of development, which is the time that gonadal sex determination is occurring in quail. There was a high rate of infertility/ mortality for both treatments, perhaps due to our injection protocol. We saw a forty-eight percent rate infertility/mortality in the controls, and sixty percent in the green tea extract group. Green tea extract eggs produced significantly more males (80%) compared to controls (17%), however we were concerned with the high mortality and the skew of control eggs towards females. We conducted an additional study using the same technique and dose of green tea extract n=56 control, 58 green tea extract eggs but incubated these eggs in a commercial incubator. This study provided lower mortality rates at twenty one percent for control and twenty two percent for green tea extract but this time there was no sex ratio skew. Compared to the control at sixty one percent male and green tea extract at sixty percent male, so P=0.96. This indicates that GTE may not disrupt gonadal sex determination in Japanese quail when provided at this dose and at this stage of development.

Validation of a phagocytosis assay for immune function assessment in Japanese quail

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When testing how animals respond to pathogens, it is important to test many different aspects of the immune response. Phagocytosis is a particularly important aspect to test because it is among the first lines of defense against a pathogen. In addition, assessment of phagocytic ability in an animal also tells us about how macrophages (the primary cells responsible for phagocytosis) are functioning, which is important because macrophages direct further immunological activities. Most existing assays for phagocytic ability in animals require isolation and culture of macrophages, which is difficult for small birds because blood samples are minimal. One technique previously used in chickens tests the ability of cells in whole blood to phagocytose particles of india ink, however this technique has previously required large quantities of blood. For our experiment we tested using the same technique using much smaller blood volumes. We wanted to test to see whether this technique would work with much smaller blood volumes. We collected50ul of blood from Japanese quail and used 30ul of that blood to conduct a scaled down version of the whole blood phagocytosis assay using india ink. India ink was added to the diluted blood and aliquots of the diluted blood were incubated for 10, 20, 40, or 60 minutes, after which they were centrifuged. Cells containing phagocytosed particles were pulled to the pellet while india ink particles that had not been phagocytosed remained in the supernatant. We then measured the absorbance of light; it was measured in supernatant at 515nm using a plater reader. We saw a significant decrease in absorbance over time, indicating that we were able to successfully detect phagocytosis in samples using much smaller volumes of blood than previously reported.

Influences of testosterone propionate exposure on rates of yolk deposition in domestic chickens

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In the poultry industry, yolk size is important for marketability of eggs. Consumers generally prefer eggs with larger yolks. While much work has been done on factors that influence yolk size, there is little work on what influences the rate of yolk deposition, which could ultimately influence laying rates and/or the nutrient composition of yolks. We have shown in previous work that exposure of hens to roosters causes hens to decrease yolk deposition rates, and we hypothesized that this effect occurred due to elevated concentrations of testosterone in hens. Here we tested whether elevating testosterone concentrations in hens influences yolk deposition rates in a similar manner. We treated 131 hens with a testosterone propionate cream that was rubbed into their combs daily in the morning for two weeks. An additional 44 hens received a control cream treatment. Starting 7d after the start of treatment, we collected eggs from hens daily for 6d. We froze the yolks, fixed them in 4% formalin, and then stained the rings of daily yolk deposition using 2% potassium dichromate. We found that testosterone propionate treatment decreased the rates of yolk deposition. Further work is being done to determine whether this treatment impacted the rates of yolk deposition differently during the day versus the night. This work indicates that testosterone may mediate the impacts of male exposure on rates of yolk deposition.

Gut microbial transplant therapy significantly decreases brain injury in a piglet traumatic brain injury model

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Traumatic brain injury (TBI) is a leading cause of death and disability in children. TBI has been shown to contribute to gut dysbiosis due to the bidirectional communication between the brain and the gut microbial population, called the gut-brain axis. Gut dysbiosis leads to an imbalance in healthy gut microbiota which can alter immune system homeostasis and impair injury recovery mechanisms. Gut microbial transfer (GMT) has the potential to reverse gut dysbiosis by decreasing inflammation and replacing unhealthy gut microbiota with healthy gut microbiota. Therefore, the objective of this study is to determine if GMT will influence lesion volume, hemorrhage volume, and midline shift in a porcine TBI model. A moderate/severe TBI was induced by controlled cortical impact in 4-week-old male crossbred piglets (treated: GMT, n=6; control: CON, n=6). Sham animals (S, n=6) underwent craniectomy only. TBI animals were administered a 25 mL oral gavage of GMT or saline 2-hours post-injury and every 24 hours for 7 days. MRI was collected 1-day (1D) and 7-days (7D) post-injury. Sequences included T2 FSE for lesion volume and midline shift (MLS) analysis, and SWAN for intracranial hemorrhage (ICH) volume measurement. GMT animals exhibited significantly ($p \leq 0.05$) reduced lesion volumes at 7D post-TBI compared to 1D post-TBI. No significant differences were observed in lesion volume between 1D and 7D in CON animals. When examining the midline shift at Falx Cerebri, CON animals exhibited a significant ($p \leq 0.05$) midline shift towards the ipsilateral hemisphere at 7D post-TBI compared to 1D post-TBI, indicative of tissue necrosis. No significant midline shift was observed between 1D and 7D in GMT animals. In addition, GMT animals exhibited significantly ($p \leq 0.05$) reduced hemorrhage volumes at 7D post-TBI compared to 1D post-TBI, however there was no reduction in hemorrhage volume between 1D and 7D in CON animals. The results showed that daily GMT enhanced lesion and hemorrhage volume recovery mechanisms and mitigated the development of a midline shift which suggests that GMT may be an effective treatment for TBI.

The Effects of Socioeconomic Status on Intent to Conserve Water

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Water scarcity is a global issue that is increasing in scale and intensity as climate change and political strife are exacerbated. Water scarcity challenges are unequally distributed across communities in the United States (U.S.) with more impoverished areas experiencing a greater negative impact when water conservation strategies are not employed. Understanding the relationship between socioeconomic status and water conservation behaviors will help political leaders and scientists in creating inclusive and effective communication regarding water scarcity. Using audience segmentation as a framework the purpose of this project was to determine the effect of socioeconomic status (e.g., income and education level) on intent to conserve water. Two research objectives were addressed: (1) Describe respondents' socioeconomic status and intent to engage in water conservation, and (2) determine if socioeconomic status predicted respondents' intent to engage in water conservation. An online survey was given to 1,049 U.S. residents using non-probability opt-in sampling via Qualtrics. Respondents answered demographic questions. To indicate their intent to conserve water, respondents answered eight questions measured using a Likert scale that were averaged to create an overall scale. Descriptive statistics and regression analysis were conducted via SPSS. More than half of the respondents had at least a 2-year college degree (59.2%). More than half had an annual family income of less than $75,000 (61%) and mean intent to conserve water was undecided or likely ($M = 3.57$, $SD = .80$). Socioeconomic status significantly predicted11% of the variance in intention to conserve water. Respondents with an income of less than $24,999 expressed a lower level of intent to conserve compared to those in the $75,000-$149,999 range. Respondents with less than a high school diploma, a high school diploma, and some college education were less likely to engage in water conservation than those with a 4-year college degree and respondents with a graduate/professional degree were more likely to engage in water conservation. Communicators should concentrate messages on groups that have the capacity and room to improve engagement in water conservation, namely those with less than a high school diploma, a high school diploma, and some college education. Communicators should create messages that are free of scientific jargon to be accessible to those with less education.

Did the Transition to EBT Tech Increase SNAP Enrollment?

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The Supplemental Nutrition Assistance Program (SNAP) has served as a nutritional safety net for Americans since its inception. The embrace of new digital technologies led to a new Electronic Benefit Transfer (EBT) method of payment, replacing the older food stamp model. By 2008 the transition was expected to be complete and those who had not yet adopted the new model of benefit transfer were no longer able to redeem physical stamps as a form of payment. This paper seeks to explore the effect that this transition in payment methods had on overall participation in the program. Previous literature has not explored this specific detail, but instead focused on unemployment and other policy changes as they relate to total participation in SNAP

Adapting a PCR approach for use in Arabidopsis thaliana genotyping assays

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The common plant genotyping process involves CTAB-based extraction and purification of DNA from an organism and amplification of the DNA in a polymerase chain reaction. This process involves 15 steps, about 66% used for DNA extraction/purification and 33% used for PCR preparation. On average, the CTAB-based process of extraction and purification costs about 2 hours of labor per 24 samples. Recently, an article was published illustrating a DNA purification-free PCR method that would bypass the most time-consuming steps of DNA extraction/purification. We developed a project, based on the proposed novel PCR method, with two main objectives. First, to determine the extracting efficiency and to add a positive control, we tried reproducing and competing the purification-free (puri-free) method with the CTAB extraction. Second, we tested the puri-free PCR approach in genotyping the flagellin-sensitive (fls2) mutant of Arabidopsis thaliana. We yielded an average of 40 ng/ul of DNA using the puri-free method. However, no PCR product was shown. We did a series of optimization steps with extraction timing and the size of the template card in the PCR solution. As a result, the puri-free DNA extraction was unable to be reproduced. In genotyping fls2, we were able to confirm the T-DNA insertion in fls2 in the CTAB-based approach but not in the puri-free method. We concluded that the Sodium Dodecyl Sulfate (SDS)-inhibitory effect produced in the puri-free method may largely affect PCR efficiency. In addition, components of the PCR buffer in our lab may lead to antagonistic interaction of chemicals between DNA purification and PCR. Nevertheless, the puri-free PCR method was proposed to be highly efficient and with considerable precision in genotyping. It could be incredibly useful for both basic research and disease diagnosis; therefore, additional research should be done to replicate and integrate this proposed protocol in the future.

Phenotypic Evaluation of Resistance to Ustilago maydis in Maize-Teosinte Near-Isogenic Lines

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Ustilago maydis (U. maydis), the causal agent of corn smut, is an important agricultural pathogen. Significant maize yield loss of approximately $1 billion annually in the United States is incurred due to U. maydis. This biotrophic pathogen has the ability to infect all aerial plant parts and locally induces tumors resulting in yield loss. The lack of resistant maize cultivars necessitates the identification of new sources of resistance. Teosinte is a maize wild progenitor that has demonstrated resistance to many plant diseases and insects. Near-isogenic lines (NILs) obtained from a cross between a maize inbred line (B73) and a teosinte species (Zea mays ssp. parviglumis), have shown some evidence of resistance to corn smut. However, little is known about the differential response of NILs, teosinte species and maize genotypes to U. maydis. Therefore, the goal of this project was to investigate the resistance phenotype of three teosinte species (Zea mays ssp. parviglumis, Zea diploperennis, and Zea luxurians), two maize-teosinte NILs (NIL 1 and NIL 2), and two maize genotypes (B73 and H95). Seedlings were inoculated with 200 µl of U. maydis inoculum at a concentration of 106 cells/ml and phenotypically evaluated for: (1) disease incidence, and (2) disease severity. Seedlings from the three teosinte species were resistant to U. maydis. The two NILs demonstrated an intermediate resistance level to U. maydis, while the two maize inbred lines were highly susceptible. The phenotypic results supported the genetic data and indicated that the two maize-teosinte NILs carry the genes associated with resistance to U. maydis and the genes were derived from the resistant teosinte parent.

Using Genomics to Analyze the Nutritional Complementation Roles of Bacterial Symbionts in Adelgids

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Adelgids are plant sap-feeding insects that contain various bacterial endosymbionts which help provide nutrients to their hosts by converting metabolites in their host's nutrient-deficient diet into vitamins and various essential amino acids necessary for host survival. We investigated the symbiosis of three species of larch adelgids containing the endosymbionts Profftia and Vallotia, whose preliminary genomic characteristics suggest are evolutionary young nutritional partners. The overall goal of this project is to continue comparing the genomic characteristics and degree of nutritional complementation of additional sequences of larch adelgid symbionts. Due to the lifestyle of intracellular bacterial symbionts, their genomes are streamlined to the core housekeeping genes and genes essential to the hosts' survival. Adelgids' alternation between nutrient rich and poor plant hosts is hypothesized to promote the mutational degradation of nutritional pathways and the replacement of their bacterial symbionts. We examined these changes using Next-Generation sequencing, bioinformatic software and genome assembly. These processes included annotating bacterial genomes to determine the amino acid production of these symbionts. This process will help us create a comparative analysis with other bacterial assemblies and support phylogenies that provide a deeper understanding of the evolutionary history of these bacterial symbionts. We expected to see differences in amino acid production and the overall extent of genomic degradation of these organisms. The results of this experiment supported the proposed hypothesis, with increased mutational degradation in evolutionarily older symbionts and additional acquisitions and replacements with younger symbionts. These new acquisitions contained many genes necessary for adelgid survival that had since been lost in the first population of bacterial symbionts. Specific genes of interest that portray this relationship of mutational loss and replacement in these bacterial symbionts are tyrA and tyrB, which are genes needed to make the essential amino acid Phenylalanine. The genomic information of endosymbionts reveals the intricacy of symbiosis. This project raises pertinent questions regarding the drivers of genome degradation and the evolutionary impact host ecology plays on gene loss and turnover in adelgid symbionts.

Analyzing the Physical Morphology of Bacteriomes to Determine the Nutritional Roles of Bacterial Symbionts in Adelgids

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Adelgids are plant sap-feeding insects that contain bacterial endosymbionts which help provide nutrients to their hosts by converting metabolites in their host's nutrient-deficient diet into vitamins and essential amino acids necessary for host survival. The endosymbionts are housed in bacteriomes, a set of specialized insect tissues found in the adelgid lower abdomen. Many species of adelgids alternate host trees, and each of these host trees provides a variety of diets with differing nutritional profiles. Adelgids' alternation between nutrient-rich and poor plant hosts is hypothesized to promote the mutational degradation of nutritional pathways in the endosymbionts. Little is known about the influence the adelgid diet has on the physical morphology of endosymbionts and bacteriomes. We investigated the impact that variations in nutrition due to alteration of host trees have on the structure of bacteriomes within multiple species of adelgids to further analyze the nutritional relationships present between the bacteria and insect host. We examined these changes using various microscopy methods, including fluorescent, confocal, and TEM, on dissected bacteriome tissues from adelgids of two different feeding styles. This process helped create a comparative analysis between the bacteriome shape and structure across adelgid species within different feeding lifestyles and qualities of nutrition. These data images illustrate correlations between the adelgid diet and the influence of bacterial endosymbionts in bacteriome structure. Bacteriomes coming from adelgids on high-nutrient diets contained different numbers of cell types and structures when compared to bacteriome cells originating from low-nutrient diets. Bacteriomes from high-nutrient diets contained a lower ratio of structural cells (small vs large cell comparison) than bacteriomes from low-nutrient diets. Differences in the overall shape and size of bacteriomes across species and feeding lifestyles raise pertinent questions regarding the evolutionary impact host ecology plays on the physical morphology of adelgid symbionts and their bacteriome host structures.

Critical issues facing the agriculture, forestry, and natural resources industries in the state of Georgia: A Delphi Analysis

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Throughout the United States, the agricultural, forestry, and natural resource industries are facing a multitude of challenges. While each industry is facing unique challenges on a national level, these challenges vary in scope and topic, and they are not necessarily generalizable to smaller geographic regions. This study compiled a comprehensive list of present or near-present critical issues to the agricultural, forestry, and natural resource industries in the state of Georgia using the Delphi methodology amongst a sample of opinion leaders from the Advancing Georgia's Leaders in Agriculture and Forestry program. Results were established using consensus building theory. To address the study objectives the researchers conducted a three-round Delphi process with an expert panel of 24 individuals. The first round of the study was conducted using the online Qualtrics survey tool, there were 21 respondents for an 87.5% response rate. There were a total of 80 critical issues identified. The issues were then cleaned with duplicates removed, resulting in 67 unique critical issues. The second round of the process asked participants to indicate their level of agreement with each of the 67 issues through an online Qualtrics survey. A mean score for retention of 3.75 was established a posteriori, a total of 47 items were retained for a 70% retention rate. Round three was conducted in person with a sub-set of 11 of the original 24 individuals, a 100% response rate was obtained. A paper-based survey asked respondents to indicate whether each issue should be retained or not using a dichotomous yes/no variable. A minimum level of consensus was established at 70% a posteriori. The panel achieved consensus on 40 specific challenges facing the different industries for an 85% retention rate. A total of 21 items achieved a level of consensus between 90% and 100% with eight of those achieving 100% consensus. The 40 retained items were then thematically analyzed based on the constant comparative method. A total of six primary themes emerged, including (alphabetically): (1) Economic Considerations - 5 items, 1 90-100% consensus, (2) Operations and Infrastructure - 6 items, 2 90-100% consensus (3) Public Perceptions - 7 items, 6 90-100% consensus, (4) Policy - 7 items, 5 90-100% consensus, (5) Regulations - 7 items, 4 90-100% consensus, and (6) Workforce - 8 items, 3 90-100% consensus.

The Effect of Government Environmental Protection Programs on the Economic Viability of Cover Crop Implementation on Soybean Operations

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As global climate change dominates environmental discussions, sustainability programs are implemented across all industries including agricultural operations. Agricultural operations can incorporate cover crops which are a non-productive crop that serves as a placeholder during seasons when active crops are not being grown. Cover crops are an effective method to reduce soil erosion and preserve soil health in agricultural operations. Government agencies employ various cost mitigation techniques, including cost-share payments, crop insurance, Environmental Quality Incentive Programs (EQUP), Conservation Stewardship Programs (CSP), and ecosystem service opportunities to reduce expenditures on cover crops. Exploration into the economic effects of natural resource conservation and environmental protection programs is vital to understanding the long-term viability of cover crop techniques. This study will assess the economic effects of state and federal assistance on cover crops used in soybean farming operations. To isolate the effects of government assistance programs, a simulation model using a partial budget analysis will provide estimated net return outcomes from cover crops. The model will compare the economic effects on a representative farming operation before and after government assistance programs are implemented. Insights into which method of assistance is most beneficial will be provided. This study will help to address the future viability of cover crops with varying degrees of government assistance related to natural resources and the environment and render if cover crops are a sustainable practice from environmental and economic perspectives. Identifying the most beneficial government assistance program (s) will allow soybean farms to minimize variable costs and maximize net returns.

The Effect of Varying Iron Supplementation Levels on the Growth Performance of Nursery Pigs

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Commercially raised piglets must receive iron (Fe) supplementation at birth, since they are born with low Fe status, sow's milk is low in Fe, and they have no natural source of Fe. Common industry practice has been to administer 100 mg Fe via injection at birth and supplement 100 ppm dietary Fe in the nursery diet. Recent data indicates that giving piglets 200 mg Fe at birth may improve growth rate the first few weeks of life. However, there is very limited data on the impact of giving more Fe at birth on the Fe needs of the pig during the nursery phase. The objective of this study was to determine if piglets receiving 100 mg and 200 mg of Fe at birth exhibited differences in growth in the nursery when fed diets containing increasing Fe concentrations. Two trials utilizing a total of 120 piglets (1.51 kg) from 15 litters were conducted. At birth, piglets were paired by birthweight and given either 100 mg or 200 mg Fe from iron dextran via an intramuscular injection in the neck. At weaning (~21 d), 120 piglets (5.71 kg; trial 1 =72, trial 2 =48) were blocked by weight and birth treatment and were randomly assigned within block to dietary treatments (3 pigs/pen). Nursery diets were formulated to contain 4 supplemental concentrations of Fe (80, 100, 120, 140 ppm), resulting in a 2 x 4 factorial arrangement of treatments. Body weights and feed intake were recorded weekly. Data were analyzed via PROC GLM in SAS and pen was the experimental unit. Piglet growth during the lactation phase did not differ ($P \geq 0.10$) from 100 mg Fe (196 g/day; 5.70 kg) to 200 mg Fe (199 g/day; 5.73 kg). During phase 2 (d 7-21) there was a significant interaction ($P \leq 0.05$) with piglets given 200 mg Fe at birth having increased ADG, while those given 100 mg Fe at birth having a decreased ADG across the increasing Fe treatments. This response was reversed during phase 3 (d 21-35) with piglets who received 100 mg of Fe at birth having increased ADG compared to those who received 200 mg at birth. Overall ADG and ADFI (d 0-35) were affected by dietary concentration of iron ($P \leq 0.05$), with piglets receiving 100 ppm Fe in the diet having a decreased ADG and ADFI compared to the piglets fed the other dietary Fe levels. There was no significant difference ($P \geq 0.1$) observed in feed efficiency from d 0 to 35 across dietary treatments. These data indicate that modern piglets reach their highest growth potential when administered 200 mg Fe at birth and at least 80 ppm Fe in the nursery diet.

Investigating the functional role of thyroid hormones on insulin-like growth factor binding protein expression during avian muscle development.

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Endocrine systems assist in maintaining growth and metabolism and are highly conserved in vertebrates but poorly understood in birds. Crosstalk between endocrine systems involved with growth may contribute to bird development, similarly to mammals. The somatotropic and thyrotropic axes are both known to be involved in growth and development and are suspected to engage in crosstalk in order to regulate skeletal muscle growth and metabolism. Pituitary growth hormone (GH) plays an important role in the somatotropic axis by stimulating the insulin-like growth factor (IGF) signaling system. This includes insulin growth factor binding proteins (IGFBPs) that regulate IGF-IGF receptor type 1 (IGFR1) interactions to influence cellular proliferation, differentiation, and apoptosis regulated by IGFs. The thyrotropic axis includes triiodothyronine (T3) and thyroxine (T4) that bind thyroid hormone (TH) receptors to regulate gene expression through thyroid response elements (TREs). Identification of putative TREs in select IGFBPs suggest IGFBP expression can be regulated by THs. The purpose of this study was to determine if THs alter IGFBP expression. Quail muscle clone 7 cells were treated with T3 and T4 in concentrations of 0, 1, 5, and 25 ng/µl for 0.5, 6, and 24 hours. RNA was extracted and converted to cDNA and gene expression was measured by performing quantitative polymerase chain reactions. Initial results of this study have shown that T3 at concentrations of 1 ng/µl increased IGFBP2 and IGFBP3 expression. This suggests that changes in the concentration of plasma T3 influences IGFBP expression and, consequently, overall skeletal muscle growth and metabolism as regulated by IGFs.

The Impacts of Fast Fashion: Indicators of Environmental Sustainability in Fashion Supply Chains

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Fast fashion, or rapidly and cheaply produced clothing designed to sell quickly and be worn less, is skyrocketing in popularity among young, fashion-conscious consumers. It is also becoming more and more of a concern to the “triple bottom line” through its environmental, ethical, and economic impacts. In particular, the methods of supply chain management used by fast fashion companies have been widely seen as environmentally unsustainable due to their intensive resource use and massive waste generation. Though fast fashion and sustainable supply chain management have been studied extensively in the existing literature, most analyses rely on case studies of individual companies that are not easily applicable to the wider industry. This project has two goals. First, it describes the results of a rigorous statistical model that determines the relationship between supply chain management styles that are indicative of fast fashion and environmental sustainability scores. The scores are drawn from ESG (environmental, social, and governance) data on Refinitiv Workspace, a database of company financial data and economic indicators for investment. The goal is to determine which methods of supply chain management increase sustainability the most for fashion companies. It is expected that those methods commonly accepted as “fast fashion” will result in lower environmental sustainability scores with the implications of lower economic sustainability and lower ethical (social) acceptability. Second, it explores the connections between transparency (measured using the Fashion Transparency Index) and sustainability in fashion companies. It is expected that more transparent fashion brands will be more sustainable, and vice versa. This project is the first of its kind to systematically evaluate more than two or three fashion companies at once, and provides valuable information to help academics, policymakers, companies, and even consumers to make decisions impacting the clothes we wear every day.

Local Soil Survey and Soil Characteristics along Toposequences in the Georgia Piedmont, USA

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Soils provide numerous ecosystem services including nutrient cycling, water filtration, and serving as plant growth media. The physical and chemical properties of soil influence the suitability for their use and limitations, however, there can be significant variability in soil properties over short spatial scales. This variability across space and with depth is often controlled by landscape shape and parent material. Soil maps are developed to represent soils for multiple uses but often cannot capture the detail necessary for intensive management. For this project, we aimed to examine the effects of solum depth on maximum clay content and the influence of slope on solum depth for a small area of Whitehall Forest in Clarke County GA. Further, a small-scale soil survey was conducted at the study site to update the soil map units for the NRCS soil survey. We hypothesized that the topographic positions with relatively high slope gradients (shoulder & side-slope) would have relatively thin soil sola and low clay contents compared to the landscape positions with gentler slopes (foot-slope, nose-slope & summit). Two hillslope transects comprised of 18 soil profiles were sampled with a bucket auger to 180 cm depth or restriction and characterized by genetic horizon according to NCSS standards. Soil from each horizon was air-dried and passed through a 2 mm sieve prior to particle size analysis by laser diffraction. We observed that mean sola depths at the shoulder and side-slope positions were relatively thinner due to higher slope gradients (19% & 29%, respectively). Solum depth was positively correlated with maximum clay content in the profile (R2 = 0.71) and negatively correlated with slope percent (R2 = 0.39) for the upland sample points. The limited number of sites sampled along the upland transects (n=11) and the exclusion of slope curvature as a variable in the regression analysis, may limit the accuracy of our results. The local soil survey revealed that the soils present along the alluvial terrace (covering ~50% of the map unit at our study area) are taxonomically different from the upland soil series currently mapped there indicating the need to update the soil survey for more detailed use. Results from this study confirm the relationships between topography and soil properties and illustrate the potential for predicting soil properties with limited data.

Examination into season fluctuations in hoof sensitivity and blood pressure on horses housed on fescue and non-fescue pastures

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Equine laminitis is a condition where the blood flow to a horse's foot is reduced, leading to the rotation of the coffin bone. Pasture laminitis is associated with high sugar consumption, which is linked with insulin resistance; hyperinsulinemia has been shown to be a causative factor in laminitis. However, in other livestock species, vasoconstriction while consuming fescue pasture has been documented. Cattle have been seen to lose their tails, ears, and hooves due to an endophyte that lives on the fescue grass. Fescue endophytes are also known to affect equine broodmares in late gestation and early lactation but has previously been considered safe for other classifications of horses. However, in a recent study, insulin resistance was documented in steers that were fed endophyte infected fescue as compared to steers fed endophyte free fescue. This preliminary study was to determine if there are any recordable differences in hoof sensitivity or blood pressure in horses housed on fescue pastures. Blood pressure was taken from the tail using an automated blood pressure cuff to determine systolic blood pressure, and hoof sensitivity was determined by using a calibrated set of hoof testers to apply a standard pressure to the medial, center, and lateral toe. Seven horses of mixed breed and age were housed on a wild-type fescue pasture and were monitored at 2-3 week intervals from mid spring to early winter. During the spring, a control group of horses housed on a dormant pasture and fed bermudagrass hay were used as a comparison. Results show increased hoof sensitivity in horses on fescue pasture during spring months as compared to controls ($P=0.04$), but no differences in blood pressure were noted ($P=0.31$). By early summer, hoof sensitivity decreased and remained low for the remainder of the year. Although there was a lack of adequate controls during this study, the results support expanding the project and comparing both hoof sensitivity and insulin response of horses on endophyte infected fescue as compared to other pasture alternatives.

Impact of diet modifications during metabolizable energy assays on profile of microbial products and nutrient transporters in broilers small intestine

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During metabolizable energy assay using the indirect method, it is customary to replace the energy-yielding components of the reference diets (usually corn and soybean meal) with the test feedstuff. The test feedstuff will alter dietary fiber profile in the test diet and may influence the intestinal environment of the birds. It is important to understand how such feedstuffs influence the digestive tract and microbial activities during the assay. For this 21-d experiment, a total of 273 Cobb 500 male broilers were used to study the possible role of partly replacing corn-soybean meal (SBM) with other feedstuffs during metabolizable energy assay on the cecal profile of short chain fatty acids (SCFA), jejunum histomorphology and jejunal nutrient transporters. The birds were allocated to 7 treatments consisting of a corn-SBM reference diet, and 6 additional diets in which corn and SBM were replaced by 40% low-protein SBM (LPSBM40), 60% wheat bran (WB60), 60% dried sugar beet pulp (SBP60), 60% soy hull (SH60), 50% corn gluten feed (CGF50), or 50% rice bran (RB50). Each treatment had 7 replicates with 3 birds per replicate. The birds received experimental diets from day 14 to 21. On d 21, after euthanasia, cecal contents were collected for short chain fatty acids (SCFA) analysis as indicator of microbial activity and the jejunal tissue was collected for gene expression as well as for histomorphology. Cecal acetate was greater for birds that received WB60 ($P \leq 0.05$) compared to SH50, CGF50, and RB50. Butyrate production was greater ($P \leq 0.05$) for birds that received LPSBM40 compared with those that received SBP60, SH50, and CGF50. Valerate tended to be lower ($P \leq 0.10$) in birds fed WB60 compared with all other treatments. Cecal total SCFA was greater ($P \leq 0.05$) in WB60 compared to CGF50 and RB50. There were no treatment effects on jejunal gene expression for CLDN1 (tight junction); GLUT1 and SGLT1(glucose transporters) or CAT2 (cationic amino acid transporter). In conclusion, dietary modifications such as replacing corn and SBM with high level of feedstuffs with various content of soluble and insoluble fibers influenced microbial activity, but these modifications did not affect the gene expression of relevant carbohydrate and amino acid transporters. It is expected that the changes seen in microbial activity as shown in SCFA profile will influence energy utilization by birds and must be considered in metabolizable energy assays.

A Geodatabase of Septic System Permits for Jackson County, Georgia

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Failing septic systems are known to contribute to pollution in surface water bodies. However, since these are non-point sources, tracking the contribution of septic systems to surface water is a challenging task. Adding to the complexity of dealing with this non-point source, most counties in Georgia also lack digitized information on the locations and age of septic systems, thus making it harder to manage them at the county level. The broader purpose of this project is to develop an ArcGIS toolbox that automates the digitization of septic systems based on remote sensing imagery and available GIS datasets in Jackson County. Such information can be utilized by the county to digitally locate septic systems. In this work, we will present a more focused aspect of this project which is the development of a GIS layer that will serve as the validation dataset for this algorithm. The GIS layer has been created using scanned septic system permit information and the attribute table contains septic relevant information such as trench depth, width, and soil series that can be queried spatially in an ArcGIS interface. The septic permits were scanned at the Department of Public Health Office in Jackson County and the GIS layers will finally be provided to Jackson County as well.

Program Evaluation of the Georgia Agriculture Experience

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Since the passing of Senate Bill 330 in 2018, elementary agricultural education has gained headway in Georgia. These burgeoning programs are now aided by the Georgia Foundation for Agriculture's GA AG Experience, a mobile classroom trailer aimed at building the agricultural literacy of Georgia 3rd through 5th graders. The Georgia Foundation for Agriculture and the University of Georgia Department of Agricultural Leadership, Education and Communication faculty have partnered to create educational materials and lessons to be used prior to, during, and after the Experience. These materials emphasize Science, Technology, Engineering, and Mathematics (STEM) in relation to Georgia agricultural commodities, including the poultry, horticulture, cotton, and peanut industries. The GA AG Experience and related lessons may be an incredibly effective method of building interest in agriculture and STEM at an earlier age. As a result, this experience could help generate greater public awareness on the origins of food and fill the deficit of individuals that are qualified in both STEM and agriculture. With the introduction of the mobile classroom and related curriculum, a program evaluation was of value to test effectiveness of methodology. Instruments for the collection, analysis, and synthesis of data regarding the effectiveness of the Experience were produced in the form of a logic model, condensing ideas of inputs, outputs, and outcomes of the mobile classroom, as well as a series of surveys to evaluate the effectiveness of The Georgia Ag Experience from multiple perspectives including students and educators. Survey response included 37 teacher responses, 1141 student responses prior to the GA AG Experience visit, and 629 student responses post visit. Current findings from these surveys suggest general effectiveness of the GA AG Experience in generating basic awareness and interest in the intended fields among students, but with some minor changes needing to be made to improve the effectiveness of establishing a long-term interest in agriculture or STEM. This research serves significance in improving the Georgia Ag Experience for future student participants, to better the process for all involved, and elementary agriculture education as a whole.

Sex Determination Utilizing Green Tea Extract in Japanese Quail

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Understanding sex determination in various bird species has been an ongoing issue in the agribusiness industry for many years. For example, scientists have been attempting to grasp the basis of sex determination from the embryonic state in the hopes of learning how to control chick sex to meet industry demands for chicks of a particular sex. Sex in birds is determined by two sex chromosomes, W and Z. A WZ genotype results in a female and a ZZ genotype results in a male. The default sex in all bird species is male, but if the W chromosome is present, estrogen production will be triggered and ovaries will begin to form. Preventing estrogen synthesis by giving female embryos an aromatase inhibitor results in development of testes rather than ovaries. Recent studies in rats suggest that green tea extract can also act as an aromatase inhibitor. Thus, we hypothesized that injecting green tea extract into eggs would masculinize female embryos much like an aromatase inhibitor. We injected Japanese quail eggs with one of the following three treatment groups (n=32 each), on day 4 of incubation: a control of 50 ul water, a low green tea concentration group of 250 ug green tea extract in 50 ul water, and a high green tea concentration group of 375 ug green tea extract in 50 ul water. After injection, the eggs were incubated for 12 days (3-4 days before hatch). On day 12, the embryos were removed and were surgically sexed based on the presence of either two testes or a single ovary. Liver tissue was also collected for DNA sexing to determine the genotypic sex of the embryos. Both of the green tea extract treatment groups resulted in higher percentages of male offspring compared to the control group (Controls- 17% male embryos, the low green tea - 80% males, high green tea- 86% males). Logistic regression analyses showed that these percentages were significantly different than the controls for both green tea doses. C: Low - □2 = 7.33, p = 0.007, C: High - □2 = 6.55, p = 0.01. We are currently running PCR tests to determine the genotypic sexes of all offspring. Ultimately, green tea extract may help us to achieve the desired gender of birds in the poultry industry. Our experiment also shows that green tea may not be a good choice for women to consume during pregnancy.

Visualization of Poultry Embryogenesis through Windowed Vessel Incubation for Academic Instruction

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Unlike mammalian embryos, the unique accessibility of the avian embryo has made them a practical model for the study of development. The use of a windowed eggshell is a simple technique for in-ovo manipulation that allows visualization of development from blastoderm formation until hatching. There have been improvements to this technique for use in developmental biology studies over time however they have not allowed for an appreciative view of development due to the small size of the window. The overall focus of this study was to create an easily replicated protocol that can be implemented in classrooms for educational use in primary, secondary and higher education. A window size of 2-2.5 cm, rather than the traditional 1 cm, was used on hatching eggs to allow and enhance the field of view and was shown to have little to no impact on hatch rates. The window was created using a rotary tool to remove the shell area where the air cell is located. The membrane was then removed using sterilized tissue forceps being careful to not puncture and destroy the embryo's vasculature. This window was then sterilized around the edges using 70% ethanol to prevent bacterial growth. This was then covered with parafilm to seal the vessel. Hatching was found to not be successful when attempting to cultivate a windowed vessel throughout the entire 21-day process. Therefore, the development was separated into four periods: Days 1-5, 6-11, 12-17, and 18-21. Embryos in the 1-5, 6-11, 12-17 were terminated at the conclusion of the period. The embryos from 18-21 were allowed to hatch and were found to have a hatch rate of 94%. The usage of parafilm for this experiment to seal the vessel was not shown to negatively impact the chicks hatching capability. The chicks resulting from this experiment had no noticeable defects. The finished product from this experiment includes a deliverable lesson plan that utilizes readily available materials and clear instructions with the goal of increasing poultry-based instruction in classrooms in Georgia. These results show that this is a very easily conducted project that can be used by educators at all levels of education.

Optimization of Gal4/UAS System in Plants

Arjun Bhatt, Applied Biotechnology Major, Department of Entomology; Presented in 2021

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The Gal4/UAS system is a powerful tool that is commonly used in Drosophila for targeted gene expression. Gal4 is a transcriptional factor derived from yeast that contains an activating domain (AD) and a DNA binding domain (BD). UAS ("upstream activation sequence") is an enhancer that is specific to the Gal4 protein and generally precedes some gene of interest. When this pathway is activated, Gal4-BD binds to the UAS and Gal4-AD recruits transcriptional machinery to drive downstream expression of a target gene. The primary purpose of this project was to optimize this Gal4/UAS system to drive downstream expression of BS3 in plants. BS3 is an apoptotic initiator that induces the hypersensitive response in plants. As such, expression of BS3 is far easier to measure because it produces visible signs of cell death in inoculated plant leaves. Nicotiana benthamiana was selected as the host plant organism because of its broad susceptibility to a wide number of pathogens and its reliable reputation within the plant pathology community. N. benthamiana was infiltrated via Agrobacterium tumefaciens with Gal4BD-VP16 and UAS-BS3. The Gal4 activating domain was replaced by the VP16 transcriptional activator derived from herpes simplex virus because it has been proven to be a stronger activator in plants. No visible expression of BS3 was observed in N. benthamiana. A plausible cause of this failure can be attributed to the presence of a single UAS preceding the BS3 gene. Studies from the Brophy lab at Stanford have demonstrated that the presence of six consecutive repeats of UAS can yield a ~10-fold increase in target gene expression when combined with the Gal4BD-VP16. As such, the primary goal for this semester was to construct 6xUAS-BS3 so that Gal4BD-VP16 can be validated as a functional tool for targeted gene expression in N. benthamiana.

Developing a Dual Antibody Based Platform for Toxin Resistance

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Aflatoxins are highly toxic secondary metabolites produced by a number of fungal species in the Aspergillus genus. Of the twenty known aflatoxins, aflatoxin B1 (AFB1) is considered to be the most toxic as it was recently categorized as a Group I carcinogen by the International Agency for Research on Cancer. In Georgia, AFB1 contamination in peanut plants is a major public health issue that is responsible for health complications such as hepatotoxicity and immunotoxicity. As such, an inducible expression system that can efficiently isolate aflatoxin affected plant was engineered using the Gal4/UAS system and single-chain variable fragments (scFvs). The Gal4/UAS system consists of the Gal4 transcriptional factor (from S. cerevisiae) and an upstream activating sequence (UAS) that enhances a minimal promoter for a gene of interest. The binding and activating domains of the Gal4 transcriptional factor were each fused to a unique scFv that is specific to AFB1. Upon exposure to AFB1, each scFv will bind to AFB1 and allow for the Gal4 transcriptional factor to be fully activated, which in turn will lead to activation of the UAS and subsequent expression of a downstream gene. The primary gene of interest was BS3, an apoptotic initiator that causes cell death in plants. BS3, as opposed to GFP, confers a greater advantage to this system because the response is easily measured and does not require any additional equipment. All in all, the Gal4/UAS system combined with ScFvs is a novel idea in the field of plant pathology because it serves as the basis of a dynamic platform that can be modified to become specific towards any toxin or molecule and in turn, induce expression of any target gene.

Effect of nicotinamide riboside on pig muscle fatigue resistance and fresh pork quality: a pilot study

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The objective of this pilot study was to test methodologies needed to execute a USDA funded study that will commence soon. The study will examine the ability of dietary nicotinamide riboside (NR) supplementation to delay muscle fatigue and improve meat quality. Barrows (N=4) were assigned to 1 of 3 treatments: a conventional swine finishing diet containing 0 (CON; n=1) or 45 mg•kg body weight^-1•d^-1 NR (SUP; n=2), or an oral drench of Karo syrup containing 45 mg•kg body weight^-1•d^-1 NR (DRE; n=1). After 11 days of feed and performance testing protocol acclimation, pigs were subjected to their assigned treatments for 10 days. On day 11, pigs were subjected to the performance testing protocol by moving them up and down a 25-m hallway until subjective physical exhaustion was observed. Electromyography (EMG) electrodes were attached to tensor fasciae latae (TFL), biceps femoris (BF), and semitendinosus (ST) in order to obtain root mean square (RMS) values, as an indicator of active muscle fibers. Pigs were walked pre- and post-performance test on a GAIT4 Walkway pressure mat system in order to evaluate fatigue through speed, cadence, stride length, stride time, and cycle time. After performance testing, pigs were harvested, and boneless loins were collected for objective and subjective color analyses. Speed was consistent between treatments at an average of 0.75 m/s. Laps ran, as well as time ran before exhaustion, were greater in pigs supplemented with NR. Electromyography data did not show any clear dietary treatment differences; however, there were trends where active muscle fibers were reduced in some muscles and increased in others during exercise. Overall, there were increases in cycle time and stride time after subjects were fatigued, and decreases were seen in speed, cadence, and stride length. Pork chops from pigs treated with NR had greater a* values during display, indicating redder meat. Visual panelist also reported NR chops were redder and had less discoloration throughout the 7-day display period. Overall, the methods utilized in the study were validated and preliminary results indicated NR aided in increasing physical stamina and improved pork chop color stability.

Analyzing the Shelf-Life Stability of Thlaspi arvense Fae1 Mutant Strain

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Pennycress (Thlaspi arvense) is an oilseed crop with promising environmental benefits. Pennycress can be grown during the winter off-season on land that otherwise would not be utilized between the corn and soybean crop rotations. This helps to reduce soil erosion, nutrient loss, and weed infestations. However, wild-type pennycress is not suitable for human consumption due to its high erucic acid content, which is a fatty acid (C22:1n9) with antinutritive properties. Recently, researchers developed a new pennycress form in which the enzyme (fae1) responsible for erucic acid biosynthesis was knocked out, and oleic acid (C18:1n9) was synthesized in its place. This fae strain has a similar fatty acid composition to that of canola oil, a widely used culinary oil, originally developed from rapeseed which also contains erucic acid. Additionally, the fae strain may also be more stable to lipid oxidation, which is a chain reaction leading to rancidity in foods. The purpose of this study was to assess the shelf-life stability of pennycress oil. To do so, oil samples from 2019 were incubated at 35 and 45°C to compare the wild type and fae strain. Fae oil from 2020 was incubated at 30, 40, and 50°C to generate a shelf-life plot. Parameters related to rancidity (peroxide value, p-anisidine value, and free fatty acid development) were then monitored at regular intervals depending on the incubation temperatures. Peroxide and p-anisidine values reflect primary and secondary lipid oxidation, respectively. For wild-type oil, they could be modeled as first order reactions, i.e., they increased exponentially with coefficients of determination (R2) between 0.972 and 0.992. In contrast, R2 for oil from the fae strain were, in some cases, low because the oil was still in the lag phase and had not undergone extensive oxidation. The free fatty acid test was used to measure hydrolytic rancidity, and both oil types exhibited less than 1% free fatty acids, indicating the oil is not prone to hydrolytic rancidity. However, the trend of the fae performing better than the wild-type continued. Thus, all the tests indicated that the fae strain is more shelf-stable than the wild-type strain. Further studies are currently being conducted using new oil samples incubated over longer storage times to model the behavior of the fae pennycress so a shelf-life plot can be generated.

Relationship between hoof sensitivity and blood pressure to endophyte concentrations on horses housed in fescue and non-fescue pastures

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Equine pasture laminitis has been a long-time problem faced by the horse industry. Increased research over the past decade indicates that the accumulation of non-structural carbohydrates in pasture plants is a causative factor in pasture laminitis, possibly due to hyperinsulinemia-driven vasoconstriction in sensitive horses. However, it has been documented that laminitis occurs more frequently on fescue pasture. Fescue is a common pasture grass in the United States, and it is often infected with endophytic fungus responsible for the well-known fescue toxicosis in cattle resulting in vasoconstriction. This area has not been well studied in horses, but a small number of studies exist examining the relationship of endophyte infected fescue on equine hoof health. It has been documented that endophyte infected seeds can result in vasoconstriction and increased hoof sensitivity. The objective of this study is long-term monitoring of hoof sensitivity and blood pressure in horses grazing a predominately fescue pasture compared to horses grazing a predominately bermudagrass pasture. Prior to long-term monitoring, preliminary data was collected to determine the best methods for obtaining accurate, repeatable blood pressure and hoof sensitivity measurements. Five horses were evaluated over a week-long trial, with data being collected 3 days in the morning and evening. Coccygeal artery blood pressure was collected using both a manual and automatic human blood pressure cuff using 5 different methods. Hoof sensitivity was measured on the medial, center, and lateral sole consecutively for 3 repetitions using a hoof tester with a pressure gauge to calibrate pounds of pressure applied. Preliminary results indicate 3 of the 5 methods of collecting indirect blood pressure were not statistically different from one another and fell within normal reference ranges. Recording blood pressure at first returning heart beat using an automatic human blood pressure cuff was least influenced by human error. After comparing hoof sensitivity readings over multiple repetitions, a trend of increasing reactivity was found, so one repetition per horse is determined to be less subject to false positive results. Once long-term monitoring begins, horses from each pasture will be tested for blood pressure changes and hoof sensitivity changes on a bimonthly basis for one year in order to determine a possible relationship between endophytic fescue and pasture laminitis.

Utilizing Key Players within Networks to maximize Diffusion of Innovations in Turfgrass Research

Edith Copeland, Agribusiness Major, Department of Department of Agricultural and Applied Economics; Presented in 2021

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Turfgrass is a multibillion-dollar industry with significant economic impact in Georgia and Nationally. The purpose of the larger grant work is to develop more sustainable and drought resistant turf cultivars to conserve water and ensure the long-term viability of turf grasses. My research intends to maximize adoption rates by producing educational-outreach programs to help extension experts, stakeholders, and consumers understand long-term impacts of drought tolerant turf selection and conservation of water. My goal is to discover the most effective way to increase society's perception and reception of drought tolerant turfgrasses. We hope to reduce water consumption through education of end-users on the economic and environmental impacts of adopting these drought resistant varieties. Education and outreach help increase adoption rates and magnify the economic and environmental impact of these new cultivars, reducing water consumption, and protecting the environment for future generations.
Phase one identified "key players" who use their influence to reach target audiences and increase adoption rates. Relationships with "key players" in different industries (strata) will give me a significant advantage in promoting the adoption of these new turfgrasses throughout the southern United States. Phase two looks at maximizing consumer impact. I will use existing systems such as Cooperative Extension, 4-H, the Department of Education, and social media to distribute materials and target specific strata of the population. When new cultivars are released into the market, there are important shifts in outreach efforts needed to reach broader audiences focused on "key players" and media channels to constitute this shift.

Determining Appropriateness and Effectiveness of Diffusion of Innovation Communication Channels in the Turfgrass Industry

Edith Copeland, Agribusiness Major, Department of Agricultural and Applied Economics; Presented in 2021

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Turfgrass is a multibillion-dollar industry with significant economic impact in Georgia and Nationally. The purpose of the larger grant work is to develop more sustainable and drought resistant turf cultivars to conserve water and ensure the long-term viability of turf grasses. My research intends to maximize adoption rates by producing educational-outreach programs to help extension experts, stakeholders, and consumers understand long-term impacts of drought tolerant turf selection and conservation of water. My goal is to discover the most effective way to increase society's perception and reception of drought tolerant turfgrasses. We hope to reduce water consumption through education of end-users on the economic and environmental impacts of adopting these drought resistant varieties. Education and outreach help increase adoption rates and magnify the economic and environmental impact of these new cultivars, reducing water consumption, and protecting the environment for future generations.
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An Investigation into the Welfare and Environmental Impacts of Equine Track Systems

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Domestic horses are typically housed in pasture, stalls, or a combination of the two. As an alternative to conventional housing, the development of 'equine tracks' is growing in popularity. The track system was first introduced as Paddock Paradise in the book, Paddock Paradise, A Guide to Natural Horse Boarding. Horses are housed in a perimeter track to encourage movement and interaction with surroundings, mimicking more natural behavior and movement. Along the track are food, water, and environmentally enriching stimuli. Though still a new concept, this is thought to have positive impacts including managing equine insulin resistance, providing a more natural and enriching environment, decreasing overgrazing, and limiting tree clearing. Some suspected disadvantages include erosion and flooding, damaging runoff, pugging and poaching, high cost, and other unknown consequences due to lack of research in this area. This study aims to observe the behavioral and environmental effects of a track system compared to conventional pasture use. Three test sites have been identified, but prior to monitoring these, activity tracking equipment was tested for accuracy. Initially, horses were fitted with a GPS watch, a handheld GPS tracker and a pedometer and tested over a calibrated distance of 0.2 km. Results indicate that accuracy of the GPS tracking devices is consistently higher than data obtained with a pedometer. Following this, three alternate exercise watches equipped with pedometers and GPS features were tested. When compared, the pedometer feature consistently under-estimated the distance walked while the GPS feature of the three watches was consistent and accurate. Watches were then attached to the halters of two horses in a 7-acre pasture over a 24-hr period to determine battery life and consistency of activity between horses. Battery life was considerably lower when GPS features were enabled (24-hrs max), limiting the time data can be collected consecutively. Additionally, horses housed together in a conventional pasture did not have comparable activity patterns, indicating that more than one horse per treatment group may need to be monitored. Future aims and methods involve fitting activity watches to horses at each of the three test sites to monitor activity and feeding patterns, as well as conducting land use surveys to determine environmental impact. Expected results should give insight into the impacts of track systems on equine welfare and environment.

The Importance of Hygiene in the Dairy Science Industry

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Mastitis, one of the most common diseases in the dairy industry, remains a concern even in healthy herds. Mastitis is defined as inflammation of the mammary gland commonly caused by infection. One of the most vital steps in controlling mastitis is through proper mammary hygiene to minimize exposure to environmental pathogens (EP). The EP can be found in the manure and organic matter (OM) surrounding the cow. There are methods that could minimize EP exposure, such as mammary hair removal, so that manure and other OM does not remain on the gland. Removing mammary hair may also promote more successful machine milking which reduces any damage by inappropriate attachment. Thus, our objective was to determine if removing mammary hair improved cow hygiene and protected teats from anatomical damage. To address this objective, we randomly assigned cows from 2 pens (red & yellow) to a control (CON) or treatment (TrT) group. The mammary hair of the TrT group (n=15) was singed for removal, while the CON group (n=21) was not. Pens were composed of both CON and TrT animals. We assessed mammary hygiene and teat anatomy prior to singeing (PRE) and every 2 weeks after for up to 6 weeks (P2, P4, P6). Mammary hygiene was assessed for each cow with scores from 1 to 4 (1 being little to no accumulation of manure/OM on mammary gland/legs up to a 4 being covered with manure/OM). Teats were scored from 1 to 4 (with 1 indicating a normal, smooth teat with no raised ring up to a 4 indicating a very rough, raised ring at the teat end). Overall, no trends or significance were found over time or between CON and TrT groups. While disappointing, we evaluated any pen differences at the beginning of the study that could have impacted our results. We found that the yellow pen began the study (PRE) with a higher average hygiene score (2.38;CON & 2.71, TrT) compared to the red pen (1.58;CON & 1.50; TrT). While stocking density (# of cows/stall) was lower than industry standard (<120%), it was greater in the yellow pen (72-88%) compared to the red (37.5%) which most likely contributed to initial differences in scores. However, there was 52.6% decrease from PRE to P6 in TrT ($P<0.05$), whereas the 21.1% decrease in CON was not significant ($P>0.05$). There were numerical decreases in teat scores across time in both CON and TrT but no significant changes. Future studies could evaluate hygiene scores at varying stocking densities to identify specific rates which promote optimal hygiene.

PerPerceptions of COVID-19 and Their Effect on Municipal, State, and Federal Park Usage Between 2020 and 2021

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Objective To correlate the change in United States citizens' perceptions of the Covid-19 virus with the usage of municipal, state, and federal parks. Methods The survey was disseminated electronically and taken by 4000 individuals in the United States. Participants were questioned on their opinions on the coronavirus at the beginning of the pandemic compared to current times. The survey asked how concerned the participant was on a range of 0-100, 0 being not concerned at all and 100 being extremely concerned, about getting the coronavirus and being asymptomatic, having flu-like symptoms, being hospitalized, dying from the virus, and/or infecting other people. This question was proposed twice to gather a change in perspective between the spring of 2020 and now. The fluctuation in the use of parks across the nation was determined from questions that gathered the distance of the participant from parks at each level, the change in participant utilization of the parks between spring of 2020 and now, and the participant's reasons for altering park usage. Results The perception of Covid-19 across the nation and within Georgia has not changed significantly since the beginning of the pandemic as most people within the study were moderately concerned with all aspects surrounding COVID-19 in the spring of 2020 and remain so now. In lieu of this, the data expresses a decrease in park usage across the United States: 29% with municipal parks, 27% with state parks, and 22% with federal parks. Though participants reduced their park visits or did not go at all, approximately 36% of participants across the nation frequented each level of parks as they would normally. The fear of contracting Covid-19 was the primary reason for the reduction in use or complete avoidance of parks among participants. However, those who increased their park usage did so primarily because parks were safe, and parks were the only entertainment during the Covid-19 pandemic. Conclusion Overall, concern with the threat of the Coronavirus across the nation has slightly decreased in the past year. Most participants remain moderately concerned with the threat of the Coronavirus which is reflected in the decreased usage of parks predominately due to the possibility of being infected with the coronavirus. Further studies are necessary for the comparison of park usage before and after the pandemic to determine the gross economic impact the perceptions of SARS-CoV-2 have had on the parks across the nation.

Investigating the Ability of Nicotinamide Riboside to Increase Muscle Fiber Number in the Developing Embryo

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The objective of this study was to determine the effects of in ovo feeding of nicotinamide riboside (NR) at day 10 of embryonic development of a fast-growing broiler strain on pectoralis major (PM) morphometrics and muscle fiber formation at various embryonic stages. Fertilized Cobb 700 broiler eggs (N=720) were weighed, stratified by weight, and within each strata randomly assigned to 1 of 4 treatments within a 2 × 2 factorial design. Factor 1 was NR dose (0.0 or 2.5 mM NR injected with 0.9% sterile saline). Factor 2 consisted of injection location (albumen or yolk sac). Eggs were incubated at 37 ± 3ºC at a relative humidity of 40 ± 2% through the first 18 days of incubation, after which humidity was increased to 60 ± 2% until hatch. At day 10 of incubation, treatments were administered and embryos/chicks were euthanized at incubation days 15 and 18, and hatch (day 21). The right PM weight, length, width, and depth were measured, and muscle fiber cross-sectional area (CSA) and density were quantified. There were no Location × Treatment interactions or main effects for day 15, 18, and hatched embryo/chick body weights, and day 15 and 18 PM measurements ($P>0.19$). There were Location × Treatment interactions for hatched chick PM weight, length, and width ($P<0.04$). When NR was injected into the albumen, PM weight decreased ($P<0.05$), while when NR was injected into the yolk, PM weight increased ($P<0.05$). Pectoralis major length was not affected ($P>0.05$) when NR was injected into the albumen, but was increased ($P < 0.05$) when NR was injected into the yolk. Chicks from embryos injected with NR in the yolk had greater ($P<0.05$) PM widths than chicks from embryos injected with NR in the albumen, but non-injected chicks' widths did not differ ($P>0.05$). There were no Location × Treatment interactions or Location main effect for day 21 chick PM depth; however, chicks from NR injected embryos had smaller ($P=0.02$) depths than non-injected embryos. There tended to be a Location × Treatment interaction for muscle fiber CSA ($P=0.20$) and an interaction ($P<0.01$) for muscle fiber density. Pectoralis major muscle fiber CSA and density were not affected when NR was injected into the albumen ($P>0.05$), but CSA declined and density increased when NR was injected into the yolk ($P<0.05$). In conclusion, in ovo feeding of NR in the yolk sac did not affect PM development until after day 18 of development and it increased weight by lengthening the muscle and increasing fiber density.

Distribution of genes involved in calcium and phosphorus uptake along the small intestine of mature laying hens

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Selective breeding in the layer industry has led to higher yields of consumable table eggs. The increase in egg production has resulted in significant animal welfare concerns such as osteoporosis, or 'cage-layer fatigue'. Osteoporosis results from layers being unable to supply adequate calcium to eggshells while simultaneously strengthening their bones, leading to brittle bones that can easily break. A layer experiencing cage-layer fatigue will decrease production, ultimately leading to a loss in profits in addition to welfare issues. Having a balanced diet with suitable amounts of calcium and phosphorus is crucial for the prevention of cage-layer fatigue, as it is the only replenishable source of calcium available for the hen. Calcium demand is thought to be highest when the hard shell, which is composed mainly of calcium, is being deposited in the shell gland. In the pursuit to avert cage-layer fatigue and reductions in egg production resulting from inadequate calcium available for shell and bone deposition, we looked at gene expression of calcium and phosphorous transporters and chaperones along different segments of the intestinal tract of mature laying hens when the hard shell is being deposited. Mucosal scrapings were collected from the duodenum, jejunum, ileum, and ceca while the egg was in the shell gland of the reproductive tract. Total RNA was extracted from these scapings, quantified by UV absorbance, and analyzed by gel electrophoresis to make sure samples were not degraded. Total RNA was reverse transcribed to generate cDNA, which was used to analyze relative levels of gene expression for calcium transport and binding (NCX1, PMCA1, TRPV6, CASR, and CALB1) and phosphorus transport (P_iT-1, P_iT-2, NaP_iIIa, and NaP_iIIb) by quantitative real-time PCR (qPCR). The qPCR analysis is currently underway. As the majority of nutrient absorption occurs in the duodenum and jejunum, with very little occurring in the ileum, our predicted results are that overall expression of these genes will be elevated in the duodenum and jejunum, decreased in the ileum, and very low or non-detectable in the ceca. In ceca, bacterial fermentation of indigestible feed and water absorption are the main functions, so we expect to see little if any expression of genes related to nutrient absorption there. We expect some of these genes to be more highly expressed than others, providing potential targets for genetic selection in commercial egg-laying hens.

Does Preferential Transport of Nitrogen Impact Nitrogen-Source Preference in the Blueberry Cultivar 'Suziblue'

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Blueberries utilize inorganic Nitrogen (N) as either ammonium (NH_4^+) or nitrate (NO_3^-). Acquired N may be transported from the roots to the shoots either after assimilation (NH_4^+ and amino acids) or directly (NO_3^-). The objective of this project is to quantitatively measure the impact that the two inorganic nitrogen sources have on N transported from the roots to the shoots. Stem cuttings taken from blueberry (Vaccinium corymbosum 'Suziblue') plants will be grown in a hydroponics system and supplied with two levels (low and high) of N in one of two forms (NH_4^+ or NO_3^-). After one week, the xylem sap will be extracted using a PMS Instrument Company Pressure-bomb apparatus. Preliminary trials with xylem sap extraction using this apparatus have resulted in successful xylem sap extraction from blueberry stems. After extraction from experimental samples, the N form and concentration will be evaluated to better understand how the differing N sources impact the form of N translocated from roots to shoots. Simultaneously, transpirational water flux in the plants will be measured by determining decrease in solution content over time. This will be used to determine the content of N translocated in each form. The information gained from this research could have an impact on improving our knowledge of N-source preference in blueberry, especially with respect to N translocation and nutrition in blueberry production in the future.

A Comprehensive Review of Natural Infrastructure in Georgia

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For my project, I will be investigating the status of "green infrastructure" (nature-based infrastructure) versus the status of "grey infrastructure" (non-nature-based infrastructure) in the state of Georgia. The objective is to provide a look into past, present, and future infrastructure projects using various data sources, such as the Georgia Forestry Commission, the Army Corps of Engineers, past literature, and even proposed legislation. I plan to do this by researching previous, ongoing, and future infrastructure plans and categorizing them based on type, scale, region, funding, scope, implementation, etc. While I will be covering a variety of infrastructure types, I plan to show a deep focus on water infrastructure specifically; this information is vital for comparing how green and grey infrastructure each help the conservation of Georgia's precious marshlands and coastal areas. I also plan to look at how trends in green versus grey infrastructure have changed over time, hopefully uncovering correlations between legislation such as the Water Resources Development Act and higher adoption of green infrastructure.

During this project, I hope to hone my skills in research, GIS mapping, data collection, and data analysis. I plan to create an exhaustive review to shed light on the topic of green infrastructure. It is my hope that my findings can be used to provide a basis for future investigations into the value of nature-based infrastructure and prove that legislation and policy can influence how Georgia designs its infrastructure. Hopefully, this can lead to a more sustainable future through the use of green infrastructure.

The Cost of the 2017 Ebola Outbreak in the Democratic Republic of the Congo

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The current COVID-19 pandemic has shown the vulnerability of global economic systems to zoonotic disease. It has revealed the interdependence between the environment, health, and the economy. This interdependence is demonstrated in the fact that certain economic processes such as land conversion, resource extraction, and livestock production can have negative impacts on the environment and on human health by contributing to risk of spillover. These spillover events have large economic, health, and social costs. In this paper I specifically focus on Ebola, a zoonotic disease, and the outbreak that occurred in 2017 in the Democratic Republic of the Congo (DRC). When assessing economic costs and benefits of land conversion, one should compare the value of the resource that could be extracted to all the costs, including biodiversity loss and the costs associated with an increased risk of disease emergence. The objective of this paper is to compile all economic costs, explicit and implicit, associated with the 2017 Ebola outbreak in the DRC in order to evaluate the true economic implications of increasing the risk of zoonotic disease. The outbreak in the DRC was relatively small, only having 8 total cases and 4 deaths. However this paper demonstrates that a small outbreak still can have major economic and social implications. In my calculations of economic cost I include the loss of human lives by using the value of a statistical life (VSL). If the value of lives lost from the outbreak is not included, the overall economic cost is a gross underestimate of the true economic burden. However, the VSL is highly debated and there is not one singular measure for it. My calculations of cost also include elements that are not measured in economic terms but are in fact costs brought about by the Ebola Outbreak such as the mental health toll on healthcare workers and children that missed vaccinations for other illnesses. Overall I concluded that the total economic cost for the outbreak was approximately 13.08- 14.8 million dollars. This is around .3-.38% of the total GDP in the DRC in 2017. This paper demonstrates that even a relatively small outbreak can have large implications for the economy and health of human beings.

Linked Chapter 12 Bankruptcy Cases Within Georgia 2003-2019

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Chapter 12 (farm) bankruptcy is designed for family farmers to restructure their debts with creditors when they can no longer pay existing debt obligations. Amid a difficult farm economy, farm bankruptcies are on the rise with Georgia tied for the third-highest total chapter 12 bankruptcy filings with 37 since the 12-month period ending in June 2020 (American Farm Bureau 2020). However, not all filings are independent. Cases may be related because the same entity files multiple times, potentially in short succession. Alternatively, cases may be related because a single farming operation may be made up of multiple legal entities that may file for chapter 12 bankruptcy (e.g., an individual and a corporation). The current study provides a description of these related cases over time and across entities for Georgia using unique data from chapter 12 bankruptcy cases filed between 2003 and 2019. From the unique data set, our methods analyzed summary statistics across total assets, real property assets, total liabilities, secured liabilities, and unsecured liabilities for all chapter 12 cases, repeat filers, and filers that had a related concurrent filing. For the same filer case group, entities that filed at least twice in our dataset, we found 32 instances in which the same entity filed for chapter 12 bankruptcy within 180 days of the outcome of a previously filed chapter 12 bankruptcy case. This timeframe cutoff (i.e., 180 days) is used based on restrictions for re-filing. For the concurrent case group, filers that had a related concurrent filing, we found that the financial data associated with cases that had a concurrent case were different from those without a concurrent case in a statistically significant way. Combined, our results suggest that the total number of chapter 12 bankruptcies would drop by 18.62% (81 cases) if the 32 repeat filings were dropped and concurrent cases were combined to just a single case. These related fillings confound the actual number of chapter 12 filings in Georgia and features how the overall number of cases may be overstated. To grasp a more accurate representation of total filings, we recommend counting the two filings from the same filer as a single case if the initial filling's outcome is less than 180 days before the subsequent filling. More research should investigate this issue in other states. Additionally, further research is required to determine the best way to combine related cases filed concurrently.

Diagnosing soil-limiting factors of row crop performance to optimize management practices

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Soil health degradation is a major problem in most farming areas in Georgia, partially due to the subtropical climate, which is characterized by heavy rainfall and warm temperature conditions. Heavy rainfall and warm temperature conditions cause the soils to be highly weathered by leaching important base cations and other nutrients, as well as rapidly mineralizing soil organic matter. These conditions cause the soils to have low buffering capacity, and therefore any slight change in the soil can severely impact crop performance. It is therefore not uncommon to find spatial variability in crop performance in many farmlands in Georgia. Identifying the major factors contributing to spatial variability in crop performance will help guide producers in optimizing their management practices. The objective of my project is to diagnose a field in Midville, GA, that has a long history of spatial variability in crop performance, and to make management recommendations to mitigate the problem. The field was under cotton (Gossypium hirsutum) production in 2020, and soils were sampled during the growing season from healthy and poor areas of the field using a stratified random sampling method. Crop performance was rated, and the soils are being analyzed for physical, chemical, and biological properties. These soil properties will be correlated with crop performance to identify the most limiting factors. Based on the results, management practices will be imposed, and crop performance verified during the 2021 growing season, to determine the effectiveness of the management intervention.

Can plant extracts serve as a replacement for ionophores to improve performance in post-weaned beef cattle?

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Ionophores, classified as an antibiotic, are a common feed technology used in cattle as a growth promoter, gut modulator, and a prophylactic supplement. Regardless of their benefits, antibiotic use in the livestock industry has been challenged due to growing concerns over antibiotic resistance. In response, plant extracts have been investigated as a possible replacement for ionophores, specifically investigating the effect of plant extracts on rumen fermentation. While ionophores have been thoroughly researched and are widely used, plant extracts require further research to prove efficacy in a production setting. Therefore, the objective of this study was to evaluate the impact of a blend of plant extracts, compared to an ionophore, on in vitro fermentation and gas production in stocker cattle in the Southeast United States. The three treatments included a control (CON), the ionophore Monensin (MON), and a commercially available blend of plant extracts including capsicum, eugenol, and cinnamaldehyde (Xtract®, XTR). Each treatment was added to a corn silage and dried distillers' grains diet (75% and 25% of the diet on a dry matter basis, respectively) at the manufacture's recommended rate. Samples of each treatment/diet combination were weighed in triplicated and inoculated with rumen fluid collected from three donor steers and an anoxic media for two experiments. Experiment 1 evaluated gas production and pH at six time points: 0h, 4h, 8h, 12h, 24h, 48h. Experiment 2 measured dry matter disappearance at two time points: 24h, 48h. In experiment 1, pH was highest ($P < 0.01$) for XTR compared to CON and MON after 48h of incubation, but there were no differences in dry matter disappearance ($P = 0.22$). In experiment 2, there were, however, differences ($P < 0.01$) in gas production with both the MON and XTR showing greater gas production over 48h compared to CON. These results show that XTR improves rumen fermentation similarly to MON . Based on these findings, Xtract® shows potential as an alternative to ionophores to improve cattle productivity and efficiency.

Effects of Tannic Acid on Mixed Ruminal Microorganism Fermentation In Vitro

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Ruminant animals are unique in their total dependence on microbial fermentation to convert feeds into a usable form and are able to convert low quality feeds into high quality milk and meat. Tannins are polyphenolic compounds found in various plant species that serve to reduce consumption by herbivores. Tannins bind to dietary proteins and exhibit antimicrobial effects against bacteria. As we have sought replacements for antibiotics, tannins have been examined for their ability to alter the microbial population and increase growth in ruminant animals such as cattle. The present study investigated the impact of tannins on the in vitro mixed ruminal microorganism fermentation. Four diets were compared: no substrate, glucose, corn starch, and tall fescue. For each diet, 0.1 g (± 0.002 g) of substrate was added to an anoxic test tube and 10 mL of anoxic media, containing 33% rumen fluid (vol/vol), collected from two steers fed a forage diet. Tubes were capped with a butyl rubber stopper and sealed to ensure anaerobiosis. Four doses of tannic acid were added to each diet based on an expected daily consumption of tannins in forage. Each combination of diet and tannic acid level was performed in triplicate. Tubes were incubated at 39 °C for 24 h. Following incubation, pH values were measured and volatile fatty acid (VFA) concentrations were determined using gas chromatography. Results indicated that tannic acid reduced total VFA production in all diets, except glucose. The glucose diet was the only diet that decreased ($P < 0.05$) the ratio of acetate:propionate, which is indicative of the energetic efficiency of the ruminal fermentation. Overall, addition of tannic acid yielded beneficial results in vitro for ruminal microorganism fermentation on a glucose diet, but not diets that reflected what cattle actually eat. These results indicate that tannins cannot be used to replace antibiotics without impacting ruminant production efficiency.

Evaluation of chewing frequency in horses eating four different forage varieties.

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Colic is a generic term used to describe gastrointestinal disturbances in horses and is a prominent issue within the equine industry. Numerous variations of the condition exist, and many causes are still unknown, resulting in unproven hypotheses on management and prevention. Bermudagrass hay is one of these hypothetical causes of ileal impaction colic. There are current recommendations to not feed bermudagrass hay to decrease risk of impaction cases, despite the fact that bermudagrass is a staple and economical forage in the southeastern United States. Reasoning supporting this recommendation includes its short stemmed, finer fiber characteristics, which potentially decrease the need to chew. Mastication is a stimulus for salivary secretion which aids in the digestion process and lubricates the food bolus through the intestinal tract. A decreased chewing frequency could inhibit the proper movement of the bolus, causing blockage. The overall aim of this study is to analyze the chewing frequency in horses that are fed four varieties of hay – bermudagrass, timothy, alfalfa, and orchardgrass. To accomplish this, an automated grazing halter with a pressure sensor within the noseband (RumiWatch, Futterungstechnik, Switzerland) will be utilized to calculate chewing frequency in horses. Preliminary data is currently being collected to ensure the halter is accurate. To accomplish this, one RumiWatch halter will be placed on 5 different horses of varying size and nose circumference. Horses will be fed a single feeding of 1kg Bermudagrass, and three independent scorers equipped with manual counting devices will count the number of times the horse chews for 1-minute intervals every 10 minutes until the horse stops eating. Data collected manually will be compared to that of the halter. After validating the halter manually, a second experiment will be conducted to determine the appropriate acclimation period needed to establish consistent chewing patterns in horses after introduction of new forages. Each of three horses will individually receive 1% of body weight in hay split between AM and PM feedings while wearing the RumiWatch halter. Three hay types will be used in a Latin Square design. Data will be collected over a 5-day period and evaluated to determine consistency of chewing frequency across days. Data form these two preliminary trials will be used to develop methods to compare chewing rate of horses on four main types of hay.

Evaluating the impact of bacterial load and IgG concentration in colostrum on passive transfer in dairy calves

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Calves are born with little to no immunoglobins and are extremely susceptible to disease within the first few days of life due to a unique fetal-dam relationship in utero. The main source of immunoglobins to a newborn calf comes via colostrum, the dam's milk produced immediately after parturition. However, several variables impact colostrum quality, which ultimately impact the ability of a calf to utilize its immunoglobins and nutrient rich components to the fullest. The objective of this study was to investigate how various handling methods impact colostrum quality which ultimately impacts calf survivability and future performance. For this study samples of fed colostrum (n=39) were taken and analyzed on farm at first collection and again at time of feeding. For on farm analysis, each sample was evaluated using BRIX refractometry with a Digital-Dairy #DD3 refractometer and for bacterial counts with a Petrifilm using a 1:125 direct inoculation with 1 mL of the diluted colostrum. Further an aliquot of fed colostrum was sent for more specific bacteriology by lab analysis. Success or failure of passive transfer in a group of Holstein and Jersey calves (n=22) was determined via blood collection at 48-60 h of age. Using the DD3, blood serum was evaluated for IgG and total proteins (TP) with effective passive transfer confirmed at 8.3% and 5.2 g/dL, respectively. BRIX readings for fresh versus previously frozen colostrum were 26.3% (n=8) and 22.1% (n=12), respectively, and were not different ($P>0.05$). IgG and TP in calf serum were positively correlated ($P<0.05$). However, neither form of assessing bacterial load, Petrifilm nor lab analysis, was correlated with BRIX reading in colostrum or IgG and TP in calf serum ($P>0.05$). In total there were 29 species of bacteria isolated from fed colostrum samples (n=39). In highest abundance were Bacilli, found in 82.8% of samples, Pseudomonas found in 44.8% of samples and Coagulase (-) found in 27.6% of samples. Further work is necessary to evaluate the method of handling on bacterial species and the impact of these bacteria on immunoglobulin absorption and gut microbiome establishment. These dynamics can play pivotal roles in calf survivability, growth and long term herd performance.

Overcoming Seed Dormancy in Myrica Rubra Sieb. & Zucc.

Katherine Kellam, Horticulture Major, Department of Horticulture; Presented in 2021

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Myrica rubra (yummy berry) is a new edible landscape plant for Georgia and adjacent states. At the UGA Horticulture Farm, several potential new clones (3 females and 2 males) are being evaluated for both landscape attributes and fruit production. Yummy berry is a small, attractive evergreen tree that can be widely used in the backyard, garden, or any other landscape. However, it is hard to regenerate this plant and clonal propagation is usually done by grafting. To graft elite clones, seedling stock plants are desperately needed. Myrica rubra seeds display both physical dormancy and possible physiological dormancy. To break this dormancy and germinate the seeds, we are testing a variety of methods including soaking seeds in gibberillinic acid (GA) at 50 and 100 ppm respectively for a week. Separate batches of seeds were also soaked in 99.9% sulfuric acid for 2 and 4 hours. We are also experimenting with physically breaking the thick seed coat by drilling a small hole to aid water absorption. Finally, we soaked seeds in a water bath at 65C and 75C for 24 hours. We expect that all treated seeds will germinate in 2-4 months with 10-80% germination rate. If GA treated seeds display a higher germination rate, we will conclude that yummy berry seeds have both physical and physiological dormancy. If other treatments display higher germination, it will be clear that the thick seed coat induces physical dormancy. These results will be published in a journal article and used as teaching material for Dr. Zhang's plant propagation course. Further studies should focus on other possible causes of seed dormancy and establish protocol for Myrica rubra seed germination within one season (instead of 2 years) with a 30% or higher germination rate (instead of the current rate of 5% or lower).

Association of Pre-treatment Somatic Cell Counts with Bacteriological Cure

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Mastitis, a disease that causes inflammation of the mammary gland, is extremely costly for dairy producers. Somatic cell counts (SCC) are often used to assess the presence and severity of a mastitis infection. Reports suggest that a lower SCC corresponds to higher cure rates following antibiotic therapy. Conversely, treatment of quarters with elevated SCC is typically found to be ineffective, which increases unnecessary antibiotic usage. Thus, the objective of this study was to identify the differences in SCC prior to antibiotic treatment for infections that ultimately cured versus those that failed. Milk from cows with subclinical or clinical mastitis was collected aseptically and recorded as a Day 0, pre-treatment sample (D0). Following collection, the infected quarter was immediately enrolled on a five-day treatment of an approved intramammary antibiotic, SPECTRAMAST® LC. The D0 SCC was determined using a DeLaval Cell Counter (DCC) and the milk was cultured on Trypticase Soy Agar with 5% Sheep Blood. If bacteria were present at D0, additional milk was collected 14 (D14) and 28 (D28) days after antibiotic therapy to determine the success of treatment. To be considered cured, the samples from D14 and D28 both had to be clear of bacteria. Enrolled quarters were then retroactively labeled as “cured” or “failed to cure”. Quarters that failed to cure had an average D0 SCC of 1,396,222 cells/mL with a SCC range from 41,000 to 4,136,000 cells/mL while the quarters that cured had an average D0 SCC of 627,117 cells/mL with a range in SCC from 98,000 to 1,983,000 cells/mL ($P \leq 0.05$). Quarters that failed to cure had an initial decrease in SCC by D14, but SCC increased by D28, even past the initial D0 SCC. In contrast, quarters that cured demonstrated a successive decrease in SCC at D14 and D28. Based on this current data, it is hypothesized that an initial SCC closer to 627,117 cells/mL will cure while an initial SCC closer to 1,396,222 cells/mL will fail to cure. However, since 50.0% of the failed to cure quarters had a D0 SCC below 627,117 cells/mL, the chance of a mastitis infection curing with antibiotic therapy cannot be deduced from SCC alone. Approximately 35.3% of cured quarters had a D0 SCC above 1 million cells/mL, indicating the chance for a quarter with a D0 SCC above 627,117 cells/mL to cure. Future studies should investigate whether the efficacy of antibiotic therapy in cases of mastitis is affected by chronicity, type of pathogen, or age of the cow.

Myofibrillar Protein Degradation Patterns in Meat With Divergent Water-holding Capacities

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The objective of this study was to examine effect of longissimus dorsi myofibrillar protein degradation on meat water-holding capacity. The study was designed as a 2 × 3 factorial, with factor 1 being meat appearance (red, firm, and normal; RFN; n = 25 or red, soft, and exudative; RSE; n = 25) and the second factor being day of postmortem aging (DOA; day 2, 7, and 14). Longissimus lumborum muscle (species confidential) was collected at a commercial abattoir, assigned a water-holding capacity category, and shipped to the Muscle Biology Laboratory at the University of Georgia. Each sample was divided into 3 portions and each portion was randomly assigned a day of aging. Upon each DOA, myofibrillar proteins were extracted using an extraction solution and centrifugation. Equal amounts of protein were separated on 10% polyacrylamide gels, transferred to nitrocellulose membranes, and blotted for intact desmin and integrin, and intact and degraded troponin-T. There was no treatment × DOA interaction or treatment main effect for intact desmin ($P > 0.30$). There was a DOA effect ($P < 0.01$) for intact desmin, with day 7 and 14 possessing less intact desmin than day 2 ($P < 0.01$), but not differing ($P = 0.14$) from each other. There was no treatment effect ($P = 0.70$) for day-2 intact intergrin content. There was no treatment by DOA interactions for all forms of troponin-T ($P > 0.33$). There were significant DOA effects for all intact and degraded forms of troponin-T ($P < 0.01$). During aging for all forms, the three aging periods differed, with intact and the 36 kDa degradation products decreasing and the 34 and 30 kDa degradation products increasing ($P < 0.04$). There were no treatment effects for intact and the 36 kDa degradation product of troponin-T ($P > 0.22$); however, RSE samples tended to possess more ($P = 0.06$) 34-kD and more ($P = 0.03$) 30-kDa degraded tropnin-T. In conclusion, all proteins degraded during postmortem aging as expected. While RSE and RFN meat did not differ in intact desmin and integrin disappearance, troponin-T degradation was greater in RSE which may indicate accelerated myofibrillar protein degradation is responsible for its poor water retention.

Role of Soil Stressors in Production of Anthocyanins by Hibiscus

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Anthocyanin flavonoids have antioxidant, anti-inflammatory, and anti-viral properties and are increasingly valued in a variety of food and beverage products. Anthocyanins are secondary metabolites that plants synthesize for protection or other means but are not essential for growth. Often plants upregulate the production of secondary compounds in response to various stress conditions such as herbivory, moisture-stress, and potentially exposure to other less-ideal soil conditions. We propose that soil pH can be modified to up-regulate anthocyanin production in Hibiscus. To test this, we will grow Roselle Thai Red, a cultivar of Hibiscus, between pH 5 and 8, which extends 1 pH unit above and below the recommended growth pH. We will plant our Hibiscus in several 4" x 4" pots until they are ready to transfer and establish in 2 gal pots with pH-adjusted soil. Thai Red Hibiscus is sown in Spring and takes roughly 90 days to mature. In mid-Summer, approximately 10 days after flowering harvest can begin. We will extract the leaves, stems, and calyx of the hibiscus at harvest and analyze the Anthocyanin content via a UV-Vis method. We can then compare data found from the alteration of pH and conclude with which conditions yield the highest levels of anthocyanin production.

Evaluation of Growth Factors on Their Ability to Promote Proliferation and Reduce Apoptosis in Neural Stem Cells

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Neural stem cell (NSC) transplantation is an emerging restorative therapy that is being studied using translational animal models for the treatment of neural injuries such as traumatic brain injuries. CRISPR-Cas9 gene editing has led to the creation of green fluorescent protein (GFP)-labeled NSCs which allow for enhanced tracking of the NSCs in vivo. However, GFP-NSCs are difficult to culture in vitro after fluorescence-activated single cell sorting (FACS), and thus improved culture conditions to promote proliferation and reduce apoptosis are needed. The objective of this study was to determine the optimal growth factor or combination of factors required to enhance NSC survival and proliferation in vitro. For this study, the growth factors EGF, N2, and Laminin were added to NSC cultures using the following combinations: 1) control, 2) N2, 3) N2/EGF (N/E), 4) N2/Laminin (N/L) and 5) N2/EGF/Laminin (N/E/L). Differences in proliferative capacity of all groups were assessed via a proliferation assay at 0, 24, 48, and 72 hours. N/E/L-treated cells showed a significant ($p < 0.05$) increase in total percent increase in living cells compared to control cells at 48 hours (7.77% ± 1.33% vs 1.00% ± 0.58%, respectively), but at all other time points none of the growth factor combinations showed any significant differences. In addition, all groups were treated with puromycin and a live cell count was performed at 3 and 5 days to assess which growth factor combination reduced apoptosis. At 3 and 5 days of exposure, all of the growth factor combinations demonstrated a significantly ($p < 0.05$) lower living cell count compared to the control media except for N/E-treated cells which were not significantly different compared to control cells (1.41x106 ± 9.37x104 and 1.80x106 ± 1.63x105, respectively). Furthermore, N/E-treated cells demonstrated a 100.49% ± 71.59% increase in living cell count from day 3 to day 5 while control cells demonstrated only a 0.07% ± 35.85% increase in living cell count from day 3 to day 5 during puromycin exposure. NSCs treated with other growth factor combinations were unable to proliferate during puromycin exposure. These results suggests that the addition of N2 and EGF to NSC cultures may provide protection from stress-induced apoptosis. Additional experiments are needed to determine whether the addition of N2 and EGF reduces apoptosis of GFP-NSCs during and after FACS sorting.

Making a Career in Agriculture: A study of current agricultural education students and seeking ways of retention for a career in agriculture

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The undergraduate research conducted was developed to provide agriculturalists and stakeholders with issues and ideas of what is preventing students currently enrolled in agricultural education courses from pursuing a career in agriculture. The research consisted of conducting interviews with students, student leaders, and active farmers. Prior to starting the research, to get myself prepared for the interviews, I developed questions about students interest and what is pushing them away from pursuing that career in agriculture, along with other factors that are influencing their career choice. This undergraduate research was conducted by myself and participants were students from Locust Grove High FFA, the Georgia FFA State Officers, and current farmers. There will be observations and results that is taken from the interviews. We found that students are influenced by factors such as their agricultural educators, their parents, the media, and current stakeholders involved in the agriculture industry.

Residence and Rebranding: Does a consumer's length of residency impact their decision to buy local products and how should local branding respond?

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There are many basic factors that could compel someone to buy a locally grown product over a non-local product, such as label design, name and availability. The objective of this research was to understand the thought process of consumers as they shop and find out what role local goods played in their shopping experience so marketing strategies could be identified that would be beneficial for local brands moving forward. We also examine how much consumers value locally produced products and name brands across a variety of products. Over 4,000 consumers across the United States were sampled during the Winter 2021. The survey asked questions to help identify what people understood local goods to be and the importance of purchasing a locally grown product and name brand product. The products included fresh produce, food (non-produce), live plants for home/landscape, live plants for garden, non-food products, cut flowers, and wine. Notably, I compared the importance of local and name brands across demographics, where they live, and how long they have lived in the state they currently reside. I was interested in how length of residence in their current state impacted their views and value of local and name brand products. I organized the data collected and created a table which reveals how the length of time someone has resided in a particular state impacted their willingness to purchase a locally produced product. I was surprised to find that people who have resided in a particular state for over 20 years were less likely to say local impacted their decision to purchase. I assumed that the longer someone lived in a particular place the more attached they would be to that environment, motivating them to invest in their community by purchasing local goods. I realized those who have lived in the same place for over 20 years, most likely fall into the generation that was influenced by1970s, 1980s, and 1990s food trends. This would explain why the mid-2000s local food push did not impact them. The data displaying the willingness to purchase of those who have resided in the same area for 10 years or less was as expected. This tells me they are paying attention to local food in their stores and are willing to invest in those items. With this in mind, I can say with confidence that those who have lived in the same place for 10 years or less and were born in between 1990 and 2010 are a great target audience for local food marketing strategists to cater towards.

Comparative Genomic Analysis of the Nutritional Endosymbionts of the Larch Adelgids

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Adelgids are plant sap-feeding insects that contain various bacterial endosymbionts which help provide nutrients to their hosts by converting metabolites in their host's nutrient-deficient diet into vitamins and various essential amino acids necessary for host survival. We investigated the symbiosis of three species of larch adelgids containing the endosymbionts Profftia and Vallotia, whose preliminary genomic characteristics suggest are evolutionary young nutritional partners. The overall goal of this project is to determine and compare the genomic characteristics and degree of nutritional complementation of newly sequenced larch adelgid symbionts. Due to the lifestyle of intracellular bacterial symbionts, their genomes are streamlined to the core housekeeping genes and genes essential to the hosts' survival. Adelgids' alternation between nutrient rich and poor plant hosts is hypothesized to promote the mutational degradation of nutritional pathways and the replacement of their bacterial symbionts. We will examine these changes using bioinformatic software and techniques. This includes assembling and annotating genomes to determine the amino acid production of these symbionts. This process will help us create a comparative analysis with other bacterial assemblies and support phylogenies that provide a deeper understanding of the evolutionary history of these bacterial symbionts. We expect to see differences in amino acid production and the overall extent of genomic degradation of these organisms. The genomic information of endosymbionts reveals the intricacy of symbiosis. This project raises pertinent questions regarding the drivers of genome degradation and the evolutionary impact host ecology plays on gene loss and turnover in adelgid symbionts.

Predicting 4-H Loyalty Among Alumni: An Empirical Analysis of Objective and Subjective Measures

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While previous research has analyzed different aspects of the 4-H program, little research has been done to analyze the antecedents of 4-H program loyalty among alumni of the 4-H program. The present study investigates the objective (quantity) and subjective (quality) aspects of 4-H alumni programmatic experiences to determine which conditions result in higher levels of program loyalty. To conduct the analysis, data were collected from a sample of alumni from the Georgia 4-H program ($n = 481$). Objectively, respondents participated in an average of seven unique activities within the 4-H program and participated for an average of 9 years in the program. Subjectively, respondents strongly agreed the 4-H program was beneficial ($M = 4.54$, $SD = .55$) and they were satisfied with their program experience ($M = 4.71$, $SD = .52$). Overall respondents were also loyal to the program ($M = 4.52$, $SD = .70$). Person correlational analysis identified statistically significant relationships between total activities, total years, benefit, and satisfaction and the variable of interest, program loyalty. Regression analysis was thus warranted and undertaken to further investigate the relationship between variables. A two-step regression analysis first analyzed objective-oriented variables of interest, total activities and total years. The model accounted for 8% of program loyalty variance (R2 = .08, F[2, 336] = 14.88, p = .00), only total activities was found to be predictive of program loyalty. The second step in the model analyzed subjective-oriented variables, benefit and satisfaction, and well as the objective variables. The model accounted for 47% of program loyalty variance (R2 = .47, F[4, 334] = 75.18, p = .00), both benefit and satisfaction were found to be statistically predictive of program loyalty; however, total activities was no longer statistically related to loyalty. The results of the analysis indicate the subjective quality of programmatic experiences are much more predictive of program loyalty than are the objective quantity of programmatic experiences. These results help identify the most effective means to keep 4-H participants loyal to the program as alumni. Based on this research, an associated recommendation would be for youth-development programs, such as 4-H, to focus on maximizing the programmatic experience of participants at each potential touchpoint.

Early detection of temperature stress using chlorophyll fluorescence imaging

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Several studies have shown that cold and heat stress cause economic loss in commercial agriculture; however, using a specialized imaging system to detect the plant stress before it causes loss remains unexplored. Here we report that by using a novel plant stress detection method we were able to detect cold, but not heat stress in lettuce. The lettuce was exposed to either freezing temperatures or temperatures up to 57 degrees Celsius for different amounts of time and then imaged. The imaging system used a long-pass filter that blocks blue light but allows far-red light to reach the camera. When plants are exposed to blue light they emit a small amount of far-red light (fluoresce). Fluorescence measurements were used to detect the plant stress. The lettuce plants exposed to freezing temperatures showed increased fluorescence before visible symptoms of the stress were observable. However, the plants exposed to high temperatures did not show increased fluorescence, but exhibited visible stress symptoms. These results are important because under current practices, temperature stress can only be detected visually after negative consequences, such as wilting and plant tissue death, have already occurred. This research has shown that cold stress can be detected earlier and can be used in practice to prevent crop damage.

Re-examination of dietary fiber in tree nuts and peanuts

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Soluble and insoluble dietary fiber (SDF & IDF, respectively), the two components that comprise total dietary fiber (TDF) play important, but different, roles in human health. ANKOM Technologies has developed a novel automated system that can isolate TDF as well as its SDF and IDF fractions, allowing for quantitation of these components in food. This study aimed to re-examine TDF values for tree nuts and peanuts reported in USDA's FoodData Central, as well as to determine commonly unreported SDF and IDF levels. Raw tree nut and peanut samples were first ground and defatted with petroleum ether before being transferred to the ANKOM Technologies TDF Analyzer. The Analyzer, calibrated with standard reference materials, and running an automated AOAC 991.43 program, performed a series of enzymatic digestions and filtrations that separated SDF and IDF components from the nuts TDF content. Quantitation was achieved gravimetrically, but only after determining ash and crude protein contents of the isolated fractions via dry ashing and the Kjeldahl assay, respectively. This re-examination of dietary fiber levels in tree nuts and peanuts revealed surprising discrepancies in measured TDF values from those reported in FoodData Central. For instance, raw unblanched almonds were found to possess a higher average TDF content of 13.9 ± 1.49% compared to the 9.90% reported in FoodData Central. This re-examination also allowed for the quantitation of the SDF and IDF components; note these are not reported in FoodData Central. Raw walnuts, despite having the lowest TDF level of samples analyzed, contained the greatest amount of SDF at 2.66 ± 0.32%. This highlights the importance of quantitating both SDF and IDF, as knowing their percentages prevent any misconceptions regarding the dietary fiber profile of a food, and the potential health benefits it could bestow. Discrepancies between TDF values determined in this study and those reported in FoodData Central, as well as a lack of quantitative data on SDF and IDF contents in general, highlights the importance of this re-examination of dietary fiber contents in tree nuts and peanuts.

The Effect of Varying Iron Supplementation Levels on the Growth Performance, Blood Hemoglobin, and Packed Cell Volume of Neonatal Pigs

Abigail Roegner, Animal Health Major, Department of Poultry Science; Presented in 2021

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Neonatal piglets are born with a low iron status and sow's milk is low in iron, therefore, piglets receive iron supplementation shortly after birth. The common industry practice has been to administer 100 mg of iron, with some recent recommendations being to increase supplementation to 200 mg of iron to address the faster growth rate of today's modern pig lines. The objective of this study was to determine if the level of iron supplementation at birth affected the piglets' growth performance or blood iron status during the lactation period. Within 24 hours of birth, 72 piglets from 8 litters were weighed, paired by birth weight, and randomly allotted within each pair to receive either 100 or 200 mg of iron from iron dextran. Piglets were weighed weekly and on the day of weaning a blood sample was collected (via orbital sinus) for hemoglobin and packed cell volume analysis. Piglets receiving 100 mg of iron exhibited lower average daily gain compared to piglets receiving 200 mg of iron on both day 7 (131 g/day vs 160 g/day for 100 and 200 mg of iron respectively) and day 14 (304 g/day vs 351 g/day for 100 and 200 mg of iron respectively). On the day of weaning (approximately 21 days of age), whole blood hemoglobin had increased from 10.2 g/dl in piglets receiving 100 mg of iron to 13.1 g/dl in piglets receiving 200 mg of iron. Packed cell volume also increased from 31.7% to 36.8% in piglets receiving 100 and 200 mg of iron, respectively. While both hemoglobin values would be considered within normal ranges, the 10.2 g/dl average would be classified as marginal since values below 10 g/dl are considered mildly anemic. The increase in packed cell volume indicates that those piglets administered 200 mg of iron had a larger volume of red blood cells. These data indicate that increasing the iron supplementation at birth from 100 to 200 mg improved both the growth performance and blood iron status of neonatal piglets from modern pig lines. Improved iron status at weaning should also improve piglet performance through the nursery period. The piglets in this study are currently being fed diets with varying iron levels to determine the combined effect of iron supplementation at birth and nursery iron level on growth performance and blood iron status.

Pre-Slaughter Fasting Effects on Gastrointestinal Microbiome

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Foodborne illnesses are a concern both nationally and globally. According to the CDC, there are 9.4 million illnesses caused by foodborne pathogens and an estimated $77 million economic impact in the United States each year. The slaughter process is a critical time point when pathogens have the greatest opportunity to enter the food chain. Since cattle are a natural reservoir for Salmonella, Escherichia coli O157:H7, and other strands of E. coli, especially when fasted prior to slaughter, it is hypothesized that lairage, the 24-hour period before cattle are slaughtered upon arriving to the feedlot, is a timepoint of concern. Because feed is removed during this period, there is a decrease in the helpful gastrointestinal microbial population which then allows the harmful pathogens an opportunity to increase their abundance in the gastrointestinal tract of the animal. The purpose of this study was to determine if this time period presents an opportunity for dysbiosis to occur. To do this, we analyzed the rumen microbial populations of 17 Angus steers who were selected based on low or high feed efficiency using residual feed intake (RFI). Rumen samples were taken when cattle arrived at the abattoir and again following evisceration to compare the microbial populations. Bacterial richness (Chao 1), evenness, and Shannon diversity increased after preslaughter fasting regardless of feed efficiency group (P 0.04). The two most abundant families, Prevotellaceae and Ruminococcaceae decreased (P 0.029) during fasting, whereas the remaining minor families increased ($P < 0.001$). During fasting, Blautia and Methanosphaera increased (P 0.003) and Campylobacter and Treponema tended to increase (P 0.086). Butyrate production tended to decrease during preslaughter fasting (P 0.068). These findings support the hypothesis that fasting causes a decrease in helpful bacteria that promotes a healthy gut microbiome leading to an increased risk for pathogens to potentially enter the food chain. The data gathered from this project will be beneficial for improving food safety and promoting a positive perception of the beef industry.

Mammary Gland Hygiene in Relationship to Somatic Cell Counts and Bacteriology

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One of the most prominent concerns for dairy producers is mastitis, an inflammation of the mammary gland caused by a pathogenic infection. Intramammary infections (IMI) increase milk somatic cell counts (SCC), which are white blood cells that respond to immune challenges. The SCC, in addition to bacteria in milk, can be used as a measure of mammary health and milk quality. Assessment of mammary hygiene is conducted on dairy farms to ensure the bacterial load on and around the mammary gland remains low to reduce IMI risk. Notably, mammary hair singeing is a technique that gently removes hair from the mammary gland to maintain hygiene. By reducing the ability of manure and mud to accumulate on mammary hair, the risk of IMI is minimized. The purpose of this research was to determine if singeing mammary gland hair at the UGA Teaching Dairy, a technique not currently practiced, contributes to a reduction in SCC and IMI. Two pens of cows were enrolled with each pen having a control (no singeing, NS) and treatment (singeing, SI) group selected randomly (control, n=20 and treatment, n=15). Aseptic milk samples were collected before singeing and every two weeks following initial singeing for up to six weeks (P2, P4, P6) to determine SCC and bacteriology. No significant differences were found in SCC across time in NS vs SI cows. Conversely, when we evaluated only the infected quarters in the SI group, the SCC numerically declined (60% decrease) in the post-collections, although not significantly ($P > 0.05$), whereas infected quarters in the NS group did not change. Prevalence of infection was greater in the SI group compared to the NS group at each time point, including pre-singing, suggesting that SI cows had increased infections regardless of their singed status. Comparably, the incidence of new infections at P4 in both the SI and NS groups were similar percentages. However, there was a greater diversity of pathogens in the NS group, including more severe, atypical pathogens indicating that singeing may prevent the occurrence of more severe pathogenic infections. This research suggests that when done safely and humanely, mammary hair singeing could be an affordable technique to reduce IMI, therefore, easing financial loss, producing higher quality milk, and reducing the need for antibiotic therapy.

Calpain activity and collagen content in meat with divergent water-holding capacities

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With meat being composed of 70% water, water-holding capacity or the ability of it to bind water, influences quality and profitability. Traditionally, pale-colored meat possesses reduced water-holding capacity; however, recently normal-colored meat is displaying the same issue. The objective of this study was to determine the effect of calpain activity, a proteolytic enzyme responsible for postmortem protein degradation, and collagen solubility on normal-colored meat that displays poor water-binding ability. Longissimus dorsi muscle (species confidential) classified as red, firm, and normal (RFN, n =25) and red, firm, and exudative (RSE, n = 25) were collected from a commercial abattoir and transported to the University of Georgia. Muscles were divided into three subsections and aged for 2-, 7-, and 14-days postmortem. On each day of aging, calpain enzymes were extracted, separated on casein-polyacrylamide gels, and activated overnight. Gels were stained with Coomassie blue and calpain-2 band intensity was measured with densitometry. Soluble and insoluble collagen of the samples were extracted using common methodology and quantified using a colorimetric absorbance assay. There was no meat classification × day of aging interaction ($P > 0.15$) for calpain-2 activity. There was a day of aging main effect ($P < 0.05$) where calpain-2 activity decreased during postmortem aging. Preliminary data would indicate RSE meat tends to have less ($P < 0.15$) calpain-2 activity than RFN meat. There were no meat classification × day interactions or main effects for all collagen measurements ($P > 0.15$). In conclusion, the increased myofibrillar protein degradation pattern seen by Lambert et al. (see companion symposium abstract) may be due to increased calpain-2 activity prior to day-2 postmortem, which resulted in reduced calpain-2 activity throughout the current study.

Using Doppler ultrasonography to improve reproductive efficiency through early pregnancy diagnoses

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The most common practices to determine pregnancy in cattle are rectal palpation and transrectal ultrasonography. These methods are accurate when utilized on days 45 and 28 of gestation, respectively, and rely on the detection of an embryo or fluid in the uterus. The objective of this experiment was to investigate the use of Color Doppler Ultrasonography (CD) as a novel pregnancy diagnostic tool on day 20 following fixed-time artificial insemination. Mature postpartum cows (n=207), from three locations in Georgia, were synchronized using the 7-day CO-Synch + CIDR protocol and fixed-time artificially inseminated 60-66 hours after a prostaglandin F2α injection. Ultrasound examinations via CD were performed 20 days after insemination. A video of each cow's corpus luteum (CL) was taken, and stored for later evaluation. Area (mm2), diameter (mm), and volume (ml) of the CL were estimated using the B-mode settings. Central, peripheral, and total blood perfusion of the CL was evaluated using CD. Final area of the CL and total estimated blood perfusion were given threshold values. Cows were considered pregnant if their CL measured ≥ 25mm2 or if estimated blood perfusion was > 25%. Pregnancy diagnosis results obtained on day 20 with CD was then compared to a gold-standard ultrasound examination performed on day 30 of gestation. Pregnant cows had greater (P<.0001) CL diameter, area, and volume than that of open cows on day 20. Central, peripheral, and total CL perfusion values were also greater (P<.0001) in pregnant cows on day 20. Sensitivity, specificity, positive predicted value (PPV), negative predicted value, and accuracy values for the CD on day 20 were 100.00, 71.4, 79.6, 86.5, and 100.00, respectively. Overall, this study indicates that CD can serve as an effective tool to recognize most of the non-pregnant (71.4%) cows by day 20 of gestation. Future research is required to establish strategy to rebreed non-pregnant cows after CD.

Transformation of Organics in Soil from Anaerobic Microbial Activity

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Soils in environments which face frequent and dramatic shifts in oxygen availability are home to microbes that have the ability to utilize other elements besides oxygen in their electron transfer for carbon consumption pathways. These microbes often reduce iron, manganese, and even more exotic elements like chromium. Because they use different metabolic pathways than typical cellular respiration, their effect on the organic matter will be different. In this experiment, we will survey organic matter of Luqullio El Verde soil using a variety of analytical tools. Particle size distribution, Fourier Transform infrared spectrometry, methanol organic extraction, and aromaticity infrared analysis will be used to analyze the predominant functional groups, concentration, sorption tendencies, and aromaticity of the organic matter both before and after anaerobic reduction of the iron, and therefore consumption of carbon. The reduction of the soil will occur at a field capacity of 0.65mL water per gram of soil in an anaerobic glove box for 14 days. In addition, imaging using scanning electron microscopy and scanning tunneling electron microscopy of the soil as well as element analysis has been used. It is expected that the organic material will decrease in concentration after incubation, specifically the free organics will be primarily consumed while organics strongly associated with minerals will be significantly untouched.

COVID-19s Affect on Online Plant Sales

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COVID 19 has caused drastic impacts the economy in a variety of ways. Through reviewing consumer data, we have been able to better understand how COVID-19 has altered plant and outdoor sales in conjunction with online shopping. This information can be useful for firms selling in the products in this industry and how the go about selling them. The data collected was from a large-scale survey with a sample population of around 4,000 consumers in the U.S. Table 1 shows the online shopping habits for plant and outdoor sales as the pandemic progresses and expected shopping after. Table 1. Online shopping patterns given the pandemic   Average   Standard Deviation Before Pandemic   29%   34% During Pandemic   33%   35% After Pandemic   33%   35% Breaking it down further, table 2 shows the percentage of answers in each range of online shopping prevalence.   Table 2. Online shopping patterns given different ranges of online shopping.   0%   0-25%   26-50%   51-75%   76-100% Before Pandemic   29%   58%   12%   15%   14% During Pandemic   26%   53%   12%   17%   18% After Pandemic   28%   52%   12%   18%   18% From this data one can see how COVID-19 has increased online shopping for plant and outdoor sales slightly. The data also shows if a person did not online shop before COVID-19 they were not as likely to increase online spending. However, if someone were already used to purchasing online their online purchasing trended would continue to increase. This information is important as it shows how COVID-19 has impacted the prevalence of online shopping through the lens of the plant and outdoor sales market. Using this information firms in this industry can be early adapters by using an online format of more plant and outdoor sales.

Elucidating the genetic effects of qFL-Chr.25, a fiber length quantitative trait locus introgressed into Upland cotton

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Evolutionary and breeding bottlenecks have created a narrow genetic base of elite cotton lines, hindering long term improvement of fiber quality in upland cotton (Gossypium hirsutum L.). G. barbadense, a closely related species with superior fiber quality, has been used with some success for transferring favorable alleles into upland cotton. In a prior study, the germplasm line Sealand 883 (SL883) was shown to carry a quantitative trait locus (QTL) for fiber length (qFL-Chr.25) derived from G. barbadense parentage. The QTL was transferred to four elite cultivars (Acala SJ-4, Deltapine 50, GA 2004089 and Paymaster HS-26) representing the four major cotton-growing regions of the US cotton belt. A recent study of the near-isogenic introgression lines (NIILs) strongly suggests the qFL-Chr.25 locus confers a positive effect on fiber length. In this study, we seek to validate the genetic effect of qFL-Chr.25 and more importantly, develop a resource for transcriptomic approach to identify putative candidate genes for this QTL. During 2020 field season, SL883, background cultivars, and 21 QTL-NIILs (QTL-positive and QTL-negative) were planted in 40-foot rows at the Gibbs Farm, Tifton in a randomized complete block design (RCBD) with three replications. Mature fiber samples were sent to Cotton Incorporated for fiber quality assessment using a High Volume Instrument (HVI). The donor parent and the QTL-positive lines showed significantly longer fibers compared to their background parents and respective QTL-negative sister lines, confirming prior study on the effect of qFL-Chr.25 in increasing fiber length. We saw significant mean differences between QTL-positive and QTL-negative lines (range: 1.1-2.78 mm) in each background, corresponding to 4-10% increase in fiber lengths over the respective parents. QTL-positive lines of Deltapine 50 and Paymaster HS -26 showed highest mean differences (~2.7 mm) compared to QTL-negative lines. The significance of these numbers can be gleaned from an estimate that in over 40 years of scientific cotton breeding in the United States, fiber length increased by only 2.1 mm (7.9%). The utilization of foreign alleles from closely related species by way of QTL introgression, such as the qFL-Chr.25 allele, has a potential to make significant impacts on the cotton industry in relatively few years if deployed in commercial cultivars.

Towards identifying genes underlying qFL-Chr.25, a fiber length quantitative trait locus introgressed into Upland cotton

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Limited genetic diversity within the elite cotton germplasm base impelled cotton breeding programs to explore gene introgression from G. barbadense to improve fiber quality. In prior studies, we introgressed a QTL for fiber length qFL-Chr.25 from G. barbadense and validated the genetic effect of the QTL in four genetic backgrounds [GA 2004089 (GA089), Acala SJ4, Paymaster HS-26 (PM26), and Deltapine 50 (DP50)] cultivar genetic backgrounds representing the four major cotton growing regions within the United States. The positive effect of qFL-Chr.25 has been consistent across years and genetic backgrounds. In the current study, our objective was to utilize a transcriptomic approach to detect putative candidate genes in the qFL-Chr.25 QTL region, which could lead us to identify the causal gene. Near-isogenic introgression lines (NIILs) in PM26 and DP50 cultivar backgrounds were selected for RNA sequencing because the highest mean differences in fiber lengths were observed between their QTL-positive and QTL-negative selections. Fiber samples were collected at 7, 10, 15, and 21 days post anthesis (DPA). RNA was extracted from 108 samples (9 genotypes, three biological replications, and four different DPAs), representing 36 NIILs each in PM26 and DP50 cultivar backgrounds, 12 parental lines for both PM26 and DP50, and 12 Sealand 883, the QTL donor. Paired-end sequencing was performed using Illumina platform (Novogene services) to generate 2.3 billion pair-end reads, 96% of which mapped to the G. hirsutum genome. In both genetic backgrounds, we consistently observed significant down-regulation of two different genes (Gohir.D06G004300 and Gohir.D06G008300) in the QTL region during early fiber elongation stages (7 and 10 DPA) in lines carrying G. barbadense introgressions. Gohir.D06G004300, a bifunctional enzyme involved in flavonoid metabolism and Gohir.D06G008300, an uncharacterized membrane protein, have not been associated with fiber development in prior studies. We conclude that these genes represent the best candidates for conditioning increased fiber length in lines carrying qFL-Chr.25. This work is paving the way for future research on functional genetic studies involving fiber development in Gossypium spp.

Investigating interactions between fruit growth and calcium distribution during development of blossom-end rot in tomatoes

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Tomato is ranked first in the United States in terms of the value of utilized production. However, it is susceptible to physiological disorders such as blossom-end rot (BER). A symptom of BER is rotting at the distal end of the fruit. Generally, this disorder appears during the early fruit growth phase, two to three weeks after anthesis. This disorder is thought to be caused by interactions between calcium and water supply, fruit growth rate, and genetics. The objective of this study is to examine fruit growth and calcium distribution in two accessions of tomatoes: one resistant to BER and another known to be susceptible under two calcium treatments. Both accessions were grown together in the same greenhouse using two separate hydroponic systems. One system supplied 30 ppm calcium, and the other supplied 180 ppm calcium with three replications of both accessions. Fully open flowers were tagged and fruit were harvested after 3 weeks. Fruit diameter and weight measurements were recorded. Calcium is translocated to the fruit mainly via the xylem. It is hypothesized that BER could be caused by poor vascular connectivity between the proximal and distal portions of the fruit. To test these hypotheses, total fruit calcium and apoplastic calcium was measured in the proximal and distal pericarp tissue. To measure total fruit calcium, fruit samples were dried in an oven set at 65 °C for three days. Apoplastic calcium was measured by using fruit discs to extract the apoplastic solution. The dried fruit samples and the extracted apoplastic solution was sent to the Agricultural and Environmental Services Laboratories, UGA, Athens for calcium analysis. Further, calcium also plays an important role in strengthening cell walls and membranes. It has been hypothesized that weakened cell walls and plasma membranes contribute to the formation of BER. Weaker membranes in the susceptible variety and in the plants receiving less calcium would support the idea of calcium weakening cell membranes. The plasma membrane strength was tested by measuring electrolyte leakage. Differences are expected between the susceptible and resistant varieties as well as the 180 ppm and 30 ppm plants. It is hoped that the data collected will help to identify physiological differences between the two accessions that could explain the difference between resistance and susceptibility. In future this information may lead to generating information that may help minimize blossom-end rot in tomatoes.

Domestic Violence, the Workforce, and Women: An Analysis on the Relationship between Employment and Intimate Partner Violence in Ten Countries

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Women's integration into the workforce is critical for narrowing the gap of gender inequality. The rapid growth of the garment industry in the 1950s increased women's employment in the sector. While access to the labor market improves the lives of women in terms of delayed marriage and childbirth, evidence for the causal effects of employment on Intimate Partner Violence (IPV) are mixed. This research aims to examine the effects of increased female workforce participation on IPV in ten countries: Bangladesh, Cambodia, Egypt, Pakistan, Philippines, South Africa, Turkey, Colombia, Indonesia, and the Dominican Republic. In 2005, the Agreement on Textiles and Clothing (ATC) ended, removing preferential trade quotas for developing countries. In some countries, this policy liberalization allowed women to enter the garment industry at higher rates due to increased production capabilities. We use the ATC as an exogenous shock that impacts the number of garment factories to estimate the causal effects of female workforce participation on IPV. We sourced national data on female employment in the textile sector in each respective country to gauge workforce participation. Data from the Demographic and Health Survey for the years 1995-2015 is used to identify the incidence of IPV for each country. We expect that as female employment increases, IPV will initially increase, but over time, the increased empowerment caused by employment will reduce the incidence of IPV. With the context that the World Health Organization estimates that one-third of women worldwide experience IPV, understanding the effects of employment is crucial to its mitigation.

There's a fire in my ants!: Examining effects of Solenopsis invicta (Buren) on the broader insect community on organic farms

Grace Won , Biological Science Major, Department of Poultry Science; Presented in 2021

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Red imported fire ants (Solenopsis invicta) are invasive predators of both herbivorous and predaceous arthropods. Overwhelming fire ant activity disrupts native insect communities and reduces overall species richness and evenness. Although negative ecological and economic consequences of fire ants are well documented, fire ants have the potential to be beneficial in agroecosystems by consuming pests and other harmful arthropods. Literature searches have revealed that there is a lack of research examining the use of fire ants in pest management in organic farming in the United States. We explored the balance of benefits of natural pest control and damage inflicted by fire ants, to native insects on organic-practicing farms, by examining correlations between fire ant abundance and the diversity of herbivores and predators. We hypothesized that high fire ant activity would associate positively with diversity and abundance of native predators, while also having negative effects on crop pests by reducing diversity and abundance of herbivores. We tested these patterns on tomato crops (Solanum lycopersicum) using pitfall traps across 18 organic farms in the Southeastern United States. Contrary to our expectations, predator and herbivore diversity did not significantly change with increasing fire ant abundance at each site. Neither tiger beetle (predator) nor cricket (herbivore) abundance significantly changed with increasing fire ant abundance. Even though fire ants surprisingly did not suppress predator and herbivore populations in our study, our findings indicate that fire ants may contribute in more nuanced ways to the composition of arthropods on agroecosystems. Further studies should examine possible effects of intraguild predation – behavior of predators that consume other predators – by fire ants on native insect communities in order to delve deeper into these complex predator-prey dynamics. This could clarify the utility of fire ants as a biological control agent and alternative method to conventional pesticides.

Effects of Nicotinamide Riboside on Avian Muscle Development and Growth

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The objective of this study was to determine the effect of in ovo feeding of a low dose of nicotinamide riboside (NR) and feeding location on the muscle development of a fast-growing broiler strain. Seven-hundred and twenty fertilized Cobb 700 broiler eggs were weighed, stratified by weight, and within each strata randomly assigned 1 of 4 treatments within a 2 x 2 factorial design. Factor 1 was NR dose (0.0 or 2.5 mM of NR mixed in 0.9% sterile saline). Factor 2 consisted of injection location (albumen or yolk sac). At day 10 of incubation, treatments were administered. Eggs were incubated at a temperature of 37 ± 3ºC and a relative humidity of 40 ± 2% through the first 18 days of incubation, after which humidity was increased to 60 ± 2% until hatch. Immediately after hatching, chicks were euthanized by prolonged exposure to CO_2 gas followed by decapitation. Pectoralis major muscle (PMM) morphometrics were collected, and the muscle was embedded and frozen in tissue freezing medium. Ten micrometer cryosections were immunohistochemically stained, photomicrographs were collected, and muscle fiber cross-sectional area (CSA) and density were determined on a minimum of 1,000 fibers. There were NR × location interactions for PMM weight and width (<0.01), while there were no interactions for PMM length and depth ($P > 0.42$). When NR was injected into the albumen, there was no differences in PMM weight and width ($P > 0.14$); however, when NR was injected into the yolk sac, PMM weight and width increased (<0.01). There tended to be a NR × location interaction ($P = 0.07$) for PMM fiber CSA, which resulted in a NR × location interaction ($P = 0.04$) for PMM fiber density. When NR was injected into the albumen, there was no differences in PMM fiber CSA and density ($P > 0.75$); however, when NR was injected into the yolk sac, PMM fiber CSA decreased and density increased (<0.02). In conclusion, NR positively affected PMM development and growth when injected only into the yolk sac. The increased PMM weight and width was due to an increase in the density of smaller muscle fibers.

Maximizing the Extraction Efficiency of Cannabinoids from Hemp

Ansley Almond, Applied Biotechnology Major, Department of Entomology; Presented in 2020

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As commercial hemp growth is becoming more prevalent in the United States, the demand for sample testing is expected to increase. Hemp can be used for textiles, bioplastics, biofuel, cosmetics, and many more products. However, growing hemp typically comes with reluctance because of its cost and its frequent need for testing to ensure its legality. As opposed to cannabis, hemp is defined as having a THC concentration that doesn't exceed 0.3%; anything higher and the crop becomes illegal, resulting in farmers losing their investment or even facing prosecution. As of now, there is no official standard for hemp extraction; companies and researchers use a variety of extraction methods. It is pertinent that a standard is established in order to manage costs for both farmers and extension agencies, while also providing results in a timely manner. This is especially important towards the end of the growing season, to avoid the crop exceeding 0.3% THC and allow farmers to harvest at an ideal time. To establish a standard, our experiment compares three commonly used extraction solutions: methanol, ethanol, and acetonitrile. We selected three strains of hemp that varied in CBD and THC concentration (low, medium, and high) and produced replicates of the experiment to observe which solution is most effective at extracting the hemp oil. It is important to test extraction at varying concentrations to simulate various time points of the growing season; we want our extraction to be as successful with low concentrations as is with higher concentrations. We used a simple extraction method involving shaking ground hemp in the designated solution for 30 minutes, then centrifuging, and filtering. This filtration process is done twice to ensure we extract as much oil as possible, although most of the oil is fully extracted after one filtration. To measure the concentrations, we ran a 1:10 acetonitrile dilution of our extracted solution through High Performance Liquid Chromatography (HPLC) to observe the peaks of our cannabinoids. Although our first set of data had some errors and inconsistencies, on average, there seems to be a trend towards better, more consistent recovery values with methanol. This is valuable information for extension agencies, researchers, and product developers because they would be able to limit costs to one efficient solution and achieve consistent and reproducible results.

In laying hens suffering from heat stress, replacing dietary inorganic selenium with organic selenium improves egg production (Project not presented at Symposium)

August Anderson, My major is not within CAES Major, ; Presented in 2020

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In many parts of the world including the Southern United States during the summer months, laying hens are exposed to high ambient temperatures which causes heat stress which results in decreased egg production. Selenium is an essential nutrient that is typically added to poultry diets using inorganic sources such as sodium selenite. However, recent research suggests that using organic sources of selenium in diets may enhance selenium absorption and retention in body tissues. The role of selenium in tissues has largely been attributed to its presence in selenoproteins which contain the amino acid selenocysteine. Selenoproteins functions include antioxidant defense, thyroid hormone metabolism and immune responses. A major physiological detrimental component of heat stress is a significant increase in oxidative stress which compromises animal production. Therefore, the objective of this experiment was to determine if laying hens undergoing heat stress and fed diets containing organic selenium would produce more eggs than heat-stressed hens fed a diet containing inorganic selenium. HyLine WD-36 laying hens were fed a layer diet containing equal levels of selenium derived from either sodium selenite (inorganic source) or hydroxy–selenomethionine (organic source) from 41 to 71 weeks of age. Each dietary treatment was provided to 120 cages per treatment with each cage containing two hens. The ambient hen house temperature range throughout the experiment was 82 to 94 degrees Fahrenheit. Hen body weights and feed consumption were not different throughout the experiment between the two dietary treatments. Marketable egg production was significantly greater (5 eggs per bird) for the hens fed the organic selenium source relative to those fed the inorganic selenium source. Egg weight and specific gravity were not different in the eggs produced from the hens fed the different selenium sources. The results indicate that feeding hydroxy-selenomethionine can alleviate the detrimental effects of heat stress on laying hens with further research needed to determine if this is due to a reduction in oxidative stress.

How detrimental is temperature abuse to the quality of shredded red cabbage?

Nicole Banos, Food Science Major, Department of Food Science and Technology; Presented in 2020

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The anthocyanin content (AC) in red cabbage is responsible for its appealing color, which however, is highly dependent on pH as well as the stability of these unique pigments. Moreover, as anthocyanins condense, polymers form which can be indicated by measuring polymeric color in addition to AC. Red cabbage also contains polyphony oxides (POP); an enzyme that becomes active when tissue is ruptured to bring it in contact with oxygen and its substrates, which leads to browning. This is particularly relevant for shredded and chopped cabbage products, as their shelf life can be reduced due to PPO-mediated browning. The aim of our study was to assess how temperature abuse affects storage stability of shredded cabbage over a 7-day period. My contribution to this objective was the analysis of AC, POP activity, browning index and polymeric color of temperature abused red cabbage in contrast to red cabbage kept at refrigerated conditions, mimicking storage conditions during transportation, retail display and home storage. AC was measured by recording absorbency at wavelengths of 520 Nam (wavelength for maximum absorbency) and 700 Nam (which allows for haze correction) at pH 1 and pH 4.5. At pH 1, they are predominantly present in a highly colored, charged form, whereas at pH 4.5, the colorless form prevails. Using both pH values allows for background correction due to the presence of polymers or other compounds. POP activity was determined by measuring oxidation of the phenolic compound catchall over a period of 60 seconds in 15 second intervals on a spectrophotometer. Browning index and polymeric color were determined using absorbencies from a metabisulfite bleached solution in comparison to extract diluted with water. This is done to correct for non-anthocyanin pigments that are resistant to metabisulfite-mediated bleached. Results show that as storage time increased, browning index and polymeric color increased. The highest increase of POP activity occurred between day 0 and day 1 highlighting that processing steps, such as cutting and slicing, may have a profound effect on storage stability due to inducing enzymatic reactions. Surprisingly, temperature abused samples showed minor differences to the control samples, but both samples had day-to-day variability that was frequently larger than the difference between the cabbage samples. These results will form the basis for further method development, to be used in upcoming storage studies.

Engineering an Inherent Resistance to AFB in Plants (Project not presented at Symposium)

Arjun Bhatt, Applied Biotechnology Major, Department of Entomology; Presented in 2020

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Aflatoxins are highly toxic secondary metabolites produced by a number of fungal species in the Aspergillus genus. Of the twenty known aflatoxins, aflatoxin B1 (AFB) is considered to be the most toxic as it was recently categorized as a Group I carcinogen by the International Agency for Research on Cancer. In Georgia, AFB contamination in peanut plants is a major public health issue that is responsible for health complications such as hepatotoxicity and immunotoxicity. As such, an inducible expression system that can efficiently isolate aflatoxin affected plant was engineered using the Gal/USA system and single-chain variable fragments (SFC's). The Gal/USA system consists of the Gal transcriptional factor (from Saccharomyces cerevisiae) and an upstream activating sequence (USA) that enhances a minimal promoter for a gene of interest. The binding and activating domains of the Gal transcriptional factor were each fused to a unique SFC that is specific to AFB. Upon exposure to AFB, each SFC will bind to AFB and allow for the Gal transcriptional factor to be fully activated, which in turn will lead to activation of the USA and subsequent expression of a downstream gene. The primary gene of interest was BSI, an apoptotic initiator that causes cell death in plants. BSI, as opposed to GAP, confers a greater advantage to this system because the response is easily measured and does not require any additional equipment. All in all, the Gal/USA system combined with SFC's is a novel idea in the field of plant pathology and holds great potential to enhance peanut production within Georgia.

Perennial Regress Germination Response to Nitrogen-Fixing Bacteria (Project not presented at Symposium)

Connor Bolton, Turfgrass Management Major, Department of Crop and Soil Science; Presented in 2020

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Research was conducted in the greenhouse at the Athens Turf grass Research and Education Center during the spring of 2020 to evaluate the effect of nitrogen-fixing bacteria on the establishment of perennial ryegrass (Lolium perenne L.). The trial was arranged in a 3 x 4 factorial design (5 replications) with 3 perennial ryegrass seeding rates (98, 196, and 294 kg ha-1) and 4 bacteria (Klebsiella varicola) inoculation rates (0, 2.5, 5, and 7.5 L ha-1). Ryegrass was seeded into 1 L pots containing a steamed 2:1 mixture of Cecil sandy clay loam and Wakulla sand. Two pots were established per treatment per trial rep in order to conduct a time-lapse destructive harvest. Therefore, two pots represented one treatment within each trial replication. Bacteria (K. varicola; Pivot Bio PROVEN) was applied with a syringe over the surface of each pot following seeding. Greenhouse temperatures were maintained at 29/25 C (day/night) with average midday (1200 and 1300 hr) solar radiation ranging from 636 to 754 µmol m-2 s-1. Irrigation (2.5 cm water wk-1) was supplied by hand immediately following seeding and treatment application. Approximately 2.5 to 3.7 cm of water was applied weekly. One pot from each treatment within each rep was destructively harvested 3 and 5 weeks after seeding (WAS). Above-ground and below-ground tissue was separated, washed, dried, and weighed to determine root and shoot biomass (g). At 3 WAS, shoot and root biomass increased as seeding rate increased. However, minimal to no differences in root and shoot biomass were observed in response to inoculation treatments. At 5 WAS, inoculated ryegrass plants began to exhibit chlorosis, leaf tip necrosis, and stunting. Inoculated ryegrass plants at the highest seeding rate (294 kg ha-1) exhibited root weight of 1.6 to 1.8 g, regardless of bacteria treatment, while the non-treated check exhibited higher root weights (2.0 g). A similar trend was observed in shoot weight. However, ryegrass plants inoculated with the highest rate of bacteria (7.5 L ha-1) exhibited similar shoot weights as the non-treated check (1.6 g). Previous research examining the effect of this bacteria strain on bermudagrass establishment yielded a significant increase in root and shoot biomass compared to the non-treated check. Preliminary results from this research suggest there may be antagonism between the bacteria inoculation and endophytes present within ryegrass.

Process validation for the reduction of Escherichia coli during the curing and drying of biltong, a South African style dried meat

Savannah Brannen, Animal Health Major, Department of Animal and Dairy Science; Presented in 2020

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The objective of this research was to validate a process for the reduction of Escherichia coli (E. coli) during the manufacture of Biltong, a South African style dried meat product while adhering to traditional, non-thermal techniques. Medium (0.80-0.83 water activity) and dry Biltong (water activity £ 0.72) are considered ready-to-eat products. Ready-to-eat beef products should achieve a 5-log reduction for E. coli O157:H7 and other non-O157 Shiga-toxin strains (STEC). Six beef eye of round subprimals were sliced 2.5-cm thick and randomly assigned to one of 3 replications. Each slice was inoculated (ca. 9.34 log CFU/ml) with a 5-strain cocktail (ATCC BAA 1427-1431) of rifampicin resistant surrogate E. coli and sampled for microbial analysis. Slices were then individually seasoned in poly vacuum bags. After seasoning, the bags were placed in storage (2±1°C) to cure for 48 hr. DI-H2O (1.5 times w/w) was added to the bag and the sample was massaged to rinse remaining cure from the exterior of the sample (2x). Post-rinse, samples were placed in clean poly vacuum bags with a brine solution for 2.5 hr. Samples were collected from Slice 1 for each rep post-salt, rinse, and brine for microbial analysis. Post-brine, slices (2-5) were placed in a curing cabinet set to 18.33±4°C and 50±7% relative humidity. After day 14 (Slices 2 & 3), 21 (Slices 4 & 5), and 27 (Slices 2 & 3) slices were sampled (12.5-cm2) for microbial analysis. At each microbial sampling point (except post-salting) the slices were also sampled for surface and whole slice pH and Aw. Samples were aseptically removed to a depth ca. 4 mm and stomached for 2 min with 90 ml 0.1% buffered peptone with rifampicin. Samples were then serially diluted and plated on APC petrifilm and incubated for 48±2 hr at 37±1°C. Counts were log transformed and data were analyzed using JMP v.14 (SAS Inst.) with time as the fixed effect and slice within replicate as the random term. Means were separated (Tukey HSD) and differences were considered significant at £0.05. Samples from d 14, 21, and 27 were all similar (P >0.05) to each other and achieved greater than 5-log reductions from their inoculation levels at 5.90±0.87, 6.21±0.81, and 5.63±0.49 log CFU/cm2, respectively. This study shows it is possible to achieve a 5-log reduction for E. coli in whole muscle dried products without thermal processing. This work should be followed by studies utilizing pathogenic E. coli O157:H7 and non-O157 STEC for further validation.

How do soil amendments affect caterpillar populations on tomato plants? (Project not presented at Symposium)

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Caterpillars, specifically hornworms, armyworms, and cabbage loopers are insect herbivores that cause significant damage to farm crops. Caterpillar populations are shaped by plant nutritive quality and defensive chemistry. However, we lack an understanding of how soil management practices may enhance herbivore suppression by altering soil microbial communities and nutrient availability. Therefore, the overarching goal of my research was to determine how soil amendments can be used to increase plant resistance to caterpillar populations by altering the rhizosphere microbiome and nutrients available to plants. To address this objective, we performed a field experiment in Summer 2019 with tomato hybrid and heirloom varieties (Mountain Magic, Defiant PhR, Eva Purple Ball, Cherokee Purple). We surveyed herbivore abundances over the season on plants of each variety fertilized with different amendments (fish meal, worm castings, chicken litter, a mix of all, or nothing [control]). I hypothesized that caterpillar populations would be most abundant on hybrid varieties and least interested in plants amended with nothing. Overall, cumulative caterpillar abundances were highest on Cherokee Purple plants and on plants amended with any fertilizer compared to unfertilized controls. However, the abundances of individual species of caterpillars varied among treatments. Both hornworm (Manduca sexta) caterpillars and armyworms (Spodoptera spp.) reached their greatest abundances on plants of the Cherokee Purple variety. However, hornworm caterpillars reached their greatest abundances on plants amended with chicken litter while armyworms reached their greatest abundances on plants amended with fish meal or a mix of all fertilizers. Additionally, cabbage loopers (Trichopulsia ni) reached their greatest abundance on Eva Purple Ball varieties amended with fish meal. They were abundant on all plants amended with a mix of all fertilizers as well. Our results indicated that M. sexta laid more eggs on Cherokee Purple and Eva Purple Ball varieties, but oviposition was unaffected by fertilization. However, M. sexta abundances were greater on Cherokee Purple varieties amended chicken litter or mixed fertilizers. From this data, we can conclude that Cherokee Purple and Eva Purple Ball tomato plants have certain qualities that make them attractive to caterpillar populations. We can propose amendments serve as a mechanism for plant nutritive enhancement with heirloom tomato varieties.

CRISPR-Cas9 Mediated Insertion of Green Florescent Protein into a Genomic Safe Harbor Site of Human Induced Pluripotent-Derived Neural Stem Cells (Project not presented at Symposium)

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Neural stem cells (NSCs) have garnered significant interest as a potential cell replacement therapy for lost and damaged neural cell types following neural injury. However, differentiation and migration of cerebrally transplanted iNSCs is not well characterized due to unreliable in vivo cell-tracking methods. Insertion of a green fluorescent protein (GFP) into iNSCs may be a more reliable approach to track iNSCs post-transplant. Insertion of GFP using a CRISPR-Cas9 system targeted for the adeno-associated viral integration site-1 (AAVS1) genomic safe harbor site (GSH) will likely reduce GFP silencing during differentiation. Therefore, the objective of this study was to determine if CRISPR-Cas9 mediated GFP-Puro cassette insertion into the AAVS1 GSH results in stable GFP expression in iNSCs without significantly impacting cell proliferation. Lipid-mediated transfection of iNSCs was performed using different amounts of Lipofectamine reagent and DNA in order to determine the optimal ratio. A puromycin kill curve was created to determine the concentration of puromycin needed to select for GFP+ cells after transfection. Lastly, to test if gene editing interferes with iNSC proliferation rates, unedited iNSCs and GFP+ iNSCs underwent a cell proliferation assay via trypan blue-based automated cell counting every 12 hours for 72 hours. Comparisons of ratios of Lipofectamine to DNA revealed that using Lipofectamine 2000 reagent at 5uL/μg DNA resulted in significantly ($p<0.05$) higher GFP efficiency than using 3.5uL/μg DNA (11.67±1.37 vs 6 ±1.94 %, respectively). However, using Lipofectamine 3000 reagent at 5uL/μg DNA produced significantly ($p<0.05$) lower cell death as when using Lipofectamine 2000 reagent (12±2 vs 26±2.5 apoptotic cells/mm^2, respectively). A puromycin kill curve was created using concentrations 0-0.3 ug/mL on GFP- iNSCs. From this assay it was determined that 0.12±0.01 μg/mL is the optimal concentration needed to kill 50% of GFP- iNSCs in 10 days, and this concentration will be used for future GFP+ cell selection. Proliferation data on GFP- iNSCs revealed the cells double every 32.43±6.72 hours. We expect that GFP+ iNSCs will have no significant difference in doubling time as compared to GFP- iNSCs. This data supports that the generation of GFP+ iNSCs using a CRISPR-Cas9 system is reliable and efficient. Further experiments are being performed to optimize GFP+ cell selection and to verify GFP expression after prolonged expansion and differentiation.

Analyzing the Protein Profile in Relation to Functional Characteristics of Intermediate Wheatgrass Flour (Project not presented at Symposium)

Sabrina Buck, Food Science Major, Department of Food Science and Technology; Presented in 2020

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The subject of this research was intermediate wheatgrass (IWG) and its potential uses in food products. IWG is a perennial cereal grain that poses environmental benefits such as reduced soil erosion and nitrate leaching. The main challenge to using IWG in food products is that its functional characteristics are different than that of traditionally used cereal grains. IWG is lower in a protein type called glutenins, which account for the elasticity of bread. The purpose of this research was to analyze the protein profile of IWG flour compared to commercial wheat flour and to evaluate how it relates to baking quality. To analyze the protein profiles, an SDS-PAGE gel was run. SDS-PAGE gels separate proteins based on their size, with lower molecular weight proteins traveling further down the gel and higher molecular weight (HMW) proteins forming bands closer to the top of the gel. The flour samples were sequentially extracted using three buffer solutions: A) phosphate buffer containing sodium chloride; B) the same buffer supplemented with urea; C) buffer B that additionally contained dithiothreitol (DTT). DTT can break disulfide bonds, and urea promotes protein unfolding due to disruption of hydrogen bonds and also some hydrophobic interactions. These buffer systems are able to solubilize different types of proteins. The results revealed similarities between wheat and IWG in the protein profile when using solvent A. However, IWG proteins solubilized using solvents B and C were in stark contrast to wheat. Notably, IWG contained fewer HMW proteins, which were almost completely solubilized in the presence of urea, whereas several wheat proteins required addition of DTT. This indicates that proteins in these two cereals exhibit different dominant intermolecular interactions, which may influence baking quality. Additionally, recipe development for IWG bread was started. Additives called dough conditioners, such as ascorbic acid, can be added to breads to enhance gluten network development. The limitation for developing this bread recipe was that IWG is not yet commercially available and there was not enough flour to bake loaves of bread with. Instead, wheat flour was used as a model system and the methods to enhance the gluten network development of IWG flour were practiced using wheat flour. Breads were scanned and the bread crumb structure compared via images analysis. Future work will assess effect of dough conditioners on crumb structure.

Does Septic System Density Impact Nutrient Loading in Water Bodies in Metro Water District, GA?

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According to the 2018 Integrated 305b/303d Report on Water Quality in Georgia, impairment of 29 miles of rivers and 7245 acres of lakes and reservoirs is attributed to nutrients and chlorophyll-a respectively. Chlorophyll-a is also typically a result of excess nutrients in water bodies. These assessed waterways may have many factors leading to the nutrient impairment, but Total Maximum Daily Load Documents (TMDLs) provided by the Environmental Protection Agency (EPA) for specific areas and waterways suggest that failing septic tanks are also major cause of the impairment of waterways. Septic tanks are common in urban and rural areas. The EPA describes septic tanks as, "a buried, watertight container typically made of concrete, fiberglass, or polyethylene. It holds the wastewater long enough to allow solids to settle out (forming sludge) and oil and grease to float to the surface (as scum)." Since septic tanks are decentralized sewer systems, they are often found in rural and other non-sewered, sparsely populated areas. A leaking or failing septic tank can act as a source of excess nutrients (nitrogen and phosphorus) to adjoining water bodies which could potentially lead to undesirable effects like eutrophication. The EPA also describes how excess nutrients can cause algal blooms. These algal blooms can cause waterways to have severely reduced oxygen levels that occur as a result of the decomposition process of the algae. This process requires oxygen and creates an effective dead zone in the waterway for other aquatic life. We hypothesize that higher volumes of septic tanks will likely have a higher chance of a nearby waterway being impaired. To research this possible correlation, I plan to use GIS programs to 1) identify the water bodies listed for nutrient impairment in the Metro Water District and 2) map out known septic tank systems to evaluate if there is a correlation between impaired waters and septic system density. I expect that the results will help to locate areas with high risks of eutrophication because of the number of septic tanks and give a better understanding of common areas with high volumes of septic tanks.

Consumer Views on Use and Legality of Hemp Based Products

Justin Campbell, Agribusiness Major, Department of Agricultural and Applied Economics; Presented in 2020

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As hemp products gain traction and increase in availability and use, there is a need to understand consumer sentiment toward hemp products. Currently, hemp production is highly regulated; however, hemp-based products are less regulated. This paper examines consumer views on regulations as well as Cannabidiol (CBD) oil use and perceived effectiveness as a medicinal treatment. We utilize data from a 2019 online survey of residents throughout the Southeastern U.S. Nine Southeastern U.S. states were surveyed with between 200-250 respondents from each of the following states, Alabama, Florida, Kentucky, Louisiana, Mississippi, North Carolina, South Carolina, and Tennessee and approximately 450 respondents from Georgia. We find that regardless if the product is food based, approximately 80% of people believe hemp products should be legal, with around half believing that there should be some type of restriction on products. With respect to CBD oil, a third of respondents have used or have a friend/family member that has used CBD oil. Of survey respondents, there is a strong perception that it can help with certain medical conditions.

The Effects Dnmt1 Knockdown on the Reproductive Ability of Male O. fasciatus

Katelyn Cavender, My major is not within CAES Major, ; Presented in 2020

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DNA methylation has been recognized as an important chromatin modification. However, its role in insects is unclear. Variation in DNA methylation levels and the maintenance methyltransferase, DNMT1, across the insect taxa suggest that there is much unknown about DMNT1 function. Dr. Moore's laboratory has established a clear role for DNMT1 in germ cell development in females, but studies from other labs suggest that Dnmt1 has no impact on male fertility. However, preliminary data in our lab indicated that knockdown in adult males may have resulted in reduced fertility as males mate with multiple females, perhaps due to an inability to replenish sperm stores. The hypothesis that DNMT1 has a specific role in spermatogenesis was tested by comparing testis size and structure, and male fertility following multiple mating opportunities between ds-Dnmt1 knockdown and control males. Males were injected with ds-Dnmt1 RNA or a control buffer at sexual maturity. They were mated with a virgin female each week for three weeks. Male fertility was assessed by examining the last clutch that contained fertilized eggs from the third and final female to mate with the male. At the end of mating trials, the testes were dissected, whole testis size was measured, and individual testis tubules' structure was assessed using markers for nuclear structure and division. The results showed that ds-Dnmt1 treated males have smaller testes, disrupted testis tubule structure, and fertilized fewer eggs than control males. Thus, the role of Dnmt1 in maintaining germ cell integrity is conserved between males and females.

Does body condition influence growth rates of ovarian follicles in laying hens? (Project not presented at Symposium)

Amanda Chan, Biological Science Major, Department of Poultry Science; Presented in 2020

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The sizes of yolks in commercial eggs are determined by the diameter that the ovarian follicle reaches before ovulation, because egg yolks are ovulated eggs that have been covered with albumen and a shell. While we know quite a bit about what dietary factors can influence the final sizes of egg yolks, we still do not know enough about how fast those follicles grow, and what factors influence those growth rates. A recent study in Japanese quail showed that if hens have high body condition indices, their ovarian follicles grow slower. The authors suggested that if hens get too overweight, the process of follicle growth could be detrimentally altered. We hypothesize that laying hens would also show a similar relationship, where hens that have a higher level of body fat would grow ovarian follicles more slowly. To test this, we collected 10 eggs from hens that were still young and had not yet reached sexual maturity and eggs from sexually mature hens over a period of 4 days. After the eggs were frozen in a -80°C freezer, we cracked them and obtained the yolks. We then placed the yolks into jars filled with 4% formalin as an aqueous fixative and placed the jars into a hot water bath set to 60-70°C for 24 hours. Then we used potassium dichromate solution to stain the yolks in the hot water bath set to 60-70°C for 24 hours. The potassium dichromate solution made the alternating light and dark gray-green or brown rings apparent. In yolks in which the rings were distinct, a pair of one light and one dark ring marked each 24-hour period of yolk deposition. After the yolks have been in the potassium dichromate solution for 24 hours, we took them out and cut the yolks in half to scan. With the time constraints, we were only able to stain and scan the 10 eggs from the immature hens and 20 of the eggs from mature hens. We compared the number of growth rings in egg yolks (i.e. the number of days it took them to grow) of the sexually mature hens and the sexually immature hens. The average ring count for the immature hens was 7.1 and the average ring count for the mature hens was 10.1. With these results we can conclude that sexually mature hens grow faster than sexually immature hens. Because we were unable to collect body condition measurements from our hens, further research and experimentation should be done to test our hypothesis. This work could aid in our fundamental understanding of avian reproduction, and help to optimize yolk sizes for the poultry egg industry.

The Public's Perceptions of Water Use (Project not presented at Symposium)

Caitlin Cooper, Agricultural Communication Major, Department of Agricultural Leadership, Education, & Communication; Presented in 2020

Faculty Mentor: Jessica Holt, Department of Agricultural Leadership, Education, and Communication

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Consumers in the United States are becoming increasingly aware of water use, both personally and commercially. This research was done to further educate consumers on how many gallons of water it takes to grow the commodities to produce the items. For example, it takes 485 gallons of water to grow enough cotton to produce one shirt. Building upon previous research, this study utilized animated and static infographics to measure if consumers' recall is impacted by intentionally drawing attention to keys data related to the importance of conserving water. The infographics are identical in information and content; however, the animated infographic will implement movement and eye-catching elements to help draw the consumers' attention throughout the infographic. The survey was conducted through Qualtrics and used a non-probability, opt-in sample. Note: The data is still inconclusive, as we are waiting on the survey results.

Improving drought tolerance and sustainability of turfgrasses used in southern landscapes through the integration of breeding, economics, and outreach (Project not presented at Symposium)

Edith Copeland, Agribusiness Major, Department of Agricultural and Applied Economics; Presented in 2020

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Turfgrass is a multibillion-dollar industry with a significant economic impact in Georgia and Nationally. The purpose of the larger grant I work within is to develop more sustainable and drought resistant turf cultivars in order to conserve water and ensure the long term viability of turf grasses. My research within this project is intended to maximize adoption rates by producing extension-outreach programs to help extension experts, stakeholders, and consumers understand the long-term impact of drought tolerant turf selection and conservation of water. My goal is to discover the most efficient and effective way to increase society's perception and reception of drought tolerant turfgrasses. We hope to reduce water consumption through education of end-users on the economic and environmental impacts of adopting these drought resistant varieties. Education and outreach help to increase adoption rates and magnifies the economic and environmental impact of these new cultivars that will reduce water consumption and protect the environment for future generations. Phase one of my research will identify "key players" and use their influence to reach target audiences and increase adoption rates. Relationships with "key players" in different industries (strata) will give me a significant advantage in promoting the adoption of theses new drought tolerant turfgrasses throughout the southern United States. Phase two of my research is to maximize consumer impact. I will use existing systems to distribute materials such as Cooperative Extension, 4-H, the Department of Education, and social media to target specific strata of the target population. When new cultivars are released into the market there is an important shift in outreach efforts needed to reach broader audiences, I will focus on the media channels and personnel needed to constitute this shift. There is a critical need for turfgrasses that can provide functional surfaces but are also tolerant to droughts and reduced water usage, but the development of those grasses solves only part of our issue. Adoption by different strata such as golf courses, home lawns, and turf production is vital to ensure these grasses are adopted. In conclusion, the long-term adoption of new cultivars has the potential to transform many landscapes aligned with societal needs, conserve water, help the environment, and provide functional landscapes that meet the demands of changing environments.

Pediatric traumatic brain injury results in cerebral changes in a translatable pre-clinical porcine model (Project not presented at Symposium)+J63

Kristin Dennard, Applied Biotechnology Major, Department of Animal and Dairy Science; Presented in 2020

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Traumatic brain injury (TBI) is a major contributor to injury-related deaths in the United States. Children under the age of 4 have the highest rate of TBI-related emergency room visits compared to any other age group. However, conventional imaging techniques have failed to contribute precise information about mild TBIs and long term effects. Recently, magnetic resonance imaging (MRI) is being used to undercover these long term outcomes and give a deeper understanding to the heterogenous nature of TBIs. After a TBI, structural changes occur in white (WM) and gray (GM) matter. The objective of this study was to utilize MRI to investigate cerebral changes after a TBI. Four-week-old Landrace piglets underwent controlled cortical impact (CCI) surgery at a velocity of 4 m/s, depth of depression of 9 mm, and dwell time of 400ms to produce a moderate TBI (TBI, n=6) and were compared with age matched healthy control pigs (HC, n=6). At 1 day post-TBI, structural T2Weighted (T2W) MRI, diffusion weighted (DWI) and tensor (DTI) imaging data was acquired on all animals. T2W images were used to calculate midline shift (MLS), DWI produced apparent diffusion coefficient (ADC) maps to assess diffusivity, and DTI produced fractional anisotropy (FA) maps to evaluate WM integrity. Compared with HC animals, TBI animals had significantly ($P <0.05$) increased MLS suggesting the TBI lesion resulted in swelling of the ipsilateral hemisphere. Compared to the contralateral hemisphere of TBI animals, significantly (P <;0.05) decreased diffusivity was observed within the TBI lesion. In humans, diffusivity of GM is increased compared to WM. Similarly, in HC animals and the contralateral hemisphere of TBI animals, diffusivity of GM was significantly ($P <0.05$) increased compared to WM. However, in the ipsilateral hemisphere of TBI animals, ADC analysis revealed no difference in GM and WM diffusivity in multiple ipsilateral brain regions, including the frontal and parietal cortices. These similar ADC values indicate reduced diffusivity in ipsilateral GM in TBI animals. While WM diffusivity was unaffected, FA analysis revealed a significant ($P <0.05$) reduction in WM integrity of the ipsilateral internal capsule in TBI animals compared to the contralateral hemisphere. Overall, these MRI results demonstrate GM and WM differences are important factors to consider when developing potential therapeutic options for pediatric TBI.

Finishing beef under cover reduces heat load and improves efficiency during the summer in the southeastern United States (Project not presented at Symposium)

Sarah DeVane, Animal Science Major, Department of Animal and Dairy Science; Presented in 2020

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Extended periods of elevated ambient temperature and relative humidity may pose a risk to efficiency and economic viability of beef cattle finishing systems in the southeastern U.S. Therefore, the objectives of this study were to quantify the effects of heat stress mitigation strategies on animal performance and welfare, as well as carcass traits of beef cattle finished during the summer months in the southeastern U.S. Forty-five crossbred Angus steers (450 kg ± 25 kg) were stratified by body weight and randomly assigned to one of three separate, environmental treatments: covered with fan (CWF), covered with no fan (CNF), and outside drylot without shade or fan (OUT). Steers were fed a corn-based finishing ration ad libitum for 92 days (June – September) and weighed at five intervals for assessment of animal performance. Panting scores were assessed daily at 0900 and 1700 to monitor animal well-being. Heat load index (HLI) and accumulated heat load units (AHLU) were quantified for each treatment to determine heat load exposure. Steers remained on study until the first treatment achieved a predetermined average target weight (613 kg). Steers were harvested under USDA inspection and carcass traits were collected at 24 h postmortem. Data were analyzed as a mixed model and least squares means were separated using the Student's t test (JMP v. 13, SAS Institute, Cary, N.C.). Steers under cover were subjected to a reduced HLI ($P<0.01$) compared to OUT steers. The average maximal AHLU of CWF and CNF were similar ($P=0.23$) and less than OUT ($P<0.01$). Differences in panting scores were observed every week between OUT and Covered steers (<0.01). Initial weights across all treatments were similar ($P=0.29$), however, final weights for CWF were greater ($P <0.01$) than OUT; CNF was similar to both ($P\geq0.07$). Average daily gain (ADG) for CWF was greater ($P=0.03$) than CNF which was greater ($P<0.01$) than OUT. Gain:Feed was similar ($P=0.22$) between CWF and CNF and greater ($P <0.01$) than OUT. Hot carcass weights were greater ($P<0.03$) for CWF than OUT; CNF was similar to both ($P\geq0.23$). No differences were observed for USDA Yield Grade (2.6; $P=0.38$), or marbling score (Modest20; $P=0.71$). In conclusion, cover improved animal performance and the addition of fans further improved ADG compared to steers under cover without fans. The improved weight gain and shorter finishing time of a covered system could have positive economic implications for beef producers in the southeastern US.

Determination of the Iodine Requirement in Nursery Pigs (Project not presented at Symposium)

Chastity Dillard, Animal Science Major, Department of Animal and Dairy Science; Presented in 2020

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Iodine is an essential nutrient, however, very little is known about the specific requirements in pigs. The current National Research Council (NRC) recommendation is 0.14 ppm in all phases of production. The primary use of iodine is in production of thyroid hormones which regulate many metabolic functions. Iodine is typically included as part of the trace mineral pre-mix. The amount of iodine that is contributed to the diet from other ingredients is variable, may not be bioavailable, and is often ignored as a source of iodine. The objective of this study was to determine if there was a response to increasing iodine levels in the nursery pig diet. Growth performance of pigs fed a diet with the NRC recommended level (0.14 mg/kg added) was compared to diets with no added iodine and those with 100 and 1000 times the NRC value (14 and 140 mg/kg). Pigs were fed test diets for 5 weeks post weaning and growth, feed intake and feed efficiency was monitored. In addition, circulating levels of thyroid hormones were measured. There was a numerical improvement in growth rate observed in pigs fed diets with 100x iodine (361, 367, 401 and 364 g/d in pigs fed diets with 0, 1x, 100x and 1000x iodine). The feed efficiency of pigs fed the 100 X diet was significantly better than any of the other groups. Circulating thyroxine levels increased linearly with increasing dietary iodine. These results suggest that the level of iodine needed may be greater than the current recommendation.

Improving broiler breeder flock welfare and reducing stress through early photostimulation and spin feeding.

Cierra Dunham, Avian Biology Major, Department of Poultry Science; Presented in 2020

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While current restricted feeding programs, such as skip-a-day feeding, improve the economic efficiency of broiler breeder operations and increase the numbers of broilers produced by the industry, this management practice of feed restriction impacts animal welfare, resulting in signs of chronic hunger and psychological distress. Consumers are increasingly concerned about how and under what conditions the animals in the food system are raised, showing an increased interest in more “natural” rearing conditions. In working to find a compromise between efficiency and well-being, our research looked at the impact of advancing the age of photostimulation (15 weeks) and 2 different feeding regimens on performance and plasma corticosterone levels. A 2X2 factorial designed experiment was completed to compare the effects of everyday spin feeding (SPIN) vs skip-a-day (SAD) regimens and photostimulation at 15 or 21 weeks. A total 1200 female Cobb 500 broiler breeder chicks were obtained and allocated into one of four treatment groups, SPIN-15P, SAD-15P, SPIN-21P and SAD-21P. During rearing, routine body weights and random blood samples were taken. Plasma serum was collected, and protein assays were run. Results revealed that SAD fed broilers yielded a higher mortality rate (19.7) than SPIN fed broilers (9.84). 2-D analysis looked at potential protein markers of stress and showed SAD-15P pullets had significantly less corticosterone levels than SAD-21P. The ELISA kit revealed that SPIN and 21-P pullets tended to have higher corticosterone levels than SAD or 15-P pullets throughout the rearing period. Sending the protein samples off for further analysis wasn’t possible due to the COVID-19. From the limited results, conclusions can be drawn that skip-a-day feeding may cause some stress as foraging for food adds a competitive and fasting aspect. Every-day-spin feeding mimics the natural foraging behavior of the birds, however, did result in more stress during the experiment due to people having to broadcast the feed, and birds associated them with collecting samples and not as a source of food. Every-day-spin feeding with early photostimulation would be a better alternative to skip-a-day if humans were not needed to broadcast the feed, as it has the advantage of encouraging more natural foraging behavior, a feature modern consumers value.

The Effect of Jet-Ag on Spotted-Wing Drosophila Oviposition in Blueberries.

Mathew Fibus, Biological Science Major, Department of Poultry Science; Presented in 2020

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Spotted-wing Drosophila (SWD) is an invasive fruit fly that is considered a billion-dollar pest. Recently, more progressive organic blueberry farmers have started using crop sanitizers in rotation with insecticides in order to extend the time between insecticide applications. In this study the effect of Jet-ag, a fruit sanitizer, on Spotted-wing drosophila oviposition was examined. The results show little evidence that sanitizers lower oviposition, but further studies must be done to make sure that no errors were made in the study that would affect the results. Spotted Wing Drosophila is a highly pestiferous fruit fly capable of infecting marketable fruits with its serrated ovipositor (Haye et al 2016). It is also known that the presence of yeasts aids in survival of drosophila spp. (Chippindale et al 2004). Yeasts are also capable of attracting SWD (Lasa et al 2019). Another thing that is important to consider is that yeasts are ubiquitous, and many are present on the skin of fruits. Yeasts that are on the surface of fruits may eventually ferment sugars inside the fruit which leads to the production of volatile compounds that are known to be attractive to SWD. Jet-Ag is an algaecide and fungicide comprised of hydrogen peroxide and peroxyacetic acid that may aid in the removal of yeasts that are attracting SWD. In this study berries were treated with Jet-Ag and compared with untreated berries. The objective of the study was to prove the effect of Jet-Ag on oviposition of SWD in choice Organic Blueberries were obtained from a grocery store. The berries are then rinsed in a strainer with De-Ionized (DI) water. Washed berries were placed onto a tray with paper towels and more paper towels were placed on top of the berries. The berries were then allowed to air dry in an insect-free cage. After drying the berries were dipped again into a 2% propionic acid solution for 10 seconds. The dipped berries were then rinsed with DI water. Berries were then placed inside the insect-free cage and allowed to air dry again. The berries were placed into 2oz deli cups with 5 berries in each cup. Treated berries were dipped 20 at a time in 50mL of Jet-Ag solution for 5 seconds. Jet-Ag solution was 4.87mL Jet-Ag per 400mL of water which according to label is the highest rate for "initial curative application". Bioassay containers were self-made and came from Sterilite plastic shoe boxes (1.5x22x12.5cm) with two square holes to allow air exchange.

Development of Value-Added Georgia Style Cured Lamb Ham (Project not presented at Symposium)

James Fountain, Food Science Major, Department of Food Science and Technology; Presented in 2020

Faculty Mentor: Anand Mohan, Department of Food Science and Technology

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Georgia style dry-cured lamb ham is a minimally researched area of the food industry. The goal of this research was to develop and standardize methods to produce dry-cured lamb ham using natural sources of nitrites with an aim of large-scale production. We purchased 10 whole lamb legs from the UGA Animal Science Department and cured it over several days under control humidity (70%) and temperature (65F). Lamb hams were visibly evaluated for it cure process on days 7, 14, 21, and 42. Results obtained from the experiments showed visible trends for some characteristics and no trends for other characteristics. Over the 28-day period; the water activity, pH, C.I.E (L,a,b) color, TBAR, and proximal composition were taken from the crust of the lamb hams. On day 42 test were performed on the inside sliced portions and the was compared with a similar product from the market place. The tests up until day 28 mostly followed the expected trends with some non-trends mostly likely due to sampling error. The pH increase, water activity decrease, and C.I.E color decreases as expected. The proximal composition and TBAR results fluctuated up and down throughout the 28 days, which is most likely due to unequal level of crust to inside ration from each test. At day 42, the water activity and pH of the sliced lamb ham closely matched the properties of commercial prosciutto. The lamb ham had a lower L* (lightness) and b*(yellowness) with a higher a* (redness) values than the commercial prosciutto. Overall, the results showed that cured lamb hams can be produced and closely mirror other dry-cured ham meat in the market place.

Assessing lung ultrasounds in early prediction of respiratory illness in dairy calves

Maddie Gray, Animal Science Major, Department of Animal and Dairy Science; Presented in 2020

Faculty Mentor: Jillian Bohlen, Department of Animal and Dairy Science

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Diseases of the bovine respiratory system represent a tremendous cost to the U.S. dairy industry. Part of this cost is sequestered in the young stock on the dairy farm with expenses ranging from the most direct, calf death, to more indirect impacts on calf growth and first lactation performance. Early and accurate diagnosis of respiratory diseases represents and opportunity to curb impacts on calf health and growth as well as more judiciously use antibiotics. The objective of this study was to investigate the use of thoracic ultrasound as a tool for more effective diagnosis of respiratory disease compared with traditional observational tools. This study utilized Holstein dairy calves (n=15) that were enrolled in their first week of life at the UGA Teaching Dairy. Beginning during this first week and following in two-week intervals calves were assessed via a traditional tool called the Wisconsin Respiratory Scoring System (WRSS) and via thoracic ultrasound. Calves that were outside of the study but showing any respiratory issues were also evaluated via these methods for general observational points. The WRSS includes scoring of nasal and ocular discharge, ear positioning, respiration rate and cough patterns of calves. Thoracic ultrasounds were performed using a linear probe with 70% isopropyl alcohol as a transducer. The probe was moved in a dorsal to ventral fashion along each intercostal space, parallel to the ribs. Auxiliary data was also collected at each evaluation to include calf weight and rectal temperature. Over the eight-week period, there was only one calf that showed signs of respiratory distress and did so according to both the lung ultrasounds and the WRSS. With the low rate of respiratory illness detected, there is little that can be gleamed to compare the two methodologies. For this reason, additional work with thoracic ultrasound was performed at a cooperating dairy herd where respiratory disease and impact on heifer growth and performance were a documented issue. From working at the UGA Dairy Farm and the cooperating herd, the researchers have established procedural information regarding use of thoracic ultrasounds that may benefit producers. Though the current work was limited by the number of respiratory cases, the information regarding the use of thoracic ultrasound for early and accurate diagnosis of respiratory disease is promising as a tool to design more effective calf treatment protocols.

Determining the Programming Needs of Georgia Young Farmer Advisors

Dalton Green, Agricultural Education Major, Department of Agricultural Leadership, Education, & Communication; Presented in 2020

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The purpose of this study was to determine the programming needs of the membership of the Georgia Young Farmer Association. Young farmer members in Georgia vary from crop producers, cattlemen, greenhouse producers, agricultural service providers and everything in-between. This needs assessment provided an opportunity to determine which topics this diverse group of agriculturalist need to be taught about in their monthly meetings and workshops provided by their local Young Farmer advisor. This study also analyzes the demographics of the Georgia Young Farmer chapter. Each Georgia Young Farmer Advisor received an email with a needs assessment survey attached from the state Executive secretary of the Georgia Young Farmers. Each Advisor then distributed this survey to their chapter membership. This Qualtrics online survey was developed by the researcher and faculty at the University of Georgia. It was reviewed by a Young Farmer advisor from each region of the state of Georgia and the executive secretary of the Georgia Young Farmers Association. The survey contained a needs assessment of various programming topics divided into five different constructs, 67 statements, and demographic information regarding the participant. The recipients of the survey had the time period of 4 weeks to complete the survey. After this 4 week period the results were collected and analyzed. The research provided 70 viable responses. The results analyzed by individual programming topic as well as construct by calculating the mean weighted discrepancy score of each statement using the Borrich calculator. The study shows that the most needed construct is farm business management with the most needed programming topic being farm taxes and exemptions. These results will be provided to the state staff of the Georgia Young Farmer Association to assist them with programming needs and resource allocation to the local young farmer chapters. The information will also be provided to individual chapter Advisors to assist them in their program planning efforts. I would suggest redoing this survey in a paper format to encourage a higher response rate in the future.

Assessing sheep mammary health after lambing in the UGA ewe population

Shayna Griswell, Animal Science Major, Department of Animal and Dairy Science; Presented in 2020

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The mammary health of the ewe, a mature female sheep, is critical after lambing when she must now care for a young lamb. The two primary measures for assessing mammary health in dairy animals is somatic cell count (SCC) and milk culturing. The SCC represents the leukocytes in milk, typically increased during infection, which compromises the ewe's ability to produce nutritious milk. Milk samples can then be cultured for growth of pathogens to confirm infection status. While a great deal is known about the postpartum dairy cow, less is known about postpartum ewes. The objective of this research project was to assess mammary health and milk quality in ewes after lambing. Samples from 15 ewes at the UGA Double Bridges Beef and Sheep Unit were collected within 24 hours of lambing (D1), 7 days after lambing (D7), and 14 days after (D14). A total of 5 mL of milk from each half of the mammary gland were collected using aseptic techniques. Samples were maintained at -20°C. At the UGA Mastitis Lab, milk samples were cultured to assess bacterial growth and SCC were enumerated. The average SCC, regardless of infection status, numerically decreased over the 14-day period from 2,295,000/mL on D1 to 1,405,000/mL on D14 though this decrease was not statistically significant ($p > 0.05$). Results showed that 26.7% of ewes were infected on D1 and D14, with 20% infected on D7. Identified pathogens included Staphylococcus aureus, Streptococcus, and Coagulase-negative Staphylococcus which are pathogens that are similarly identified in dairy cattle. With only 3-4 of the 15 ewes infected in varying quarters over the 14 days, there was not enough data to compare mammary halves in the context of infection. However, overall infected SCC was numerically higher compared to overall uninfected SCC (2,201,000/mL vs. 1,681,000/mL respectively) but not different ($p > 0.05$). Moreover, we did not identify a correlation between number of offspring and infection rate suggesting that the stress of nursing multiple lambs does not increase the risk of mammary infection. Ideally, we would collect additional data to increase our values for each of the categories discussed above. The major conclusion from this project is that SCC varies greatly during early lactation in sheep and infection rates remain low, indicating the necessity for greater numbers of animals for future analysis.

Assessment of Conserved Gene Function of the Symbiotic Virus in D. Longicaudata Parasitoid Wasps

Quinn Hankinson, My major is not within CAES Major, ; Presented in 2020

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Parasitoid wasps are insects that lay their eggs in or on the bodies of other organisms, eventually killing their hosts. Diachasmimorpha longicaudata wasps lay their eggs in the larval bodies of tephritid fruit flies. D. longicaudata is also the host of an insect poxvirus, D. longicaudata entomopoxvirus (DlEPV), with which it has come to coexist over evolutionary time. DlEPV serves as an exception to the pathogenic relations most viruses form with their hosts, because this virus forms a beneficial, heritable association with the wasp, working to suppress the fly host immune system and ensure survival of wasp progeny. Changes in gene interactions may be explained by the transition of DlEPV from a pathogen to a symbiont existing in wasp tissue. The purpose of this work is to assess whether ancestral gene function is conserved in the DlEPV RNA polymerase subunit RPO147 and structural protein P4b. To test this hypothesis, we knocked down viral gene expression using RNA interference (RNAi) technology. RNAi assays were performed using double-stranded RNA (dsRNA) injections in early-stage female wasp pupae. Quantitative PCR was then performed to check for a knockdown on target gene expression. The resulting RNAi knockdowns suggest at least one gene, RPO147, has a preserved ancestral function in DlEPV. Further research on P4b is necessary to explain whether its function is also conserved. These similarities in gene interactions provide valuable insight into the evolutionary pathway that DlEPV took to transition from pathogen to mutualist.

Burn to the Ground: Mapping and Measuring Recent Fire History and Soil Magnetism in the Georgia Piedmont

Damian Hans, Water and Soil Resources Major, Department of Crop and Soil Science; Presented in 2020

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Landscape fire has significant effects on the biological, physical, and chemical properties of soil. Depending on a soil's characteristics and burning conditions, heat-induced fine-grained ferrimagnets (both magnetite and meghemite) can form in iron rich soils during a fire. The goal of this project was to evaluate the relationship between recent fire history and soil magnetism at the UGA Whitehall Forest. Using high-resolution, LIDAR-based elevation/terrain models, historic aerial photos, and soil properties to identify areas throughout the Whitehall Forest likely to experience variable responses in soil magnetism after prescribed burning. The sample areas were selected within areas of the Whitehall Forest that were scheduled to be burned in the Spring of 2020 (Sample Area 1: with 15.213 acres, Sample Area 2: with 5.5476 acres, and Sample Area 3: with 1.8793 acres). Each area exhibited the same general soil type (Pacolet or Madison series), similar slope percentages (6-15 % slopes), and each represent varying degrees of fire return intervals (1, 2, and 3 burns over the last decade), and contrasting landscape positions (divergent uplands vs convergent drainages). Prior to burning, soils were sampled at three depths (0-5cm, 5-10cm, and 10-15cm) at three upland locations and three drainage locations within each sample area. A total of 54 samples will be analyzed for magnetic susceptibility to establish baseline soil magnetism values prior to prescribed burning. Additional samples will also be collected from the same locations after burning to compare the effects of pre and post burn soil low-intensity fire on magnetic susceptibility. This work will improve our understanding of processes that create ferrimagnets in soils, establish baseline measurements on soil magnetic susceptibility, evaluate the effect of duration since burning on soil magnetic susceptibility, and explore the potential for using magnetic susceptibility as a proxy for fire history in Piedmont soils.

Effect of the combination of 25-hydroxyvitamin D3 and higher level of calcium and phosphorus in the diets on bone 3D structural development in pullets

Ashley Hatch, Biological Science Major, Department of Poultry Science; Presented in 2020

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Previously, our lab found additional 25-hydroxyvitamin D3 (25OHD) in the pullet diet increased bone size and created more pores in the cortical bone, which allowed more mineral deposits in the bones during the laying period. However, due to larger structure size, bone mineral density (BMD) was decreased in 25OHD treatment. We hypothesize the additional Ca/P on the top of 25OHD could improve BMD and bone quality. A study was conducted to explore the effect of 25OHD combined with additional Ca/P in the diets on bone 3D structural development in pullets. A total of 560 day-old Hyline W36 pullets were randomly assigned to five treatment groups (8 replicates; 14 birds/replicate) and raised until 17wks. Dietary treatments were; 1) vitamin D3 at 2,760 IU/kg (D), 2) vitamin D3 at 2,760 IU/kg + 31.25mg 25OHD/ton (L25D), 3) vitamin D3 + 62.5mg 25OHD/ton (25D), 4) vitamin D3 + 62.5mg 25OHD/ton+ high Ca&P (25D+Ca) , and 5) vitamin D3 (2,760 IU/kg) + high Ca&P (D+Ca). At 17wk, femur bones were collected and scanned using Micro-computed tomography (Micro-CT) for bone 3D structure analysis. The data were subjected to a one-way ANOVA using the GLM procedure, with means deemed significant at <0.05. The results indicated that 25D +Ca treatment had lower open pore volume space, open porosity (open pore volume/cortical tissue volume), total volume of pore space, and total porosity (total pore volume/cortical tissue volume) in the cortical bone compared to D+Ca. It also showed a higher cortical BV/TV (cortical bone volume/cortical tissue volume) in 25D+Ca than D+Ca. These results indicated the combination of 25D and high Ca/P diets reduced pores in the cortical bone area and improved bone quality. Furthermore, 25D+Ca treatment had lowest trabecular pattern factor and structure model index compare to the other treatments, which indicated its beneficial effects on trabecular structural development. Moreover, 25D+Ca had a higher trabecular percentage (trabecular bone/cavity volume%) compare to D and 25D, which suggested the additional Ca/P on the top of 25D increased trabecular content in the cavity. In conclusion, the combination of 25D with higher level of Ca/P could improve cortical bone quality in pullets and showed a beneficial effect on trabecular bone 3D structural development. The combination of higher bio-active form of vitamin D3 and higher level of Ca/P could become a potential feeding strategy to improve pullets' bone quality.

Effects of guanidinoacetic acid (GAA) on growth performance and bone development in broilers (Project not presented at Symposium)

Ashley Hatch, Biological Science Major, Department of Poultry Science; Presented in 2020

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Abstract redacted due to confidentiality clause with granting agency.

Evaluating the use of pulse oximetry and lactate levels in predicting respiratory illness in dairy calves

Mary Hillis, Dairy Science Major, Department of Animal and Dairy Science; Presented in 2020

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The future productivity of a dairy operation is found in the calf barn. The most commonly cited health issues in dairy calves are scours and respiratory diseases. The objective of this study was to investigate new methodologies to ascertain calves at risk for respiratory diseases as well as accurately diagnosing respiratory illnesses. For this study, we evaluated Holstein calves (n=12) for blood lactate levels and pulse oximetry within 6 hours of calving and then at 24 hour intervals until three days of age to assess animals potentially predisposed to respiratory issues. High lactate concentrations are correlated with neonatal asphyxia in cases of dystocia, and thus may be an indicator of early respiratory distress. Pulse oximetry has long been used as an indicator of respiratory distress in humans and small mammals. Auxiliary health data such as weight and signs of respiratory illness according to the Wisconsin Respiratory Scoring System was collected as well. Lactate levels ranged from .4 – 5.2 mmol/L while pulse oximetry ranged from 84-98 % spO2. The average lactate level at the 6 hour mark was 4.02mmol/L while the average pulse ox level was 92.7%. The average lactate level at the 3 day mark dropped dramatically to 1.4mmol/L, while the spO2 levels stayed fairly stable, with an average value of 90.7%. Data was analyzed using PROC MIXED statistical analysis. Lactate and oxygen saturation were not associated with dystocia score (>0.05), nor correlated to incidence of respiratory distress, or growth rate of calves (>0.05). Several calves exhibited high lactate levels at birth, possibly due to dystocia at calving. Each of these calves lactate levels fell in line with their peers by the 3 day mark. These calves exhibited normal spO2 levels throughout the course of the study. Only one issue of respiratory distress was identified according to the respiratory scoring system, and thus no conclusive data may be elucidated from this part of the study. Limited respiratory illnesses in the current study impeded the ability to collect worthwhile data related to early and accurate identification of respiratory disorders. However, information regarding the practicality of lactate concentrations and pulse oximetry in calves may prove useful in communications with producers. In conclusion, while the proposed work may have implications for identification and treatment of respiratory disorders, a greater number of animals are needed to create substantial findings.

Microplastics: A Macro Problem (Project not presented at Symposium)

Amanda Howard, Environmental Economics and Management Major, Department of Agricultural and Applied Economics; Presented in 2020

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Microplastics, small plastic particles measuring less than 5 mm in diameter, pose a large threat to ecosystem and human health. As more research comes out regarding microplastic pollution, concerns over its potential harm increases. Legislation surrounding microplastics has been limited to banning the manufacturing of microbeads in rinse-off cosmetics. If further action is to be taken, it is imperative to understand consumer attitudes and behavior towards microplastic pollution. Therefore, this study is broken up into two parts: scientific research behind microplastic pollution and human dimension looking at consumer knowledge and behavior surrounding microplastics. The first half aims to develop a powerful overview of different aspects of microplastic pollution. Here, the study defines microplastics, their prevalence, and locates its sources before diving into how environmental and human exposure impact ecosystem and human health. Lastly, the research discusses potential solutions to address their ecological and human health effects. The second portion studies the potential averting behavior of consumers using a comprehensive survey. The survey will be developed using Qualtrics and sent out to approximately 300 people to complete. Qualtrics will use a stratified random sample to send the survey out to a diverse sample population, so the study will not be skewed by sampling bias. It will focus on the respondents' awareness of microplastic pollution, their attitudes and concerns regarding the potential environmental and human health impacts and the possibility of legislation, and finishing with the asking about the participants' willingness to adjust behavior (i.e. reducing plastic water bottle consumption, purchasing products of different materials, and avoiding microfibers in fabric). The results of this survey will provide an important understanding of consumer's attitudes toward microplastic pollution and averting behavior. The study will serve as a snapshot of the characteristics of microplastic pollution and consumer behavior surrounding it.

What does the Future hold for Geraniums?

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Geraniums are easy-care abundant bloomers whose bright flowers will blossom from spring until fall and can be purchased at any garden center and many retail outlets. This project examined the consumer market for geraniums by identifying and evaluating market segments as well as how plant introductions impact the market. First, we examined consumer preference for retailer's prices, labeling (i.e., origin, GMO, and organic), retailer location, and plant variety impact consumer choice. The second objective was to explore different segments within the market in order to better understand how varying marketing efforts impact sales. Finally, the third objective was to observe the impact plant introductions have on the market via market simulations. We made our observations by using an online survey asking respondents to choose their preferred geraniums by giving them options of various labels and prices. The survey included a conjoint analysis experiment to evaluate products with varying attributes and levels, and by allowing a respondent to rate enough combinations of attributes with varying levels, an estimate of value can be obtained for each attribute and level. Then we examined price sensitivity, calculated market shares and created different market scenarios through the first choice model. The results indicate that the average consumers are very price sensitive and even though certified GMO free geraniums are favored, the market share quickly shifts back to no label geraniums as the price premium increases. By examining the geranium flower market, we are able to have a better understanding of how retailers need to set their prices and label their plants, how consumers make their purchasing decisions, and how a new breed disrupts the market.

Characterization of Volatile Compounds in Different Cocoa Bean Varieties (Project not presented at Symposium)

Sandhya Iyer, Food Science Major, Department of Food Science and Technology; Presented in 2020

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Chocolate is a lucrative food industry. Cocoa bean production is valued at approximately $10 billion annually, and the worldwide chocolate industry's worth is approaching $100 billion. There are four main cacao tree cultivars: Forastero, Criollo, Trinitario, and Nacional. Forastero accounts for 95% of the world production because of its high yield and tolerance to diseases. However, the other three varieties also known as "fine flavor" or "fine aroma" are characterized by more complex and desirable flavor profiles. Recently, there has been an increase in the demand for craft single-source chocolates. Most studies focus on the health aspects of chocolates, like antioxidant properties, but they focus less on the organoleptic properties. Many studies have linked quality to origin rather than to variety. Although soil and climate influence chocolate quality, the place of origin may not be the best indicator of quality. To our knowledge, there is not study that compares the volatile composition and aroma profiles of same cultivars from multiple regions of the world. The hypothesis for this study was that the main determinant in flavor is variety rather than country of origin. The objective of this research was to elucidate whether there were significant chemical differences among the main varieties of cocoa beans. The cocoa beans were roasted for 20 minutes at 120°C and conched for 24 h, and samples from each variety were taken at 10 mins, 12 h, and at 24 h. Volatile compounds were then characterized by head space solid phase micro-extraction gas chromatography mass spectroscopy (HS-SPME-GC-MS). Principle component analysis (PCA) was done to see if location or variety contributed to clustering. The score did not show any significant clustering of variety or of location. The loading plot showed that there were some compounds which contributed heavily to the scattering of the samples. Of 91 characterized compounds, 23 were unique to the Trinitario variety, 22 were unique to the Criollo variety, and nine were unique to the Forastero variety.

The effects of Gossypol addition on mixed ruminal microorganism fermentation on beef cattle (Project not presented at Symposium)

Hannah Johnson, Animal Science Major, Department of Animal and Dairy Science; Presented in 2020

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Cottonseed is commonly supplemented into cattle rations in the southeastern United States due to its economic value and ability to add sufficient protein, fat, and effective fiber to the ration. Gossypol is a polyphenolic compound in cotton plants, and the highest concentration is found in the seeds. Gossypol has negative impacts on fertility and the growth rate in male animals, both ruminants and monogastrics. Other polyphenolic compounds such as tannins alter the ruminal microbial population and reduce ruminal feedstuff degradation. These negative associated feed effects limit the amount of cottonseed products included in ruminant rations. The objective of this study was to determine if cottonseed that contained gossypol could be used as a dietary supplement at low levels without negatively impacting forage digestibility or energy availability to the host animal. This study used an in vitro mixed ruminal microorganism fermentation to assess the impact of low-level gossypol supplementation. Common dietary components were used in separate fermentations, and included cracked corn (Zea mays; CC), average quality (RFQ = 100) Coastal Bermudagrass (Cynodon dactylon; ACBG), high quality (RFQ = 120) Coastal Bermudagrass (Cynodon dactylon; HCBG). Gossypol was dissolved in ethanol to create a stock solution with a final concentration of 0.1 mg gossypol/ µL ethanol. All substrates were fermented at 5 concentration levels of 0x (ethanol only), 1x (32.8 mg), 2x (65.6 mg), 3x (98.4 mg), and 4x (1,31.2), and the impact on ruminal microorganism fermentation and end products (e.g. Volatile Fatty Acids, ammonia concentrations, and pH) were measured. Volatile fatty acids were measured in a 5:1 ratio with rumen fluid and metaphosphoric acid (1 mL rumen fluid, 0.2 mL metaphosphoric acid). Results showed that the volatile fatty acid production decreased as the concentration of gossypol increased. Ammonia was tested and did not show any direct correlation with the concentration of gossypol. The dry matter disappearance gradually decreased as gossypol increased except for the 3x concentration, and pH had a direct correlation with the amount of gossypol present in all concentrations tested.

Influences of yolk deposition rate on offspring growth in Japanese quail (Project not presented at Symposium)

Morgan Knupp, Avian Biology Major, Department of Poultry Science; Presented in 2020

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When animals reproduce, they prepare their offspring for environments into which they will be born or hatched in many ways. While animals can care for and protect offspring in the postnatal period, they can also provide them with key nutrients during the prenatal period to prepare them for the impending environment and maximize growth. For birds, the egg yolk is an important component of maternal investment, and the nutrients within the yolk are critical to offspring growth and survival. Egg yolks form over a period of 7-10 days in many birds, a period during which large quantities of yolk precursors and nutrients pass into developing oocytes preceding ovulation. The exact amount of time it takes for egg yolks to form varies substantially among females within species. In Japanese quail, for example, yolks can form in as little as 4 days or as many as 10 days. The goal of this study is to determine how much the difference in yolk rings affects the growth rate of Japanese baby quail. To do this, we quantified growth rates of three follicles produced from 60 Japanese quail. Previous works show that females are consistent in how quickly they grow follicles, so we assigned average growth rates to each female based on our measurements. We then collected additional eggs from each female, incubated them, and measured embryonic sizes at days 5, 10, and 15. We then tested for relationships between follicle growth rates and embryonic sizes at each stage. Results will be discussed.

Investigating Hypoxia Signaling in Tribolium castaneum (Project not presented at Symposium)

Bren Latorre-Murrin, Entomology Major, Department of Entomology; Presented in 2020

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Insects grow discontinuously, acquiring nutrients during intermolt periods and then molting when sufficient nutritional status is achieved. The ultimate signal that an insect is ready to molt remains unclear, though changes in oxygen supply and demand have been proposed to play a role. Recently, a decrease in oxygen (hypoxia) has been shown to be an essential signal for molting in larval mosquitoes. Hypoxia is detected by the hypoxia-inducible factor (HIF) pathway, a highly conserved pathway in metazoans. It remains unclear if the developmental role of HIF is conserved more broadly across insects. To test this hypothesis, the role of HIF signaling in development of the red flour beetle, Tribolium castaneum, was examined. Expression of the HIF transcription factor HIF-∝ was silenced using RNAi and HIF-∝ inhibiting drugs. Due to poor survival of the drug-injected larvae, we focused on RNAi using dsRNA injections into late-stage larvae and observing molting outcomes. Fourth-instar larvae injected with HIF-∝ targeting dsRNA exhibited abnormal molting. 85% of treated insects failed to eclose successfully, relative to 80% successful eclosing controls. Larvae that did pupate displayed highly abnormal phenotypes, partially formed pupal structures, and failed to properly sclerotize. Few of the pupae from treated larvae eclosed into adults, and those that did eclose did so abnormally, with pupal fragments attached to their abdomen, wings, and elytra, and die soon after eclosing. Control larvae pupated and eclosed normally at high frequency (<80%). Currently we are determining the degree of HIF-∝ expression in dsRNA-treated larvae, as well as looking at Juvenile Hormone inducible transcription factor Kruppel homolog 1. In the future, this work could provide valuable insights into insect developmental physiology, and possibly uncover a novel target for insect pest control.

What are the perceptions of women about the current landscape of the Georgia State Government? (Project not presented at Symposium)

Emily Leonard, Agricultural Communication Major, Department of Agricultural Leadership, Education, & Communication; Presented in 2020

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During the 2020 Georgia Legislative Session, I have the opportunity to work as a legislative intern for the Georgia Agribusiness Council. My duties include managing schedules, attending legislative meetings, networking with members of the Agribusiness Council, and researching legislation that will directly affect those immersed in the agriculture industry. After attending my first week of work, I realized that those who work in leadership roles are primarily from the male gender. As a woman who holds a passion for leadership, I am intrigued with this realization and hope to dive deeper into the perspectives of the few women who work in different platforms within our state's capitol. The objectives of this study were to: describe the demographics of the sample, describe how the sample feels as a woman engaged in Georgia politics, describe how the sample defines and characterizes civic leaders, and describe the recommendations of the sample related to increasing the civic engagement of women in Georgia. The women involved in this study came from different levels of leadership within Georgia state politics. For example, some of these women were secretaries from legislative offices, lobbyists, and the wives of elected officials. To obtain different perspectives of women across the spectrum, I interviewed these women with questions to bring forth their thoughts on the current use of gender roles in Georgia state politics. Due to my research being cut short, I was not able to interview a larger sample, but out of the group that I was able to interview, over 50% of the sample felt that their leadership styles had been compromised at some point during their time in their positions due to actions by the male gender. Over 50% of the sample recommends that a young women in Georgia politics leadership program and/or coalition should be formed in hopes of furthering the involvement of women in civic leadership engagement. These women come from different levels of education, ages, and cultural backgrounds, but they all feel that some sort of change needs to be made in order to further the advancement of the female gender in modern politics. After these trying times end, I hope to resume my research to further understand the perspectives of a larger sample of women involved in Georgia's political activities.

Event Tourism: An Analysis of Visitor Expenditures at a City Festival (Project not presented at Symposium)

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The aim of this study is to determine, from a comparison of visitor expenditures, the economic impact of an event or festival on the local host city. Due to the abridged semester, independence was not determined for mean spending differences between populations; regression between the number of events attended at the festival and total visitor expenditures was also not determined. Three-hundred forty-five surveys (n=345) were completed by the attendees at the 2019 Savannah Pride Festival. Certain percentages regarding attendee retention, new and returning visitor expenditure differences, and primary travel purposes were collected. The research team, composed of student-volunteers, used Qualtrics convenience sampling software on iPads to collect data. The team had a tent in the main area, and attendees were offered beads as an incentive; the researchers would occasionally approach individuals. The survey took eight minutes to complete, in which the respondents, who had to be at least eighteen years old, answered questions about their primary residence, travel preferences, and demographics. Three-hundred forty-five surveys (n=345) were deemed sufficient. It can be determined that 53.9% of the respondents were not from Savannah, and 33% of the people came primarily for the festival. 60.9% of the attendees had never been to the festival prior to this year. The survey asked how many people the respondent was financially responsible for and how much the respondent would approximately spend per day on lodging, retail, dining, and recreation. 34.7% of the respondents noted that they spend up to fifty dollars on dining. 50.5% said they spend up to fifty dollars on retail, and 33.7% spend around fifty dollars for recreation. Because 53.9% of the participants were not from Savannah and 68.8% of the participants had never been to the festival before, it can be concluded that the Savannah Pride Festival brings visitors to the city, and is economically beneficial. There is a hotel concept called "heads in beads," meaning to get as many guests in as possible, and this is what a city festival does; most of the participants, nearly 30%, reported staying in a full-service hotel. All spending was done by those who were visitors to festival, and based on the data collected, when a city hosts an event, there will be a period of economic gain, due to the increase in hotel, restaurant, retail, and recreation revenue.

Review of Barriers to Cover Crop Adoption in US Farmers

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Ecological benefits of cover crops include boosting soil organic matter, sequestering carbon, and reducing soil erosion. In turn, these benefits can lead to advantageous economic outcomes in terms of weed suppression, decreased fertilizer requirements, and overall soil productivity leading to increased yields. Nevertheless, cover crops are utilized in only 4% of American cropped land (USDA Census of Agriculture, 2017). Many surveys have been conducted to investigate the barriers to cover crop adoption among farmers, but most have been small or region-specific. Additionally, most surveys have examined the attitudes of farmers who have already implemented or are in the process of implementing cover crops, leaving insight into the attitudes and barriers faced by non-adopters under-examined. This CAES-funded undergraduate research project identified 11 US cover crop surveys conducted between 2007 - 2019, collected the survey instruments from researchers, and organized the survey questions into hierarchical thematic categories and subcategories. Categories identified include farmer and farm demographics, farming practices, and cover crop attitudes and practices. Subcategories identified include farmer values and goals and networks and information sources. Objective versus subjective questions were further delineated. This study is part of a large-scale, multi-institutional project focused on cover crop adoption. The results of this study will inform the development of a nationwide survey of farmers who have and have not adopted cover crops. The data collected from farmers, both adopters and non-adopters, will serve as a foundation for outreach and education strategies that target perceived barriers and support cover crop adoption as a best management practice.

Elucidating Bacteriophage Roles in Insect Host Protection

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Aphids are ideal for studying phenotypic effects of symbionts which can be manipulated among controlled aphid genotypes due to their clonal reproductive phase. The symbiont Hamiltonella defensa and its contribution to pea aphid protection against the parasitoid Aphidius ervi is a complex process to understand. The defensive symbiont must itself be infected with a toxin-encoding phage (APSE) to disable wasp development and creating experimental aphid lines to differentiate their effects has proven difficult. The goal of elucidating phage and bacterial roles in the protective phenotype would be accomplished by APSE transfers into multiple H. defensa strains and multiple APSE types into a single H. defensa strain. Experimental lines were created through microinjections from natural occurring lines with desired infections so that protection levels could be predicted. Parasitoid assays were conducted to confirm the protection level. By controlling for H. defensa variation in B stains of H. defensa, variable protection resulted from APSE infection. Additionally, by keeping APSEs consistent among multiple H. defensa strains, similar protection levels were present. This study was conducted with only 5 aphid lines and will be expanded to include a larger variety of H. defensa/APSE combinations to determine generality of this finding. This information enhances our understanding of symbionts as indicators of resistance against biological control using parasitic wasps.

Difference in somatic cell and bacteria counts in quarter vs composite dairy milk samples

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Dairy producers face many challenges managing compromised mammary health which may impact milk quantity and quality. One of the most common mammary health challenges is mastitis, defined as inflammation of the mammy gland and typically caused by bacteria. Other than visually observing the milk or mammary gland, mastitis can also be detected by culturing milk for bacteria or identifying an increase in milk leukocytes (somatic cell count, SCC). The bovine mammary gland is comprised of 4 separate quarters. Each quarter can have a different SCC and be infected with different bacteria. Frequently, producers utilize a composite sample (4 separate quarters collected into one) to assess overall mammary health as it is more cost-effective. These results may be misleading because only one quarter may contribute to elevated SCC. Conversely, if only one quarter is infected, the elevated SCC or presence of bacteria may be diluted by uninfected quarters. Misleading findings may affect the producer's ability to make well-informed decisions. Thus, the objective of this project was to assess differences in SCC and bacteria counts in quarter vs. composite milk samples. Utilizing the UGA Mastitis Lab, the SCC and bacterial counts from 18 cows were quantified. Average quarter SCC (AQSCC) was calculated from the 4 individual quarters. Milk samples were cultured, bacteria identified, and counted. A composite sample was then created by combining 1 mL from each quarter sample. Composite SCC (CSCC) and bacteria were assessed. A total of 80% of cases ($p=0.17$, not different from 100% accuracy) were correctly identified when comparing bacteria in the quarter samples to bacteria in the composite sample, meaning if we wanted to detect a cow with contagious Staph. aureus mastitis with one sample, we could do that effectively. The overall AQSCC was not different from the CSCC ($p=0.17$). Similarly, the AQSCC and CSCC of infected quarters was not different ($p=0.80$). However, the AQSCC (1,080,047.62 cells/mL) and CSCC (2,367,000 cells/mL) of uninfected quarters was different ($p=0.02$), representing a critical flaw in using CSCC. If the CSCC resulted in a false positive (deemed infected when she isn't), this may result in unnecessary antibiotic therapy or premature removal from the herd. Ultimately, there are some flaws in utilizing the composite sample approach, especially when making critical management decisions. More work is required to refine the approach utilized in this project.

Is sex of the avian egg correlated with concentrations of corticosterone and testosterone in yolk? (Project not presented at Symposium)

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Currently, in the poultry layer industry, hundreds of millions of male chicks are culled at hatch annually because they do not have the ability to lay eggs. Female birds have the ability to bias sex ratios of their offspring according to environmental and social conditions, and it is now known that the hormones corticosterone and testosterone are likely mediators of this process; treatment of laying hens with corticosterone triggers the production of more female chicks, while treatment with testosterone triggers the production of more male chicks, and this likely occurs via modulation of the process of sex chromosome segregation in the female. It is unclear, however, whether the hormones in circulation diffuse directly into the germinal disc that contains the genetic information to influence offspring sex, or whether it is the hormones that accumulate in the yolk beneath the germinal disc that elicits the effect. We hypothesize that hormones in the yolk surrounding the germinal disc drives the process of meiosis to skew the sex of the chick produced. To test this, we will collect eggs from 30 Japanese quail pairs, isolate the genetic material from the egg, and collect the yolk immediately surrounding it. We will then quantify levels of corticosterone and testosterone in the yolk, molecularly sex the genetic material using polymerase chain reaction, and test whether yolk surrounding male and female germinal discs differ in concentrations of testosterone and/or corticosterone. We predict that male germinal discs will be surrounded by yolk containing higher concentrations of testosterone and lower concentrations of corticosterone.

Consumer Taste and Preferences with Regards to Pork Lard and its Substitutes.

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In today’s day and age, we have a vast supply and diverse selection of food products that cover the realm of processed foods, fresh produce, meats, cooking oils, seasonings and countless other items related to food. One category of food related items one might find in their kitchen or on the store shelf is cooking oils. Today's consumer has access to many different cooking oils and oil substitutes for use in cooking, baking, frying and more.   The objective of my research was to take one of the many options consumers have as a cooking oil and try to gather consumer taste and preferences information about that product. This product is lard. Lard is rendered pig fat that was used by many Americans in the early to mid-1900’s prior to falling out of popularity. In order to test this, multiple methods were utilized.   The objective was to gather more information on what consumers think about Lard, what products they currently use that may be a substitute to lard and to find out what groups of people may be receptive to the idea of using lard in their kitchen. I decided to create, distribute and analyze a survey where people could answer questions that all together would provide me with a view of what the sample population thought about lard and its substitutes.   The second aspect of my methodology was to plan out a taste testing where I would have food products cooked using lard and its substitutes. This would be a blind taste test where my goal was to have a sample size of 30-40 tastings. While I was not able to carry out my planned taste test due to complications surround Covid-19, I do want to outline and show proof of concept for this test.   The results gathered from the survey showed that most people believe that lard is not very healthy overall but that it is a higher quality. They think that lard has a better taste generally but that it is not readily available for purchase. From the data we found that most people who cook use olive oil or butter to do so. However, 97.6% of responses said they had heard of lard before. These results gave us great insight to how a lard product might best be marketed and what the current market outlook is. We believe there is potential for a product of this type to be viable in today's market if marketed and branded properly.

Simulating the effect of wildfire on soil magnetism through controlled laboratory experiments

Matthew Molini, Environmental Resource Science Major, Department of Crop and Soil Science;
Presented in 2020

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Wildfires are a significant factor driving landscape change and can significantly alter the chemical, physical, and biological properties of soil. Due to spatial variability in burning conditions, detecting where and how intensely a fire may have burned is vital in understanding the relationship between wildfire and soils. Our overarching objective was to quantify the effects of heating on the magnetic susceptibility of soils from the Georgia Piedmont containing different amounts of iron-bearing minerals to develop an empirical relationship between the measurable magnetic susceptibility and the temperature and duration of heating. Subsamples were heated using a muffle furnace to simulate a range of temperatures (of 300 and 500 degrees Celsius) and heating durations of (5,15,30, and 120 minutes) commonly experienced during a forest fire. Soil magnetic susceptibility was measured in each soil both before and after heat treatment to quantify any changes in magnetism that may occur. We also measured the total organic carbon content and total elemental analysis of the same soils to better interpret the response of soil magnetism to heat treatments for the development of a more robust empirical model. Further samples are under review to find the in-depth content and the relationship these components have with the soil magnetic shift as well as the varying depths. The current samples include Iredell A (0-15cm), Iredell Btss1 (15-30cm), Ashlar A (0-6cm), Ashlar Bw1 (6-12cm), Chewacla A (0-8cm), Chewacla Bw1 (22-35cm), Molena A (0-16cm), Molena Bt1 (110-120cm), Pacolet A (0-15cm), and Pacolet Bt1 (48-68cm). The varying depths are to test how the different horizons are affected by wildfires and if the organic horizon, found higher in the soil profile, is affecting the soil magnetism. The layers containing organic matter are represented by the "A" Horizons, as well as the higher depths in comparison to their "B" Horizons with deeper depths. Using this information, we hope to develop a proxy for quantifying the impacts of fire on soils that will complement field observations of scorched landscapes. Implications of this research project will advance our understanding of soil-fire relationships and support spatial predictions of fire history and severity across a range of Georgia landscapes.

Histochemistry, Immunohistochemistry, and Electron Microscopy of Globule Leukocytes in Bovine

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Globule leukocytes (GL) are intraepithelial cells found in the mucosa of the respiratory and digestive tract that increase in response to certain hypersensitivities, such as helminth infections and asthma. Although thought to be a subtype of mast cell, in most species these cells are poorly characterized. In this study, histochemical and immunohistochemical staining as well as electron microscopy were used to characterize GL from the bovine gastrointestinal tract. Tissues evaluated were identified from paraffin embedded archival specimens and stained with PTAH, Luna, and Giemsa. Stains were used to highlight morphological differences or similarities between GL and other cells. In bovine, GL were not metachromatic on Giemsa, unlike tissue mast cells. GL stained red like eosinophils on Luna stain and were PTAH positive like reported for large granular lymphocytes (LGL). Bovine GL were immunonegative for CD-3 (T-cell marker), CD-21 (B-cell marker), CD-79a (B cell marker), and carboxypeptidase. However, GL were immunoreactive for CD -117, a mast cell marker, and tryptase and β chymase, which are found in mast cell granules, suggesting a close relationship between GL and mast cells in this species. Electron microscopy revealed GL and mast cells had similar ultrastructure. Though these results suggest that GL and mast cells are closely related cell types, they do not conclusively prove that GLs are derived from mast cells or vice versa.

Evaluation of a magnetic nanoparticle attached phosphorus compound as a novel phosphorus source for broilers (Project not presented at Symposium)

Elise Nanista, Biological Science Major, Department of Poultry Science; Presented in 2020

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Magnetite (Fe3O4) based magnetic nanoparticle (MNP) is a sorbent used to remove phosphorus (P) species in poultry processing wastewaters. Approximate 13% (wt.) P was attached on the spent MNP. We hypothesized P in spent MNP is a potential P source for broilers. A study was conducted to evaluate the potential of using the spent MNP as a P source for broilers. A total of 240 Cobb 500 male broilers were randomly allocated to 4 dietary treatments with 6 replicates and 10 birds each. Treatment consisted of 1) a positive control (PC) with 0.90% Ca and 0.45% nonphytate-P (nPP); 2) a negative control (NC) with a reduction of 0.15% nPP; 3) NC plus 0.075% of P from MNP; 4) NC plus 0.15% of P from MNP. Body weight, feed intake, feed conversion ratio was recorded at day 7, 14, and 18. At d 18, 3 birds per cage were randomly selected for DXA scanning. Liver, heart, and spleen were collected for Al and Fe residue analysis. Ileal digesta were collected from the rest of the birds for P digestibility. Data were subjected to SAS using one-way ANOVA following GLM procedure. The significance level was set at $P<0.05$. Means were separated using Duncan's Multiple Range Test. The addition of 0.075 and 0.15% P from MNP increased ($P<0.05$) the body weight gain at d 7 to 14. NC showed a significant lower ($P<0.05$) body mineral density and body mineral content compared to PC. Diets with additional 0.075 and 0.15% P from MNP increased ($P<0.05$) body mineral density and body mineral content compared to NC, and it reached to the same level as PC. No significant difference was found between the treatments for Al and Fe residue in liver, heart and spleen. The ileal P digestibility was not influenced by MNP. In conclusion, tested P in MNP could be efficiently and safely used by broilers as a P source.

Effects of Ground Cover Management on Natural Enemies in Northeast Georgia (Project not presented at Symposium)

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The brown marmorated stink bug (BMSB) is an invasive pest of numerous commodity crops including peaches. Currently, BMSB is managed with broad spectrum insecticides, which are incompatible with integrated pest management (IPM). In Southeastern peach production, multiple types of ground cover are used, and habitat complexity provided by ground cover may positively affect populations of beneficial insects. Our objective was to investigate the effects of ground cover management on natural enemies in Georgia that may attack ground-dispersing BMSB nymphs. Three 30 meter circular plots were established at three farms in the Athens area and were managed one of three ways: unmowed vegetation, vegetation mowed at 3 inches, or bare ground by burning vegetation. Pitfall traps were used to monitor the presence of natural enemies and were collected once every week for six weeks between August and September 2019. Predators from 4 general categories were counted: Ground Beetles/Carabidae, Predaceous Hemiptera, Ants, and Spiders. We found statistically significant effects on the number of Carabidae and Hemiptera, which were more abundant in bare ground and unmowed vegetation respectively. Additionally, mowed vegetation provided intermediate results for both of these groups. Spiders did not show a statistically significant response to any ground cover, but this may have been due to the fast recovery of vegetation in bare ground plots. The largest number of spiders was collected from mowed vegetation plots. There was no effect of ground cover on the number of ants present at any of the plots. These results suggest that ground cover management has an effect on natural enemy populations, but that there is no single management type that is “more beneficial” than the others. We believe that this information will be useful for developing IPM programs for BMSB, and intend to further investigate the effects on food webs and predation of BMSB in future studies.

A preliminary investigation into the effects of nicotinamide riboside supplementation on muscle fatigue in exercising horses (Project not presented at Symposium)

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Nicotinamide riboside (NR), a vitamin B3 analog, occurs naturally in yeast, bacteria, and mammals. NR can produce nicotinamide adenine dinucleotide (NAD+) via two pathways within mitochondria. Because the nicotinamide moiety of the NAD+ molecule cannot be synthesized, supplementing nicotinamide-containing compounds, including NR, have been widely studied over the past decade to offset the conditions of disease and aging. In numerous disease and aging models, NR increased mitochondria biogenesis, NAD+ production by up to 270%, increased the time to fatigue in endurance or exercise tests, and increased muscle mass accumulation. This study tested the hypothesis that supplementing NR will improve exercise performance and recovery in horses. Horses (N = 10) performed a standard exercise test (SET) before and after being placed on one of two treatment groups (0 or 15 mg/kg body weight of NR) for 10 days. Blood collected pre- and post-SETs was analyzed for lactate and aspartate aminotransferase (AST), with no differences found between treatment groups or at time points. Lack of change in AST levels may demonstrate that exercise was not strenuous enough to induce muscle enzyme leakage post exercise in either group. Video footage captured using a high-speed camera (200 frames per second) was used to quantify gait related changes due to delayed onset muscle soreness. No differences were recorded between treatment groups in stride length, stride duration, percentage of stride duration spent in the swing phase, or break over speed of the limb. Slight statistical difference between groups was noted in the amount of time body weight was distributed on two limbs versus one limb in the stance phase of the trot. The findings suggested that the effect of NR on gait quality had very little to no significance, but further investigation into how it affects weight distribution following fatigue might be warranted. A trial period more than 10 days could be investigated in the future. Additionally, prior to the second SET, wireless electromyography units were adhered to the gluteal muscles of the hind limb to measure active number of muscle fibers and speed of contraction. Data from this is still being analyzed and may provide useful information into the effects of NR on muscle contraction and fatigue.

Influence of phytase supplementation in pre-experimental diet on true phosphorus digestibility of soybean meal supplemented with or without phytase

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The objective of the research is to study the influence of phytase supplementation in pre-experimental diet on the true phosphorus (P) digestibility in soybean meal (SBM). A total of 384 male broiler chicks at zero day old were allocate to 96 cages, each cage holding 4 birds. For the first sixteen days (the pre-experiment period), the chicks were fed a corn-soybean meal starter diet supplemented with or without phytase (2 diets). Phytase is an enzyme that increases availability of phosphorus in plant based feedstuffs. On day 16, each of the two treatments in pre-experimental period were divided into 6 diets, making a total of 12 treatments from days 16 to 21 (the experimental period). At day 21, all the birds were euthanized and digesta were collected from the terminal ileum of the birds for analysis for dry matter, titanium and phosphorus. Apparent phosphorus digestibility will be calculated from the concentration of titanium and phosphorus in diet and ileal digesta. True phosphorus digestibility will be calculated by regression analysis of feed intake against phosphorus indigestibility to estimate endogenous phosphorus loss and true phosphorus digestibility. The chemical analyses are on-going with analysis of P outstanding. Currently available data from the experiment showed that there was no effect of pre-experimental phytase application on weight gain but there was a decrease (<0.05) in feed intake. An increase of dietary P level due to an increase in dietary SBM led to higher (<0.01) weight gains, feed intake, and gain:feed. Data from the growth performance showed that pre-experimental phytase supplementation did not affect the response to phytase supplementation in the experimental phase. This observation will have implications on effect of pre-experimental phytase supplementation on true P digestibility during the experimental phase.

A Porcine Model of Alcohol Use Disorder Voluntarily Consumes Alcohol to Intoxication and Exhibits Motor Function Deficits in a Two Bottle Choice Test (Project not presented at Symposium)

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Alcohol causes 88,000 deaths annually, making it the third leading preventable cause of death in America. Animal models are used to determine the physiological impact of alcohol abuse on human health. Pigs share a similar metabolism and brain anatomy to humans, which makes them a representative model for human alcoholism. The objective of this study was to determine if pigs will voluntarily consume alcohol to intoxication in a two bottle choice (2BC) test and display motor deficits as a result. Male (n=10) and female (n=10) pigs 6 months of age underwent 2BC testing for 33 days. For the first 12 days, alcohol pigs (n=7 male, n=7 female) were trained to drink increasing concentrations of an alcohol/saccharin solution or water alone during one-hour intermittent access. Subsequently, pigs were given intermittent access to an 8% alcohol/saccharin solution or a saccharin water solution for an 18-day testing period alcohol. Control pigs (n=3 male, n=3 female) were given intermittent access to saccharin water in both bottles. Blood and gait were collected at pre and days 12, 19, 26, and 33 of alcohol consumption. Blood was assessed for blood alcohol level (BAL). In humans, a BAL of 80 mg/dL and above is indicative of intoxication. All pigs drank to intoxication except for one female. BAL averages at all time points during alcohol consumption exceeded 80 mg/dL, which indicates that the alcohol pigs voluntarily consumed alcohol/saccharin solution to intoxication. In addition, there was a strong, positive correlation (r2=0.7987) between alcohol consumption and BAL. Changes in motor function as a result of alcohol consumption were also observed. Velocity and cadence significantly ($P < 0.05$) decreased at all timepoints compared to pre-alcohol consumption, with the biggest change occurring between pre and day 12 for both parameters. Furthermore, cycle, step and stance time significantly ($P < 0.01$) increased at all timepoints compared to pre-alcohol consumption, also with the biggest change occurring on day 12 for these parameters. Control pigs did not display changes in any parameters at any timepoints. These results indicate that pigs display deficits in motor function during intoxication as a result of a decrease in gait speed. In this study, pigs achieved a level of intoxication and associated motor function impairments that are similar to humans, thus making it an ideal model for developing treatments for alcoholism that would better translate to human medicine.

Impact of delayed feeding on gene expression associated with nutrient absorption in newly hatched broiler chickens

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Immediately after hatch, chicks change their food source from lipid-rich yolk to carbohydrate-rich feed. Often, this transition is delayed up to 72 hours in commercial broiler chickens due to different hatch times and logistic impedance. This delay in feeding at hatch could negatively impact the development of many vital systems, including the gastrointestinal (GI) tract, although the issue has not been fully researched. The objective of this study was to explore how delayed access to feed impacts developmental expression of nutrient transporters in the jejunum, the section of the GI tract where most nutrient absorption occurs. Chicks were fed within 3 hours (H) after hatching or delayed feed access for 48H after hatching. Jejunum was collected from 6 birds per group on embryonic day 19 (E19), 4H, 1 day (D), 2D, 3D, 4D, 6D, 8D, 10D, 12D, and 14D after hatch. Total RNA from these samples was analyzed by reverse transcription-quantitative PCR to determine levels of amino acid transporters. Body weights were determined on the same ages, and birds delayed access to feed weighed significantly less from 6D onwards ($P < 0.05$). Immediately, an age effect was apparent for all transporters. Cationic amino acid transporter 2 (CAT2), peptide transporter 1 (PepT1), large neutral amino acid transporter 1 (LAT1), and sodium-coupled neutral amino acid transporter 2 (SNAT2) expression decreased significantly in both groups between 4H and 14D ($P < 0.05$). For B(0) neutral amino acid transporter 1 (B0AT1), expression in the fed group increased after hatch, decreased, and increased again. The delayed group exhibited this same pattern but lagged behind the fed group. As a result, at 2D and 3D, the delayed group expressed significantly higher levels of B0AT1, while at 8D fed group B0AT1 expression was significantly higher ($P < 0.05$). A similar pattern of delayed expression was seen for excitatory amino acid transporter 1 (EAAT1). At 8D, expression in the fed group was significantly higher than in the delayed group, and at 14D expression in the delayed group was significantly higher ($P < 0.05$). From these data, we propose that 48H delayed feeding affects developmental gene expression in the jejunum of newly hatched broiler chicks. With time, though gene expression patterns in birds delayed feed did become similar to those in the fed group, a long-term reduction in body weight suggests that delayed feeding at hatch could have prolonged effects on growth and metabolism.

Webster County Feral Hog Research Abstract (Project not presented at Symposium)

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Feral swine (Sus scofa) are a destructive force to be reckoned with for many farmers. These massive creatures can destroy row crops, pastures, orchards, and other landscapes (Pinkston, 2018). Although they are not native to the United States, feral swine occur in large numbers throughout the country. Perhaps one of the leading areas of feral swine population is Webster County, located in southern Georgia. This large population of feral hogs has created a massive issue for farmers in that many of their crops and infrastructures are being destroyed. Several farmers who found themselves in this situation, agreed to participate in a pilot experiment produced by JAGER PRO™ to help rid their land of the feral hogs and protect their crops. Now that a year of putting these practices in place has passed, I conducted in-person interviews with the farmers so they could express their outcomes of the project. Overall, the farmers have provided data that shows that the project provided each farmer with a different overall experience and outcome, but that there were also several similarities and differences within the project. Some of the major similarities that were shown include: all were grateful to have a relief from staying up all night watching the hogs themselves/having to have other people help them watch all night, all expressed excitement for upcoming practices that were being put into place soon, all agreed their feral hog problems had not worsened, and all agreed that communication from JAGER PRO before the project was good. Some of the differences in the outcomes of the farmers included data such as: the number of hogs the project was eliminating, whether the project was better than any previous elimination methods that were in place, and what ideas (if any) would be put into place once the project was over. This research provides an insight into the value of coordinated feral swine control as additional programs are developed across the nation.

Establishing the Hormones Leading to the Differentiation of Myocytes in a Quail Muscle Cell Line (Project not presented at Symposium)

Charlotte Pilcher, Biological Science Major, Department of Poultry Science; Presented in 2020

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Development of muscle mass, consistency, and health are vital in the production of poultry meat, and understanding mechanisms guiding muscle differentiation in poultry is critical for reaching these standards. We and others have established that serum-starving a Quail Muscle 7 (QM7) myoblast cell line results in formation of differentiated myocytes, which ultimately fuse to create multi-nucleated muscle fibers. This suggests that serum growth factors are promoting proliferation rather than differentiation. We aim to determine which hormones shift the balance between these two outcomes. To accomplish this, mRNA expression of hormone receptors and activating enzymes at discrete points in QM7 cell differentiation will be examined. These receptors and enzymes include insulin-like growth factor 1 receptor (IGF1R), growth hormone receptor (GHR), thyroid hormone receptor (THR), as well as the thyroxine (T4) to triiodothyronine (T3) converting enzyme deiodinase (DIO). To provide further insight, we will culture cells in media with specific hormones inactivated or stripped from the media. Peptide-based hormones may be removed by heat-inactivating FBS, whereas, steroid-based hormones may be removed from FBS using activated charcoal. Cultured cells can then be observed for differentiation in the absence of these hormone classes, by immunohistochemical examination of paired-box protein 7 (PAX7), a myoblast marker, and myosin heavy chain (MHC), a marker for differentiated muscle, which are useful in tracking QM7 differentiation. Together, these data will provide insight into which hormone classes contribute to the proliferating versus differentiating state of the cells.

Functional magnetic resonance imaging patterns post traumatic brain injury demonstrate altered functional connectivity between brain networks

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Several neuroimaging methods have been applied to assess injury severity, location, and recovery over time in traumatic brain injuries (TBI). However, a large proportion of TBI survivors have persistent functional impairments that do not always correlate with the location of the focal lesion. Recent studies suggest that functional magnetic resonance imaging (fMRI) may provide an enhanced means to observe functional disconnection and compromised brain networks. The objective of this study was to utilize noninvasive fMRI to longitudinally assess functional connectivity between neuronal networks following TBI. Four-week-old Landrace piglets underwent controlled cortical impact (CCI) surgery at a velocity of 4 m/s, depth of depression of 9 mm, and dwell time of 400ms to produce a moderate TBI (TBI, n=5) or no surgery (healthy control (HC), n=7). At 1 day post-TBI, fMRI data was acquired on all animals. Resting state fMRI (rs-fMRI) and task-based fMRI (tb-fMRI) data were acquired to look at whole brain intrinsic networks (resting state networks, RSNs) and specific networks in isolation in response to stimuli, respectively, as measured by Pearson spatial correlations and mean ratios. Five RSNs were evaluated: visual (VIS), executive control (EX), sensorimotor (SM), cerebellar (CERE), and default mode (DMN) networks. In response to a visual and tactile stimuli, we examined the VIS network and the EX, SM and CERE networks, respectively. Pearson spatial correlation coefficients and mean ratios revealed a significant decrease (<0.05) in TBI animals compared to healthy controls (HC) in the EX network. Activation in individual anatomical structures within the SM (premotor cortex) and DMN (inferior temporal gyrus and parahippocampal cortex) networks revealed significant changes (<0.05) between TBI and HC animals. In addition, tb-fMRI revealed significant (<0.05) differences in the EX and SM networks in TBI animals compared to HC animals in response to the tactile stimuli. Overall, these rs-fMRI and tb-fMRI results demonstrate whole brain network circuitry impairments after TBI. Incorporation of fMRI in animal models may lead to an increased understanding of TBI sequalae on brain circuitry, and consequently, potential therapeutic options.

Kinematic Analysis of Horses' Movement in Clicker Trained Versus Handler Led Situations

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Gait analysis is commonly used in the study of human and animal locomotion, but when applied to horse gait studies, minimizing gait variability and gathering reliable data is difficult. Due to significant costs of high-speed treadmills, horses are frequently led by a handler, but handler impact on variability has not been determined. Variability in individual horses' attentiveness and desire to move synchronously with a handler may lead to variation and lateral asymmetry in gait. The purpose of this project is to determine the effectiveness of clicker-training as compared to conventional handler leading of horses for gait analysis. The study determined whether horses can be clicker trained using positive reinforcement to move at a constant pace with less variability and asymmetry as compared to handler led horses. Ten horses were utilized for six weeks using successive clicker-based positive reinforcement until they moved freely down a 30m concrete pad to a target. Three methods of gait analysis were tested: free movement by use of signal and clicker reward, horses led by handler (H1), and horses led by a different handler (H2) (to determine inter-handler variability). At the conclusion of the 6-week training period, all horses were filmed in each treatment method using high speed cameras, and gait data was analyzed for temporal variables. Behavioral data (number of sessions to achieve 80% mastery rate and retention of clicker training response) was also analyzed. Upon analyzation of results, it was found that free horses had a shorter stride duration and greater swing percentage of stride duration as compared to handler led horses ($P<0.05$). No differences were noted in left vs right side in clicker trained or handler led horses. Data collection was repeated following 6 months of latency with an almost 100% retention rate and similar kinematic findings to those observed at 6 weeks. Data showed that horses were able to be trained to trot towards a target freely at a consistent pace. Additionally, data implies that differences exist in the kinematics of freely trotting horses as compared to handler led horses, though symmetry was not affected. The larger swing percent of cycle suggests the movement of the horses was more relaxed when trotted freely. With this in mind, clicker training horses to trot to a target may be a good alternative to acquire a representative sample of natural movement when treadmills aren't available.

Estimating Soil Organic Matter from Spectral Imaging

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Throughout this project, we collected spectral image data, soil texture, soil moisture content and soil organic matter from multiple farms located around the Tifton Campus. We used a Sensera multispectral camera to take images of dry and wet soils. The soil samples collected were taken to the soil lab to determine soil type and soil organic matter content in the top two to three inches of the test site. A TDR soil moisture sensor took soil moisture measurements. The images were processed to combine the soil features (soil type, moisture, and percent soil organic matter). A machine learning algorithm is used to determine if an estimate of soil organic matter (low, medium, high) can be made using spectral imaging.

The effect of heat damage on dry matter disappearance and protein availability in whole cottonseed

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Due to the availability from Georgia's cotton industry and its excellent nutritional value, whole cottonseed (WCS) has become a popular feedstuff for beef cattle. Whole cottonseed is often fed as a supplement to hay because it provides protein, energy and effective fiber. Since WCS is a byproduct of cotton production, cottons gins may implement management practices that are more efficient but have negative impacts on the feed value. Water may be sprayed to reduce dust, and as a result WCS may heat up due to microbial fermentation, and potentially catch fire. Nutritionally, this may result in the Maillard reaction, binding amino acids to reducing sugars, and cause some of the protein to become unavailable to animals. Gins may mix heat damaged WCS with clean WCS to salvage value, but there is no data available to quantify the amount of protein available in WCS to help producers understand the value, or lack thereof, of heat damaged WCS. The objective of this research is to evaluate the impact of heat damage on dry matter disappearance (DMD) and nitrogen kinetics in situ. Samples were ground and subjected to ruminal degradation with the use of three cannulated steers. A randomized design was utilized with the 3 ruminally cannulated steers, 3 levels of heat damaged WCS: NN; 0% heat damaged, NH; 50% heat damaged, and HH; 100% heat damaged, and 5 time points: 0, 6, 12, 24, and 48h. In situ DMD was greater (<0.001) for NN(69.2%) at 48 h, and N/B (57.0%) was greater (<0.045) than BB. (51.2%) Whole cottonseed in the NN treatment had a greater (P = 0.01) amount of ruminal degradable N at a measurable rate compared to the BB with N/B intermediate (70.0, 61.2, and 54.0%, respectively). The resulting ruminal undegradable N fraction was less (P = 0.03) for NN (8.4%) compared to BB (21.9%), and NN tended to be lower (P = 0.058) than N/B (19.8%). Results from this study indicate that heat damaged WCS decreased DMD, had a decreased amount of available N that is degradable at a measurable rate and an increased amount that is unavailable for rumen degradation. Overall, if WCS is heat damaged, the product retains some of its feed value. However, producers should be aware of the reduced value to to lower DMD and available. Key words: Maillard reaction, heat damage, in situ, nitrogen kinetics

Differential Pruning and Canopy Division of Vertical Shoot Positioning Training Systems in Chambourcin (Project not presented at Symposium)

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Vine training systems and pruning strategies can affect crop yield and fruit chemistry in wine grape vineyards. The vertical shoot positioning (VSP) system is currently the most popular training system but this system limits sun exposure as it is a single-canopy system. By dividing the canopy, the exposed leaf area will increase, leading to greater radiation interception and, hopefully, increases in crop yield and quality when compared to a single canopy. In order to explore the effects of spur pruning and canopy training, we compared the effects of spur pruning to different bud densities [Low (24 buds per vine), Medium (36 buds per vine), or High (48 buds per vine)] and canopy division (Single, Divided) on crop yield and grape sugar concentration (Brix) in the popular, red-berried, hybrid wine grape cultivar 'Chambourcin'. High pruning produced a crop yield equivalent to approximately 16 tons per acre, which was about 11% greater than Medium pruning and 33% greater than Low pruning. However, Low pruning produced a crop with an average 20.3 °Brix, which was 5% greater than Medium pruning and 9% greater than High pruning. The Divided canopy produced a crop yield equivalent to approximately 15 tons per acre, which was 23% greater than Single canopy, and produced a crop with an average of 20 °Brix, which was around 7% greater than Single canopy. Our results to-date suggest that canopy division may increase crop yield and hasten sugar accumulation relative to a single canopy. However, there appears to be a tradeoff with pruning density; high bud densities produce high crop with low sugar and low bud densities yield less crop with higher sugar. Thus, the best combination of pruning and canopy training may be a divided canopy system with a medium bud density (36 buds per vine), which would produce economical, high quality grape crops.

The effect of teat suckling location on average daily gain (Project not presented at Symposium)

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Piglets require large amount of nutrients from milk to effectively reach desired weaning weights. The order by which piglets choose a teat can have a large bearing on whether they will reach this desired weight. A sow's teats located more rostrally are known to have a higher yield of milk than those teats located caudally. Piglets that choose to suckle at the more rostral teats may have an advantage in average daily gain than their siblings suckling more caudally. Three farrowing groups of seven sows each under similar feed conditions, produced 203 piglets which were included in the study. Piglets were weighed daily from the third day post-parturition until weaning on day 18-21. They were assigned teat numbers, with most rostral pair being teat one and most caudal being eight, based on the teat suckled during weigh-in, and their daily growth during that day was associated with that teat. Averages of each teat were taken for every day, and then an average of each teat was taken for the entire nursing period. Piglets nursing teat one showed the greatest average daily gain and there was a decrease in average daily gain for piglets nursing each successive teat except for teat four, which had a weight gain like teat two. Overall, there was an increase in gain of 65.9 grams from teat one to teat eight over the entire lactation period. Piglets which nursed at the more rostral teats had the largest gain and the trend of decreased growth from more caudal teats was reproduced in the data.

The Effect of Light on the Growth and Development of the Painted Lady Butterfly (Vanessa cardui) (Project not presented at Symposium)

Kathryn Spinks, Entomology Major, Department of Entomology; Presented in 2020

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We researched the effect of light because a lot of animals are known to be disrupted by light. This disrupting from light might disrupt pest species, such as the Vanessa cardui, in their development. The larval test group was exposed to a blinking light pattern at night while the other group was on a 12-hour light and 12-hour dark cycle. We then measured the overall development and eclosion times. We expect to see effects during the pupal development time but no significant differences in larval growth. We are attempting to better clarify the results of this experiment in the past. Our results can have implications that there is the possibility of using light disruption as a way to manage pests.

Identifying Patterns In Soil Carbon Dioxide And Reduced Iron Production During Shifts In Atmospheric Oxygen Content

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When Fe(II) is oxidized to Fe(III) in the presence of dissolved soil organic matter (DOM) it can form Fe-OM co-precipitates; oxidation of Fe(II) by O2 also generates free radical species that transform into CO2. However, these processes are rarely studied concurrently. We hypothesized that DOM is rapidly converted to CO2 during Fe(II) oxidation and that this could be measured as an increase in CO2. Soil samples were incubated in vials under anoxic conditions to increase [Fe2+], then we exposed the samples to an oxygenated atmosphere and resealed them to trap any CO2 produced. At five-minute increments, the headspace of each replicate was sampled and then the soil was sampled for [Fe2+]. In all cases, there was a sudden pulse of [CO2]. By manipulating water, time, and soil, we were able to vary the amount of [Fe2+] present at the end of the incubation. We found that at higher [Fe2+], the baseline CO2 concentrations increased as well as the peak CO2 concentration of the pulse, and the timing of the pulse. Finally, contrary to our expectations, we found that the [Fe2+] did not decrease significantly during the oxidation phase. This research will help flesh out this understudied area of soil chemistry.

Effect of Viral RNA Polymerase on Transcription and Expression of Wasp Genes in Microplitis demolitor

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The parasitoid wasp, Microplitis demolitor, has a unique lifecycle of depositing eggs and viral particles into its larval host and consuming the host before emerging to pupate. To combat the host's immune response, the wasp produces a Bracovirus in its ovaries. The wasp and virus share some early genes, many of which make a viral RNA polymerase (including subunits encoded by lef-4, lef-5, lef-8, lef-9, and p47). This RNA polymerase targets "late" genes responsible for proteins important to virus structure. Burke et al. found in 2013 that knockdowns of lef-4 and lef-9 genes reduced transcription of two late genes. My project will determine which genes are transcribed by the viral RNA polymerase by analyzing RNA-Seq datasets generated in the Burke lab from normal adult ovaries when compared to lef-4 knockdowns using a previously annotated M. demolitor genome. Using mRNA sequencing and differential expression analysis, I will identify genes with lower expression in the knockdown samples that are likely controlled by the viral RNA polymerase and determine whether the viral RNA polymerase impacts transcription of wasp genes. Results show that when lef-4 is knocked down, the transcription of 42 of 61 late structural nudivirus genes are expressed at significantly lower levels than control samples, while the remainder are not significantly changed. This study will allow us to learn more about the function and evolution of beneficial genes with viral origins in parasitoids as we discover more about the role of viral genes within the M. demolitor genome.

Relating sensor and soils data to find relationships with Normalized Difference Vegetation Index

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Nitrate in forages is an important factor to plant health and forage quality. High amounts of nitrogen can cause forage to be toxic and low nitrogen can cause the forage quality to be low, both of which will cause economic losses. Precision agriculture is a practice that takes the guessing out of the equation and brings known data into the decision making. Nitrogen can be applied variably to overcome these problems. The objectives in this study were (1) to use ArcGIS and JMP to understand relationships between soil electrical conductivity (EC), near infrared (NIR), Normalized Difference Vegetation Index (NDVI), topography, permanganate carbon (POXC), Loss on ignition (LOI), and Nitrate and (2) to find which soil factors most strongly relate to NDVI. This study was conducted on 9 hay fields in Putnam County, Georgia. Detailed maps have been created for each field based on soils data (POXC, LOI, Nitrate), satellite data (NDVI), and Veris data (EC and Slope). The maps also allow for the interpolation of point data into raster data which then can be used as a visual for the crop consultant or the producer, and to help correlate the point data with NDVI. JMP was then used to find correlations between the data. We have found a few things with this data: (1) depending on the type of nitrogen fertilizer applied and how it was applied to the plots (UAN-B, UAN-D, Urea) we found different regression models were required to correlate NDVI with soil POXC, LOI, Nitrate and EC, and (2) slope of the land played a big part in the amount of active carbon (POXC) and organic carbon (LOI) in the soil and was significant enough that it should be included in the regression model. We found the relationships of NDVI and the soil qualities are positive and stronger when the UAN was applied by dribble method (UAN-D).

The Effects of Different Bacteria on Kissing Bug Development

Anthony VanDieren, Entomology Major, Department of Entomology; Presented in 2020

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The kissing bug, Rhodnius prolixus, requires the bacterial symbiont Rhodococcus rhodnii for growth and development. However, whether other bacteria are capable of functioning as symionts of R. rhodnii is currently unknown. To test the effects of other bacterial species on kissing bug growth and development, kissing bug nymphs were isolated in well-plates and fed sterile blood inoculated with one of three different bacteria (Escherichia coli, R. rhodnii, R. triatomae) or sterile blood alone. Nymphal growth and development was monitored daily and bacterial DNA extractions were performed on nymphs approximately every five days after feeding. Bacterial DNA copy-number was then measured using quantitative PCR, and this data was used to determine which bacteria persisted in the kissing bug gut across development. We found that E. coli and R. triatomae cannot persist in the kissing bug gut across molts indicating that neither would be an effective symbiont in the absence of R. rhodnii.

The Effect of Escherichia coli on Development of Kissing Bugs (Project not presented at Symposium)

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The kissing bug, the main vector of Chagas disease, requires the bacterial symbiont Rhodococcus rhodnii for its growth and development. In fact, without R. rhodnii, the kissing bug is unable to molt and advance through the instars, leading to a premature death. Kissing bug numbers have been effectively controlled through pesticides, but multiple occurrences of resistance have been reported. Paratransgenesis is an approach to controlling population numbers or disease transmission through the manipulation of bacterial symbionts. This technique has not been adopted in the field for multiple reasons, one being the major gap in our understanding of the functions of the normal microbial flora in kissing bugs and how the microbial flora interacts with other microbes such as Escherichia coli. We investigated if E. coli can persist in the gut of first instar Rhodnius prolixus nymphs that hatched from surface sterilized eggs. We also tested the ability of E. coli to rescue the development of sterile nymphs and if R. rhodnii and E. coli can co-exist in the gut. Nymphs were fed blood containing R. rhodnii only, E. coli only, and a mixture of both. Over the next several days, kissing bug growth and development was monitored daily. DNA extractions were taken, and qPCR was used to estimate the number of each type of bacteria during different developmental stages. Nymphs fed E. coli alone suffered developmental delays and other developmental consequences.

Proteomic Changes as a Result of Sixty Years of Selection in Commercial Broilers

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Over the last sixty years, broilers have been selected for an increased growth rate, a younger age at slaughter, and a better feed efficiency. This has created the modern-day broiler, a much different bird from the 1950s broiler. However, UG has maintained a population of birds, known as the Athens Canadian Random Breed (ACRB), which exhibits characteristics more similar to broilers from the 1950s. Using this line, and comparing it to modern commercial broilers, changes in the genetics of broilers, due to years of selection, can be determined. In this study, protein composition of hepatic and muscle tissue of the ACRB birds was compared to those of the two commercial broilers, the Cobb 500 and the Ross 308; the purpose being to identify the protein changes in these tissues due to selection. Samples of these tissues were collected, and the cells were lysed to isolate the proteins. Concentrations of proteins in the samples were then measured and proteins were separated using 2D Gel Electrophoresis. Using this method, the proteins could be separated by their isoelectric point and by their molecular weight. The gels produced as a result of this could then be imaged and analyzed for similarities and differences between the different lines of birds, with the goal being to identifying how the ACRB samples differed from the samples from the two lines of commercial birds. Proteins of interest, in the gel, were then sequenced to determine their identities. Pyruvate kinase muscle isozyme, myosin, actin, and heat shock protein 70 were found to be upregulated in the Cobb and Ross birds in comparison to the Athens Canadian Random Breed.

Validation of a human stride sensor for use in equine exercise physiology research (Project not presented at Symposium)

Lacey White, Animal Science Major, Department of Animal and Dairy Science; Presented in 2020

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Stride length, distance traveled, and speed are key variables for equine exercise physiology research. However, they can be difficult to obtain outside of a controlled environment, or without the use of an equine high-speed treadmill. In addition, speed and/or distance can be used to standardize exercise tests between horses but can be difficult to control and consistently maintain. There are several products on the market for humans that can track stride length, distance, and/or speed while the person is exercising. The use of these products in equine exercise physiology research would be beneficial, however; none have been validated in the horse. Our objective was to determine if a human stride sensor will reliably and consistently track stride length, distance, and speed when placed on a horse. Four stock-type horses were used in this study. A stride sensor (Polar Stride sensor Bluetooth® Smart, Polar USA) was attached to an equine sports medicine boot (SMB) at a placement of halfway between the carpal and metacarpophalangeal joints. The SMB was then placed on the horses' left front leg. The stride sensor was paired to a GPS-running watch (Polar M430, Polar USA), and calibrated automatically between horses and gaits using GPS. The horses traveled over a set distance of 16.1m in a sand arena. Time was recorded for speed calculations, and stride length was determined by measuring the distance between footprints in raked sand. Measurements were collected for three gaits (walk, trot, canter) per horse. Data pulled from the sensor was compared to data collected by hand. Speed and distance traveled varied by less than 2.7% and 1.8%, respectively, at each gait. However, the stride lengths obtained by the stride sensor, compared to the hand measured stride lengths were 17% lower at the walk, 6% lower at the trot, and 31% lower at the canter. The stride sensor could be used in equine exercise physiology research to determine speed and distance traveled, but not stride length.

The effects of bisphenol A on early embryonic development in chickens

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The influences of bisphenol A (BPA) on embryonic development has been of increasing concern due to the increase in use and production of plastics that contain BPA by humans. BPA leaches from plastics into the environment and has been linked to disruption of the endocrine system in developing organisms. Though the influences of BPA have been studied in mammals, more work needs to be conducted on other animals, particularly birds which have received little to no attention. Previous studies have shown that exposure to BPA has adverse effects on sexual differentiation in birds, but in all previous studies, BPA was administered to the egg at day 3 of incubation or after. Because transmission of BPA to the egg would come from the mother, our objective was to test the hypothesis that BPA may also negatively influencing development even earlier, during the first few days of incubation. To test the hypothesis, 90 fertilized chicken eggs were collected and divided into 2 treatment groups: BPA (100ul oil/lecithin emulsion containing 200ug/g BPA n = 35), and Control (100ul oil/lecithin vehicle, n = 35). All eggs were then incubated for 4 days at 37°C and 70% humidity, after which a hole was cut into the small end of the egg to reveal the chicken embryo. Embryonic heart rate was measured by counting the number of heart beats in 30 seconds. Comparisons were also drawn between the fertility of eggs between treatment groups and proportion of premature deaths in the embryos due to developmental abnormalities. The heart rates were compared between treatment groups using a t-test. The fertility rates and the presence of developmental abnormalities were compared using Fischer's exact tests. There was no difference in whether an embryo was present in the egg, indicating fertility and very early survival at the blastocyst stage were similar between BPA and control groups ($p = 0.67$), however of the embryos present, significantly more of the BPA embryos had arrested development and died prior to day 4 of embryonic development ($\chi2 = 7.47$, $p = 0.007$). In live embryos, BPA embryos had significantly lower heart rates compared to controls ($t = -3.94$, $p=0.0005$). These results indicate that the hypothesis that exposure of chicken embryo to BPA in yolk negatively influences early development and metabolism. It is crucial that more studies are conducted in vivo with more wild avian species that encounter contaminants from pollution in their natural habitats due to the human encroachment.

Analysis of the genetic diverstiy of NBS-LRR disease resistance genes in maize lines

Amaja Andrews, Applied Biotechnology Major, Department of Entomology; Presented in 2019

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The U.S. is ranked first in the world in corn (Zea mays) production, with 97 million acres of land reserved for production. An important trait that is selected for maize and all plants grown in agricultural is their ability to defend themselves against pathogen attack. Puccinia sorghi is the causal agent of common rust of maize and is considered one of the most important production problems affecting maize resulting in billion dollar losses annually. Most plants carry a large number of different classes of disease resistance genes (R-genes) to detect the presence of pathogens and induce defense responses such as localize cell death. For this project, phenotypic analysis and a PCR-based approach will be used to characterize the genetic diversity of the Nucleotide Binding Site-Leucine Rich Repeat (NBS-LRR) class of R-gene homologues (RGHs) in three maize lines (RP1-M, H95 and B73) with different resistant phenotypes to Puccinia sorghi. This work will provide insight as to how these R-genes evolve in maize in response to the pathogen and the potential use of the R-genes in breading programs to improved resistance to Puccinia sorghi in maize.

Effects of Adaptive Lighting Systems on Ornamental Seedling Production

Ruqayah Bhuiyan, Horticulture Major, Department of Horticulture; Presented in 2019

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The initial weeks of a plant's life are critical for good plant growth up to maturity. Supplemental light (provided by LEDs) applied during the seedling stage can shorten the production cycle and is often necessary for high-quality ornamental plants. We studied the growth responses of two crops under various light treatments and analyzed the differences between the light treatments. The two crops used were Digitalis purperea 'Dalmation Peach' and Rudbeckia fulgida 'Goldsturm.' Both were grown in a greenhouse setting and exposed to five different daily light integrals (DLI, total daily amount of light received by the plants) over an eight-week period. The five treatments were a control (sunlight only), DLIs of 8, 12, and 16 mol/m2/day, and 16 hours of supplemental light at 96 µmol/m2/second, representative of commercial greenhouse practices. Plants of both species grown under sunlight only grew very slowly compared to all other treatments. Those exposed to a DLI of 8 mol/m2/day or 96 µmol/m2/second grew more slowly than those in higher light treatments and showed similar growth responses. Plants of both species exposed to 12 or 16 mol/m2/day had a low specific leaf area, while the control plants (sunlight only) had the highest specific leaf area; indicative of thin leaves, a typical shade avoidance response in plants. For both species, providing a DLI of 16 mol/m2/day showed little or no additional benefits compared to 12 mol/m2/day, meaning the extra energy required to power the light bars is not necessary to stimulate more growth in these crops. The supplemental lighting during seedling growth greatly shortened the production cycle and increased the quality of the seedlings. This can have great financial benefits for growers.

Effects of Dietary Protease on Protein Digestion and Growth in Nursey Pigs

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Pigs are typically weaned prior to the time that their digestive tract function is fully developed. The digestive enzyme capacity of weaned pigs has the potential to be limiting for protein digestion and growth, especially in the first few weeks post weaning. Supplemental exogenous protease could improve growth performance by supplementing endogenous enzymes and enhancing overall protein digestion. The objective of this study was to test the hypothesis that supplemental exogenous protease will result in improved growth performance of weaned pigs. For this study, 96 pigs (age 21 days; commercial line of pigs), from the University of Georgia Swine Unit, were allotted to 24 pens of 4 pigs/pen for 28 days to look at the effect of protease supplementation (0 g/1000 kg or 400 g/1000 kg feed). Body weight, average daily gain, feed intake, gain to feed ratio, and nitrogen digestibility of the pigs fed these diets was evaluated. In addition, an in-vitro assay was developed to determine if differences in protein solubilization due to the protease could be detected in the feed as a means to predict the response in the animal. Overall (Days 0-28), the results showed that the pigs fed protease had a trend ($0.05 < P < 0.10$) towards higher body weight and average daily gain when compared to pigs not fed protease. After day 21, Pigs fed protease had a significantly higher in body weight ($P<0.05$) than pigs not fed protease. Pigs fed protease trended ($0.05 < P < 0.10$) to have higher gain: feed than pigs feed no protease on days 0-10, but overall, there was no significant difference between the diets. In addition, average daily feed intake and nitrogen digestibility were not significantly different between the diets. In vitro, there was a numerical increase in protein solubilized in samples with the protease added, but it was necessary to add greater amounts of enzyme to show statistically significant differences. These results indicate that the addition of protease to feed has the potential to improve the growth performance of weaned pigs and could enhance protein digestion. The potential benefit of protease supplementation to the producer is lower diet cost and a reduced impact on the environment.

Can Ag Tourism Help Mitigate Farm Labor Sourcing Problems?

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A combination of stricter immigration policy and a changing workforce has depleted the supply of migrant, settled and residential laborers that many farms rely heavily on for seasonal and unskilled labor inputs. When undocumented workers were evicted, the local workorce was generally unwilling to assume the vacated farm positions. Labor-intensive farm businesses experienced labor hiring and shortage problems. The only legal pathway for hiring supplemental foreign workers, the H2A visa program, however has experienced patronage issues due to inefficient fulfillments of labor requests and cost of the program. To date, the H2A program supplies less than 20% of the nation's demand for farm labor. Subsequently, many farms report that these labor shortages have caused income losses for farms; especially small and medium-sized farms. As many sectors in the farm industry explored labor substitution strategies the agritourism business model began to become more frequent as farms looked to diversify and add another stream of revenue. This research project explores how agritourism operations (with an emphaisis on U-Pick farms) labor model potentially mitigates labor specific problems. In the absence of extensive farm-level data, this study employs the case study approach in order to focus on farms that have adopted the agriotourism model and study how labor inputs are affected and if they do indeed mitigate labor and revenue issues. The case study found difficulty in finding participants in the study due to the sensitive legal nature of which many farms source their labor. The study received many non-responses and withdrawn interest from participants. Ultimately data was taken on farm production, labor inputs for farm production and revenue and labor inputs for U-Pick operations and compared to available data to see if there could be a cause and effect relationship between labor inputs on U-Pick operations and production or revenue. In conclusion the study found that labor inputs vary depending on the size and type of agritourism conducted on the farms and profit of agritourism operations varied as well but that the structure of agritourism is conducive to labor saving effefcts.

The impact of genetic selection on skeletal health and development in broilers

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In the poultry industry, genetic selection has resulted in broilers with a faster growth rate. However, modern broilers have increased skeletal problems, particularly leg weakness. Vitamin D plays an important role in calcium and phosphorous homeostasis and is essential for proper bone development. Despite this, no research has been conducted to determine if there is a connection between genetic selection and proper metabolism of vitamin D. The UGA Poultry Science department maintains a flock of Athens Canadian Random Bred (ACRB) birds representing meat-type birds before intensive commercial genetic selection began. Using them, comparisons can be made with modern broilers to determine impacts of genetic selection. Preliminary results using one line of commercial broilers at one age indicate that genetic selection may have compromised vitamin D metabolism. The purpose of this study is to determine impacts of genetic selection on hormonal systems regulating skeletal health in two commercial broiler lines during different phases of growth. We have collected liver, kidney, and intestinal tissue from birds at different ages and are examining expression of genes involved in the conversion and activity of vitamin D, as well as levels of mRNA for hormone receptors involved in calcium and phosphorus homeostasis. Based on the results of a prior study, we expect the commercial broiler lines to have lower levels of mRNA for genes involved in the proper activation of vitamin D and the proper homeostasis of calcium and phosphorus. This decreased gene expression could be the cause of skeletal weakness in modern broilers.

Using Georgia Pecans to Make a Healthy Nut Butter with Value Added Apple Pomace Powder

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The majority of pecans are sold whole, however there is a large market in using pecan pieces to make value-added products. As one of Georgia's largest commodities, new pecan products are economically valuable for Georgia and a healthy addition to the snack food isle. Nut butters made from pecans are excessively runny, do not spread well and tend to separate. Thus, we investigated the use of dry apple pomace powder (APP) to increase the flavor and nutrients of pecan butter, the products ability to spread and thickness of the product. Pecan paste was produced from pecan midget pieces and mixed with 0-15% APP, along with sugar and salt. Adding APP increased product color lightness, with L* decreasing from 42.82 for smooth pecan butter with no APP to 37.36 for samples with 15% APP. The hue (h) and chroma (C) were also affected with h decreasing from 61.25° at 0% APP to 59.15° at 15% APP, indicating a slightly more yellow color, while C decreased from 11.68 to 9.48 indicating a less saturated color. Similar changes in color were noted for chunky style pecan butter. Texture properties were measured with a conical spreadability rig. In general, firmness increased with the level of APP with values of 66.42 g force at 0% to 1990.5 g 15% APP. The chunky style was firmer than smooth pecan butter with firmness values of 16854 g at 0% increasing to 19518 g at 15% APP. The addition of APP solids increased the firmness to values more similar to that of peanut butter. The ability to spread was also tested by shear force and showed that increasing APP produced a product that spread but also resisted the tendency to flow. The average shear force in the smooth pecan butter increased from 358.3 gsec at 0% to 1374.7 gsec at 15% APP. Values for the chunky pecan butter increased from 7106.3 gsec at 0% to 13736 gsec at 15% APP. Thus, the products ability to spread and and maintain thickness were improved by adding APP, which would be more attractive to consumers of the product. In addition, the added solids decreased the tendency for oil to separate from the product. The APP also provided added nutrients including fiber and antioxidants such as catechin.

Tanshinone-IIa-Loaded Nanoparticles Reduce Midline Shift and Lesion Volume and Improve Cerebral Diffusivity in a Pig Ischemic Stroke Model

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Stroke is the 5th leading cause of death in the United States. However, there are currently no neuroprotective Food and Drug Adminstation (FDA)-approved drugs to treat stroke. In this study Tanshinone-IIA-loaded nanoparticles (Tan-IIA NPs) were used as a therapy to treat symptoms arising from ischemic stroke using a porcine model. Tan-IIA NPs may have the ability to reduce inflammation and acute cytotoxicity after stroke. Therefore, the objective of this study was to determine if Tan-IIA NP treatment reduces tissue damage in a porcine ischemic stroke model. Ischemic stroke was induced by permanent middle cerebral artery occlusion (MCAO). Approximately 15mL Tan-IIA NP treatment (n=2) and PBS control (n=2) solution were administered intercisternally (IC) 1 hour post-MCAO. Magnetic resonance imaging (MRI) was performed at 24 hours post-MCAO. T2-weighted (T2W) imaging was utilized to measure changes in hemispheric swelling, midline shift (MLS), and infarct volume. Diffusion weighted imaging was performed and consequent apparent diffusion coefficient (ADC) maps were generated to measure changes in diffusivity. At 24 hours post-MCAO, T2W imaging showed that Tan-IIA NP treatment lead to decreased swelling of the affected ipsilateral hemisphere relative to PBS pigs. Decreased swelling also led to a reduced MLS in the Tan-IIA NP treated pigs compared to PBS pigs. Tan-IIA NP treated pigs also showed a decrease in cerebral infarct volume compared to PBS pigs, respectively. ADC maps showed that Tan-NP treated pigs exhibited a reduced percent decrease in diffusivity compared to PBS pigs. This study demonstrated the use of Tan-IIA- NP's ability to exhibit neuroprotective properties that lead to tissue recovery in a porcine ischemic stroke pig model and may prove to be a viable therapeutic treatment for ischemic stroke patients.

Uniform Germination: LED lighting effects on four species

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Uniform germination can be hard to attain but is important for reducing variability in plant growth experiments. Germination has been problematic in some species in the studies on effects of supplemental lighting in the van Iersel lab. Improved seed germination protocols are important to attain more uniform germination, which can reduce costs and resources for greenhouse growers. Light intensity and quality (color) are important factors in controlling germination. An example of this is lettuce, whose germination is inhibited by far-red and stimulated by red light. Germination responses to light are crop-specific. We determined how four species germinated under different LED intensities and spectra (dark, far-red light only, white light only, low white light with far-red, and high white light with far-red). We set up a metal cart with different light treatments on each of the five shelves. Measurements included germination rate and early seedling growth (shoot dry weight). Each shelf had 4 species (lettuce, rudbeckia, digitalis, cilantro) under the same light intensity and spectrum, with four replications. So far only results from cilantro are available. Cilantro germination rate was not affected by the treatments. Cilantro seedlings exposed to high white light intensity had higher dry weight than with dark, far-red, or low white light with far-red ($P < 0.05$). Seedlings in the dark were excessively elongated and more so than those in other light treatments. High white light with or without far-red resulted in more compact seedlings, indicating higher quality. Preliminary observations of lettuce show treatments with high white light and high white light with far-red germinated better than in other treatments. Digitalis and rudbeckia observations cannot be made currently. Although it is too early for final conclusions, results from cilantro indicate that the highest quality seedlings are obtained with high intensity white light.

Retrofitting Vertically Shoot-Positioned Petit Manseng to Improve Vineyard Crop Yield

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The objective of this study was to assess the effects of different trellising and pruning techniques in Petit Manseng, an important winegrape cultivar in Georgia and the easter U.S.. The most common trellising practice is known as Vertical Shoot Positioning (VSP). In this system, exposed leaf and fruit zone area is limited by the ~15cm space between the catch wires. In our study, we tested the VSP system against a divided canopy design. Within both the VSP and divided canopy system, we also implemented three different pruning techniques: double cane, cane, and spur pruning. The divided canopy increased pruning weight as compared to single canopy, and spur pruning increased pruning weight as compared to single and double cane pruning. Double cane pruning increased yield compared to spur and single cane pruning. The results of this study suggest that retrofitting of existing VSP spur pruned systems to divided canopy, double cane pruned systems can increase crop and return revenues while maintaining vineyard health and sustainability.

Terminal die-back, the result of a new Neofusicoccum species

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Neofusicoccum sp., a member of the Botryosphaeriaceae family, is a fungal pathogen of woody hosts. It is a threat to pecans (Carya illinoinensis) throughout the South as it damages the above ground parts of plants. Terminal die-back is the most common symptom, resulting in dying or browning of terminal leaflets, and eventually entire compound leaves, scattered throughout a tree. The pathogen often remains dormant until the host's defense responses are suppressed by environmental factors such as drought. Some orchards in Georgia have begun displaying terminal die-back. The causal fungus has been identified as a member of the genus Neofusicoccum, but the species identity was previously unknown. Additionally, the disease has become more prevalent in Texas, so we were interested in determining if the casual fungus is the same as the species in Georgia. To determine the species of the fungus causing the disease, we studied the morphology and phylogenetic relationship of samples to those of known species such as Neofusicoccum ribis. Isolates of the fungus causing terminal die-back of pecan were grown, DNA extracted and 4 genes were sequenced, which were used for phylogenetic analysis. For morphological analysis, the isolates were sub-cultured onto water agar along with a piece of sterilized pecan material. Isolates were then kept at a stable temperature with alternating light. Results indicated that the isolates collected from Georgia and Texas are phylogenetically and morphologically similar to each other but distinct from other Neofusicoccum species. These results show that terminal die-back is caused by a new fungal species that needs to be fully described and named. We propose the name Neofusicoccum caryigenum.

Vidalia Onion Awareness and Perceptions

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According to the USDA, onions are one of the most highly valued vegetables that Georgia produces, contributing over 131 million dollars to the economy. This has led to Georgia to name the Vidalia Sweet Onion as the state vegetable. However, even though Vidalia onions are grown only in a small area in Georgia, they are sold throughout the U.S. In marketing Vidalia onions throughout the U.S. it is essential that Vidalia producers understand awareness and perception of their product as the product moves away from the Georgia production region. Using an online consumer survey of around 1,500 U.S. consumers we examine how awareness and perceptions change as consumers move farther from the Georgia production region. In order to assess distance from the Georgia production region we calculate the distance, in miles, from the respondents reported zip code of residence to the zip code at the heart of Georgia Vidalia onion production. Utilizing logit models we then evaluate the role of socio-demographics and distance on awareness and perception. We find that as various socio-demographics impact awareness and perception of Vidalia onions. Further, we find that as distance increases awareness decrease and perceptions differ from those of consumers living closer to the Georgia production region. Using this information, Vidalia onion producers and industry stakeholders can assess how to improve awareness and perceptions for consumers throughout the U.S.

The effects of the corazonin gene on the mating behavior of sunflower fed Oncopeltus fasciatus males

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Dr. Moore’s lab has previously discovered that a male milkweed bug Oncopeltus fasciatus’s diet has an effect on his lifestyle behavior. When males are fed on milkweed, their natural diet, they live a live fast die young lifestyle. They mate quickly and frequently. Contrariwise, males fed solely on sunflower seeds have a life style that is much more relaxed and focused on longevity. They are less focused on mating frequently. These differences in lifestyle have been linked to the up and down regulation of the corazonin gene. The research at hand will knock out the corazonin gene with double stranded RNA injections. It will then assess if this causes sunflower fed males to live more like milkweed fed males without the genetic modification. This will be evaluated by analyzing the mating behavior of both control and corazonin knockdown males. When a male is 7-10 days old, a virgin female will be added its petri dishes. The time to copulation will be measured for each pair of bugs. They will also be checked several times at random within the first 48 hours of their time together. These checks will assess if they are in that moment mating or not. These measurements will be used to determine the mating rates of control versus corazonin knock down bugs. It is predicted that knocking out the corazonin gene in sunflower fed males will stimulate a milkweed fed lifestyle, meaning they are expected to mate more quickly and more often.

If Double-Yolked Eggs Result from Double Hierarchies or a Rapid Growth of the F2 Follicle

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We hypothesize that in laying hens the F2 follicle in the ovary undergoes fast final development and is ovulated in close succession to the first as a result. We monitored 386 Hy-Line W36 laying hens for 6 weeks during their peak egg production and counted the number of double-yolked eggs that were produced. We collected 5 double-yolked eggs and froze them for yolk separation. Once the yolks were separated, we observed whether they shared a chalazal membrane or thick albumen to provide clues on whether or not they traversed the entire oviduct together. Each yolk of the double-yolked egg was weighed and compared to weights of yolks in single-yolked eggs that were collected in the same time period. The yolk rings of the double-yolked eggs were stained to determine whether one of the yolks completed a faster yolk maturation than the other yolk. During the 6-week collection period, 10 hens laid double-yolked eggs and 5 were collected for examination. When eggs were removed from the 5 double-yolked eggs, the two yolks shared chalazal membranes, indicating that they had traversed the entire oviduct together. Weights of the two yolks in the double-yolked eggs were significantly lower than those from single-yolked eggs. This indicated that females may have been depositing resourced into two yolks at once. The results of the yolk ring analysis will tell us whether both were developing as two separate hierarchies, or whether the second egg yolk is the F follicle from a single hierarchy that developed after the first. We still do not know the mechanism responsible for the production of double-yolked eggs, but the prevalence of double ovulatory hierarchies leads us to believe that double-yolked eggs are produced due to a double ovulation.

Evaluation of botanicals used to treat seborrheic dermatitis (scalp eczema)

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Seborrheic dermatitis is a type of inflammatory condition that causes inflamed, itchy, dry skin to form on one's scalp. Statistics released by the National Eczema Association show for African-American or Black females, the chances of getting childhood scalp eczema are significantly higher than other ethnic groups.. Cocamidopropyl betaine (CB) is a common thickening chemical used in shampoos and lotions. This chemical compound, however, has been proven to exacerbate scalp eczema. Furthermore, current eczema treatment shampoos that contain CB are not made for all hair types and none are made specifically for Black hair. We identified pot marigold (Calendula officinalis L.) and chamomile (from genera Matricaria and Chamaemelum) as important botanicals for CB alternatives. To begin evaluation in this study, we grew 10 different genotypes of calendula and 13 different genotypes of chamomile, consisting of US Department of Agriculture plant introductions, cultivars, and species. Timing, growth, and amount of flowers were evaluatedto identify the most productive calendula and chamomile genotypes for further study. Once identified, the two most productive of each plant type will be evaluated for the extraction of active plant compounds that contribute to alleviation of scalp eczema. This research will be the basis for possible formulation of an allnatural plant-based hair product that will not only target and treat scalp eczema but will also serve as an effective and safe treatment for all hair types

Treatment Decisions for Presumptive Mastitis Using Dairy Heifer Secretions

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Mastitis, or inflammation of the mammary gland, has long been an issue that challenges the dairy industry. While commonly associated with lactating dairy cows, mastitis can also afflict non-lactating dairy heifers. Heifers diagnosed with mastitis may experience inhibited mammary growth resulting in future milk losses. Mastitis is easier to identify in lactating cows because they are seen at least 2 times daily to be milked, and many cases contribute to altered milk color and consistency. However, detecting mastitis in heifers can be challenging as dairy heifers are not frequently observed since they are not yet lactating. While heifer secretions can be collected, they do not resemble milk so visual inspection for infection has not been straightforward. Anecdotal evidence from the University of Georgia (UGA) Mastitis Lab, however, suggests that heifer mammary gland secretions from infected vs. uninfected glands possess their own distinct properties much like milk and may be used to predict infection status. Therefore, the aim of this study was to determine the accuracy of using dairy heifer mammary secretions to predict infection. A total of 15 dairy heifers from the UGA Teaching Dairy were enrolled. A secretion sample was collected from each of the 4 quarters/heifer and then ranked on a scale of 1 to 3 based on viscosity. The scoring system was as follows: scores of 1 were assigned to secretions that were thick and honey-like, 2 were sluggish but movable when swirled, and 3 were thin and watery. Based on previous data, only samples with secretion scores of 3 were presumed infected and treated with intramammary antibiotics under veterinary supervision. Results demonstrated that 73% of heifers and 45.76% of all quarters were infected. Mastitis pathogens identified included Staphylococcus aureus, Staph. hyicus, Staph. choromogenes, Staph. capitis, Trueparella pyogenes, and Streptococcus species. In terms of success rate for infection identification, 86.67% of infected quarters were accurately identified ($p<0.01$) using the current secretion score method. While promising, this demonstrates that approximately 13% of quarters identified as infected were actually uninfected indicating that antibiotics were administered unnecessarily. Future research is needed to improve the accuracy of this system and may include investigation of adding color and turbidity to the current scoring system.

Variability of Community Supported Agriculture business model in Georgia and support of local food system

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Community Supported Agriculture (CSA) business models in the U.S. have evolved. The purpose of this research was to determine what makes Georgia CSAs successful considering their involvement with their local food system. Data about CSA shares, price and local food system features was collected based on online research and phone interviews with several Georgia farmers involved in a CSA. Results show four important features to consider. First, a CSA alone is not profitable enough for small-scale farms. A CSA is part of a larger portfolio of marketing channels including farmers markets, restaurants and agritourism. These channels aim at directly selling to customers which has many advantages. For example, farmers can interact with current members and attain new members. By interacting directly with their local farmers, customers get to be part of their local food community. Second, successful CSAs often involve multiple farms in order to meet members' expectations. This allows a diversified portfolio of products and different prices set up according to share size. Most shares offer 7-10 produce items and operate for 12 to 20 weeks. Some CSAs also offer various value-added products, such as locally sourced butter. Third, CSAs may connect with urban Atlanta consumers who have higher disposable income, stronger demand for fresh food, and express a need to connect with farmers. In addition to CSA shares, farmers may offer gardening classes, farming demos, and youth camps. Farmers also invite members to their farm for U-pick, allowing members to learn about food production from the farm that grows the produce they eat. Lastly, within this marketing scheme, farmers won't consider selling to grocery stores because they think it creates more waste. Direct marketing strategies result in shorter food miles and hence, are more environmentally friendly. Farmers have diversified their marketing strategies overtime to be more profitable and sustainable. A CSA works in symbiosis with other marketing channels. It also promotes farmers to collaborate and have a strong relationship with their customers. CSAs educate the community, keep distribution expenses minimal, and positively impact the environment, all while providing an innovative share that meets consumer expectations. CSAs appear to represent an important cornerstone to local food systems in Georgia.

Local Labeling Awareness and Perceptions Across State Lines

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Local labeling is an important issue within the horticultural industry as many producers have devoted considerable resources to advertising their product is local. Further, all states have implemented some form of local labeling program to increase local purchasing. As states expand the reach of these programs, the programs begin to compete as awareness and perception moves across state lines. Using an online survey to study consumers in the Southeastern United States, we look to identify how state labeling programs are viewed in nearby states. Notably, we assess awareness, perception, and impact on purchasing of these programs in their "home" state as well as nearby states. Specifically, we evaluate the Georgia Grown, Certified SC Grown, Got to be NC Agriculture, Fresh from Florida, Buy Fresh, Buy Local, and Pick Tennessee Products, Kentucky Proud, Farm Families of Mississippi, and Louisiana Grown programs. Our results indicate that local labels are better perceived in their home state, while also impacting purchase to a higher degree. Further, we find that residents are aware of other state's labels, though this effect decreases the farther away the state is from the local branding effort. This information is critical for states and retailers wanting to expand their reach into other states. For instance, if awareness for a label is high in a state, but perception is low, then a state's effort should focus on changing perception. However, if awareness is low then efforts should focus on increasing awareness.

A Look at Bans on the Public Consumption of Tree Nuts

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Per capita tree nut consumption in the U.S. has trended upward over the past decade. However, nuts, both tree and field, have seen potential markets shrink as nut bans have been implemented throughout the U.S. The purpose of this study was to assess where nut bans have been implemented (e.g., schools, workplaces, etc.), especially as the bans relate to tree nuts. Using an online survey of around 1,100 respondents throughout the Midwest we examine which tree nuts have been banned in various locations. Results indicated schools were the most prevalent place nuts were banned, followed by work and then other locations. Further, even though peanuts are most often perceived as the major nut that is banned, respondents reporting bans indicated that all nuts were more likely to be banned than individual nuts. Notably, for workplaces, tree nuts were more likely to be banned than peanuts when individual bans were imposed. Thereby, this research fills a critical gap in that tree nut producers and industry stakeholders need to invest in educational campaigns to limit nut bans, while also investing in new varieties that address consumer concerns about tree nuts.

An investigation into the response of Paspalum vaginatum to saline conditions

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As human activity and climate change continue to erode soil quality, saline soils are becoming more prevalent in arid regions. Increased soil salinity threatens agricultural production because most crops are salt-sensitive. Paspalum vaginatum, or seashore paspalum, is a perennial turfgrass that is extremely salt tolerant. It is also closely related to some of the world's most important cereals, maize, sorghum and pearl millet, which are salt-sensitive. We are investigating the genetic factors underlying salt tolerance in seashore paspalum to help breeders address the challenges of meeting the global demand for food. The first objective of my study was to validate genes that were differentially expressed in an RNA-Seq experiment following the exposure of seashore paspalum to salt stress. We prepared cDNA from mRNA isolated from accession HI10 and conducted semi-quantitative RT-PCR with five primer sets. Our results confirm that the Nucleobase cation symporter 1 (NSC1) gene is up-regulated in leaf tissue during salt stress. The second objective is to map salt-related traits. Five mapping populations were generated by crossing seashore paspalum full-sib lines that varied in leaf sodium content. To validate the crosses, genomic DNA from a small set of progeny was isolated and analyzed using genotyping-by-sequencing (GbS). The UGbS-Flex bioinformatics pipeline was utilized to process sequence data. An analysis across 3465 polymorphic sites was used to validate all five candidate populations. Cross 17-100.1 was selected for trait mapping. A total of 115 genotypes from population 17-100.1 were transplanted and exposed to a salt level of 30 dS/m. Control plants were grown at 0 dS/m (freshwater). The biomass of root, leaf, and stolon tissue was quantified, and samples of leaf tissue were prepared for an analysis of sodium and potassium content. Leaf samples were also collected for DNA extraction. Identification of SNP markers for genetic mapping using GbS is in progress. Phenotypic data will be utilized in conjunction with the GbS analysis to conduct QTL mapping in the future.

Testing for Influences of Ovarian Follicle Growth Rate in Japanese Quail

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It is well-known that avian oocytes remain arrested as small white follicles in the ovary for most of the bird's life and undergo rapid yolk deposition only when recruited into an ovulatory hierarchy. Egg production is a demanding process that requires adequate resource intake, but the factors that control how fast and how big the ovarian follicles grow remain unknown. While studies have shown that dietary fat content can influence yolk composition and that hen age and strain can influence yolk size, it is still unclear whether body composition, a good indicator of energy reserves, influences yolk size. It is also unclear whether yolk size is constrained by skeletal size. We hypothesize that body composition, and thus energetic reserves, exerts significant influences on the total amount and rate of growth for ovarian follicles. To test this, we monitored egg-laying patterns of ninety female Japanese quail and collected eggs from each female for a two-week period. We also weighed females, measured their tarsus lengths, and calculated body condition using the residuals of mass to tarsus length. Finally, we weighed frozen egg yolks, fixed them in formalin, and stained yolk rings with potassium dichromate. Female quail lost a significant amount of weight during the total six weeks that they were monitored ($t = 6.88$, $p < 0.0001$). Yolk weight was significantly related to body condition index ($F = 6.84$, $p = 0.02$), but not skeletal size ($F = 0.62$, $p = 0.44$). This indicates that the total amount of lipid allocated to the yolk is dependent on the amount of body fat a female has, and that skeletal size does not appear to constrain yolk deposition. We found that the optimal treatment of the yolks was a 6-hour incubation in 4% formalin, followed by an 18-hour incubation in 2% potassium dichromate. This protocol differed substantially from previously published protocols. Interestingly, staining of dark rings, which represented yolk deposition during the day, was not always consistent, with some rings staining both darker and thicker than others. This likely indicates substantial variation in rates of yolk deposition, which could reflect variation in dietary intake among days. Further analysis of yolk rings will indicate whether the rate of yolk deposition, or how many days the follicle takes to grow, is related to the body composition of the female, however our results indicate that yolk size is dependent on the composition of the body rather than overall size.

Rapid detection of azole-resistant Aspergillus fumigatus protocols in commercial food crops

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Worldwide population expansion in the past 50 years has significantly put pressure on the worldwide production efficacy of the agricultural sector. With the rise of multiple emerging fungal pathogens negatively affecting crops, animals, and people, it is extremely paramount to diminish their negative impact on hosts. Azoles are a common chemical method used to combat fungal pathogens of plants, which are estimated to destroy up to 125 million tons of food crops each year. However, with growing integrated farming measures to reduce yield loss to pests and microbes, co-evolutionary fitness tradeoffs have allowed many microbes to gain resistance to azole treatments not only in plants but also in human infectious strains as well. In fact, Aspergillus fumigatus infections in humans without antifungal treatment leads to mortality of nearly 100%. Azoles are the drug of choice in treating aspergillosis. Previous research has shown that A. fumigatus has been recovered from the surface of various food items including apples, apricots, pecans, walnuts, and almond from both orchards and retail stores. However, no prior knowledge is known if these strains are azole resistant. This project will further investigate if azole-resistant A. fumigatus strains are present of foods produced in agricultural environments with high frequencies of azole resistance, such as peanut, watermelon, tomato, and apple. Previous research projects in the lab have resulted in effective protocols for soil isolation of azole-resistant A. fumigatus strains but not from food items. This project initiated the development of a protocol to extract A. fumigatus from the surface of various food items grown in the Southeast, such as peanuts, pecans, and apples. Multiple extraction methods in order to define the most effective A. fumigatus isolation method from food items. Preliminary A. fumigatus isolations from food items yielded four azole resistant strains from peanut. Developing an effective protocol for isolating azole-resistant A. fumigatus from the surface of food items will help in rapid detection and mitigation of human mycoses treatments and plant diseases caused by fungi.

When pigs fly… errr, poop. Changes in the fecal microbiome caused by antibiotic feeding.

Rachel Hampton, Animal Science Major, Department of Animal and Dairy Science; Presented in 2019

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Antibiotics have been widely used in human and animal medicine not only to prevent diseases but also to improve growth efficiency. Because of this increase in efficiency, they have made animal-based protein more affordable. Concerns about the incidence of antimicrobial resistance has led to American retailers and consumers choosing "antibiotic-free" meat. Because we currently do not understand how antibiotics improve animal growth efficiency, this study was designed to determine the impact of feeding a commercial antibiotic (Carbadox) to newly weaned (21 d of age) pigs (n = 48 pigs in 12 pens). Pigs were divided into two treatments (control and Carbadox fed at 50g/ton), and pigs were randomly allocated to six pens per treatment, and were fed through 70 d of age. Carbadox treatment tended to improve ($P < 0.1$) ADG from d 21-35 of age. ADFI remained similar between groups ($P > 0.1$), but was numerically higher in Carbadox treated pigs at all time points. Carbadox did increase ($P < 0.06$) gain to feed performance from d 21-63 of age compared to untreated control pigs (0.666 vs 0.708 kg gain/kg feed, respectively). Feces were collected on d 35, 49, and 63 of age; and fecal microbial DNA was extracted and sequenced by Ilumina to determine microbiome populations. The number of OTU's were higher (1371 v 1225; $P < 0.05$) in control pigs compared to Carbadox pigs across all time points. Microbial alpha diversity as measured by Chao1 was greater ($P < 0.1$) in control than in Carbadox treated pigs across all time points, while the Shannon index was not different between treatments. Collectively, Carbadox treatment did not significantly affect pig growth or BW in this small scale study, but did numerically improve overall gain to feed. However, our results suggest that a decrease in the microbial diversity may be related to improved animal growth efficiency in newly weaned pigs, which suggests that these effects can potentially be mimicked by the use of natural compounds or pre- and probiotics. Therefore further research is required to understand what the effects of antibiotic treatment are at the animal level and how they can be mimicked using other microbial manipulation techniques.

Role of Biocholine on growth performance, hepatic gene expression, and adiponectin in broilers

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Choline is a water-soluble vitamin essential for physiological functions, optimum performance and lowering of fat content of the liver and body in broiler birds. If choline intake is inadequate, liver fat and abdominal fat contents increase, which can cause fatty liver syndrome. Choline chloride supports digestion and utilization of dietary energy in poultry. Biocholine, a natural alternative for choline chloride, contains glycerol, phosphatidyl inositol and phosphatidylserine that play a significant role in metabolism, enzymic modulation and biosynthesis of phosphatidylcholine that can produce a growth response. The objective of this study was to evaluate the effects of choline chloride and Biocholine on body weight gain, feed intake, FCR, and liver metabolic gene expression in broilers over a 42-day period. A total of 240 1-day old Cobb 500 broiler chicks were randomly allocated into two treatment groups (2 trt x 6 rep x 20 birds/pen). The two treatments were (T1= Synthetic choline chloride 60%, and T2= Biocholine with 30% of synthetic choline chloride). Quantitative real time reverse transcription polymerase chain reaction (qRT-PCR) and Adiponectin ELISA was performed at five weeks of age for assessment of Peroxisome proliferator-activated receptors (PPAR) gene expression in the liver. Results were subjected to a one-way ANOVA using the GLM procedure, with means deemed significant at $P<0.05$. The results indicated no significant difference in feed intake and FCR, however six-week average body weight in Biocholine group was numerically higher than the choline chloride group. qRT-PCR and ELISA results indicated that Biocholine supplementation leads to hepatic gene expression of PPAR receptors with a 39.03% increase compared to the choline chloride group. The chicken Adiponectin mRNA displayed high levels in liver tissues with Biocholine supplementation at 14.61% higher versus what was observed in choline chloride group. Bioactive of Biocholine and natural phosphatidyl choline conjugates are agonists of PPARs, therefore Biocholine activates PPAR receptors leading to signal transduction and release of Adiponectin hormone. This initiates lipid metabolism by reducing free fatty acid uptake in the liver and lipolysis for better energy metabolism and potentially can prevent fatty liver syndrome. In conclusion, the results indicate that Biocholine can successfully replace synthetic choline chloride in poultry dietary feed.

The effect of differing Se and Mg levels on growth performance in nursery pigs

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The objective of this study was to observe how different ratios of dietary selenium and manganese effect nursery pig growth. Manganese and Selenium are crucial microminerals in the natural anti-oxidant defense systems of mammals. Nursery pigs have been shown to experience high levels of oxidative damage. Thus, this study was run to observe whether or not higher levels of Mg and Se in the diet could help to counteract this oxidative damage and allow the pigs to grow more efficiently during this stage of life. Piglets of similar weight and age were randomly divided into 6 blocks; each block was housed in a separate pen and given a different diet ad libitum with a specific amount of Se or Mg. Each individual diet block included one of two levels of Se (0.1 or 0.3 ppm) and one of three levels of Mg (0, 12 or 24 ppm). A total of 3 trials were run for a duration of 5 weeks each and data was collected on a total of 216 pigs. The body weights and feed intake of each pen were taken weekly to assess average daily gain, average daily feed intake, and gain to feed ratio. Blood and fecal samples were also taken to provide information on nutrient uptake. The ADG, ADFI, and G:F ratio were evaluated and compared on a week-by-week basis. The average daily feed intake did not differ significantly amongst the dietary blocks from week to week. The ADG, however, saw statistically significant variation in the second and fourth week of study. In the second week, the pigs being fed 0.1 Se and 24 Mg had greater ADG than the other pigs being fed other diets; in the fourth week, the 0.3 Se 24 Mg pigs had greater ADG. The G:F ratio only differed significantly amongst the dietary groups during the fourth and fifth weeks. During the fourth week, all the groups displayed more efficient growth than the 0.1 Se 0 Mg pigs. In the fifth week, the 0.1 Se 12 Mg pigs saw the most growth per feed intake and the 0.3 Se 0 Mg group saw the least. When evaluating the data as a whole, we only see did not see any significant trends amongst the 6 diets. However, when looking just at the effects of Mg, we see significantly higher overall ADG in the 24 ppm Mg pigs, though there is no significance in the ADFI or G:F ratio. From these results, we can conclude that increased levels of dietary Mg aid in a higher growth rate among nursery pigs, while the ratios of dietary Selenium and Manganese have a limited effect on growth.

There is No Significant Difference in Average Daily Gain Among Swine Injected with Multimin 90 At Birth, At Weaning, and At Birth and Weaning

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The objective of the project was to determine whether Multimin 90, a mineral injection primarily given to cattle, would increase the average daily gain in swine if given at birth, at weaning, or at both birth and weaning. Multimin 90 contains 15 mg Cu/mL (as Cu disodium EDTA), 60 mg Zn/mL (as Zn disodium EDTA), 10 mg Mn/mL (as Mn disodium EDTA), and 5 mg Se/mL (as sodium selenite). To examine the effect of Multimin 90 mineral injection, 9 groups of 4 pigs with similar birth weights were grouped together. This includes 3 groups of 4 males and 6 groups of 4 females. Each pig that received an injection was given 0.1 mL intramuscularly. In each group, one pig received no injections, one received injections at birth and weaning, one received an injection at birth, and one received an injection at weaning. The pigs were weighed a birth, day 3, day 7, day 14, day 21 when they were weaned, and day 14 post-weaning. Results were analyzed using a 2x2 factorial on Statistical Analysis Software (SAS). When pigs were injected at both birth and weaning (birthinj=1 weaninj=1), the average daily gain for days 3, 7, 14, 21, and 35 were 126.0, 160.0, 226.1, 170.6, and 157.32 grams respectively. For pigs who were injected just at birth (birthinj=1 weaninj=0), the average daily gain for the weigh periods were 137.8, 196.6, 224.0, 179.3, and 126.0 grams. For pigs injected at weaning (birthinj=0 weaninj=1), the average daily gain for the weigh periods were 114.2, 186.5, 260.0, 203.8, and 149.8 grams. For pigs not injected at all (birthinj=0 weaninj=0), the average daily gain for the weigh periods were 104.2, 201.6, 252.7, 236.9, and 122.04 grams. Additionally, the p values were high for this study, which indicates there is no statistically significant difference in the average daily gain in swine when injected with Multimin 90 across the 4 treatment groups. The p value for the injection at birth is 0.1695, which indicates there is not much evidence of an effect. The p value for an injection at weaning is higher, 0.5565, which means there is no evidence of an effect. In conclusion, Multimin 90 mineral injection does not increase the average daily gain, whether it is given at birth, at weaning, or both.

Comparative analysis of different molecular and serological detection methods of Xylella fastidiosa in blueberry

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Despite numerous studies on Xylella fastidiosa, there is no comparative study to determine which detection method is more favorable. There is no comparative data on speed, cost, accuracy, or the transferability of detection method from laboratory to field. Because of these facts, we collected known infected plants and tested the functionality of conventional PCR, real-time PCR, LAMP, ELISA, and Agdia RPA end-product detection technology AmplifyRP ® Acceler8 ® in order to collect data on each technique. The goal being to produce and collect insightful data and information that will provide growers, farmers, and diagnosticians with the most effective diagnostic and, by result, treatment methods for this devastating disease. Xylella fastidiosa infected Blueberry samples were used for bacterial detection in the above stated diagnostic methods. The results of these tests are as follows; the detection limit for C-PCR was observed to be 1pg (≈350 copies) per reaction for the primer used in this study, which is lower than the other two different PCR based methods. The detection limit for real time PCR assay was minimum of 25 fg (≈8 copies) per reaction but with a substantial variation in between the replicate Ct values. For LAMP assay the detection limit was found to be with a higher concentration of DNA. These results suggested that, both the real time PCR and LAMP assays are more sensitive than the C-PCR, among those real-time PCR is the most sensitive assay to detect the X. fastidiosa DNA molecules. It was obtained that the AmplifyRP ® Acceler8 ® assay required least time (≈42 minutes) to detect the pathogen in the infected samples compared to other methods, but was the most costly.DAS- ELISA is least expensive, but required skilled labor and lab facilities, and needed most time to proceed. Real-time PCR was the most sensitive assay to detect X. fastidiosa DNA molecules but is not portable and rewuires skilled lab labor. LAMP assay was less sensitive compared to real-time PCR, but is less costly, quick, showed greater sensitivity than C-PCR, portable, and didn't require any specialized thermo-cycler, laboratory facilities or skilled labor to proceed. In conclusion, real-time PCR was the most sensitive and reliable assay to detect pathogen in laboratory conditions where pathogen quantity could be determined. However, overall, LAMP and RPA based end-point-detection technology AmplifyRP® Acceler8 ® were more convenient and can be widely used for on-site detection.

Characterization of Volatile Compounds in Different Cocoa Bean Varieties

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Chocolate is a very lucrative food industry. Cocoa bean production is valued at approximately $10 billion annually, and the worldwide chocolate industry's worth is approaching $100 billion. There are four main cacao tree cultivars: Forastero, Criollo, Trinitario, and Nacional. Forastero accounts for 95% of the world production because of its high yield and tolerance to diseases. However, the other three varieties also known as "fine flavor" or "fine aroma" are characterized by more complex and desirable flavor profiles. Recently, there has been an increase in the demand for craft single-source chocolates. Most studies focus on the health aspects of chocolates, like antioxidant properties, but they focus less on the organoleptic properties. Many studies have linked quality to origin rather than to variety. Although soil and climate influence chocolate quality, the place of origin may not be the best indicator of quality. To our knowledge, there is not study that compares the volatile composition and aroma profiles of same cultivars from multiple regions of the world. The hypothesis for this study was that the main determinant in flavor is variety rather than country of origin. The objective of this research was to elucidate whether there were significant chemical differences among the main varieties of cocoa beans. The cocoa beans were roasted for 20 minutes at 120°C and conched for 24 h, and samples from each variety were taken at 10 min, 12 h, and at 24 h. Volatile compounds were then characterized by head space solid phase micro-extraction gas chromatography mass spectroscopy (HS-SPME-GC-MS).

Effect of a xylanase feed additive on the in vitro fermentation of warm season forages by mixed ruminal microorganisms

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Xylanase is an enzyme feed additive that is commonly included in rations of swine, poultry, and cattle to increase the bioavailability of soluble sugars derived from feedstuffs. Cattle diets often include xylanase which can degrade xylan found in forages included in cattle rations. It has been suggested that including xylanase in cattle rations will increase the ability of the ruminal microbial ecosystem to more completely degrade hemicellulose in forage. The present study evaluated the effect of a xylanase feed additive on the mixed ruminal microorganism in vitro fermentation parameters, such as in vitro dry matter disappearance (IVDMD), and volatile fatty acid (VFA) production. An in vitro fermentation of two common Georgia forages fed to cattle – bermudagrass and tall fescue – was performed using an anaerobic mixed ruminal microorganism population. Levels of xylanase (0, 0.925 g/L, 0.185 g/L, 0.37 g/L and 0.74 g/L) were included in triplicate (n = 3) tubes. After 24 h of fermentation, Dry Matter Disappearance and VFA production was compared for all xylanase treatments. Analysis of variance (ANOVA) was performed for each forage using the fermentation bottles as experimental units with the different levels of xylanase as independent factors. Results showed that VFA production, IVDMD, neutral detergent fiber disappearance, and acid detergent fiber disappearance were not significantly different ($P > 0.05$) for either of the forages tested or by xylanase inclusion. Because of the lack of expected xylanase activity, an assay for xylanase solubility was conducted. Solutions of xylanase and water at various pH readings (pH 3 and 6-8) were prepared and incubated, similarly to the in vitro microorganism fermentation. Xylanase solubility did not change throughout the biologically relevant pH range tested. Our findings imply that the commercial xylanase used in this study did not solubilize in aqueous systems at ruminal pH. Therefore, it cannot increase bioavailable sugars from the fibrous substrates commonly found in cattle rations. So, collectively, these findings demonstrated that the commercial xylanase tested provides limited benefit in cattle rations, since it failed to improve dry matter degradation or to increase production of intermediate metabolites that provide energy to the animal such as VFAs.

Superresolution analysis of meiotic chromosome synapsis in the domestic cat

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Dog and cat overpopulation results in the annual euthanasia of millions of animals according to the Humane Society of the United States. Current contraceptive strategies, including spays and neuters, are unable to adequately control the populations and limit loss of life. An alternative approach involves interference with meiotic germ cell development (as a method of controlling gamete formation) and thus, to induce infertility in stray animals. However, little is known about meiosis in the tomcat, with only one published report to date. In this study, we conducted fluorescence immunochemistry and superresolution structured illumination microscopy (SR-SIM) analysis to characterize chromosome configuration during cat spermatogenesis in surface spread early, mid, and late pachytene stage spermatocytes. Preliminary data demonstrate previously unreported patterns of DNA double strand breaks (as identified by phosphorylated histone H2AX (γH2AX)) in autosomes. In addition, we provide a detailed analysis of the stage-specific configurations of the XY chromosome pair during pachytene stage of meiosis. SR-SIM analysis of feline XY body revealed structural chromatin organization of this specialized nuclear domain with unprecedented resolution, and provided novel insight into protein markers involved in DNA damage response and epigenetic modifications. These results further our understanding of critical proteins and their functional implications in normal feline spermatogenesis, and may provide the initial stepping-stones for strategies to inhibit spermatogenesis in the cat.

Evaluation of equine forelimb kinematic response to commonly used head and neck positions

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Recent controversy over head and neck positions (HNPs) used in equine sports has sparked interest in equine back and limb kinematics due to potential effects on muscular and spinal health. Due to its insertion and origin, the brachiocephalicus muscle plays a large role in protracting the equine forelimb as well as positioning the head relative to the limb, and thus relates head and neck position to forelimb kinematics. Training equine athletes in hyperflexion, or rollkür, has become more popular in some equine sports. Previous studies have shown that horses ridden in rollkür experience higher oxidative stress levels, airway obstruction, greater flight instinct, and greater incidence of conflict behavior. Studies have found direct correlation between varying HNPs and kinematics of the back and hind limbs. However, little research has related forelimb kinematics to HNP. The objective of this study was to quantify changes in forelimb kinematics in response to four commonly used HNPs. Four stock-type horses of comparable height and neck length were used in a Latin square design to test the following HNP treatments: (1) free/loose (FL), 2) high/flexed (HF), 3) low/flexed (LF), 4) neutral/flexed (NF). HNPs were accomplished through the use of a chambon and side reins attached to a surcingle fitted to each horse by the same handler. Horses were trained three times per week for eight weeks, with gait being analyzed at the end of weeks two and eight. For gait analysis, three synchronized cameras (XcitexTM Procapture, Woburn, MA, USA) recording at 150 frames per second were used to record horses as they trotted freely down a 30 m concrete pad at 3.8 m/s in each HNP. Data was analyzed using SAS version 9.4 (Cary, NC, USA) with treatment as the variable. No differences were seen between treatments at the end of wk 2, however, temporal differences were noted between treatments by wk 8. Swing percent of stride duration was longer in FL as compared to NF and LF ($P<0.05$). Stride duration was longest for NF, with NF horses having a longer duration than HF ($P=0.01$) and FL ($P=0.05$). Though the neutral HNP showed both greater stance and swing times due to the greater duration of stride, horses in free HNP spent a greater percent of stride in swing phase, indicating a more relaxed and higher quality gait. These preliminary data show potentially negative long-term effects of restrictive HNP training on the equine athlete’s gait.

The Effects of Multimin 90 on the Growth Performance of Neonatal Pigs

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Multimin 90 is an injectable, supplemental source of Selenium, Zinc, Manganese, and Copper that is often used to improve growth performance in the cattle industry. However, it is generally believed that piglets are also nutrient deficient at birth and potentially at weaning. These deficiencies can result in several diseases thereby decreasing their chance of survival. For example, a zinc deficiency can cause Parakeratosis, or pigs deficient in selenium can experience iron toxicosis when iron injections are provided at birth. Thus the objective of this study was to test the effectiveness of Multimin 90 on the growth performance of neonatal pigs. Within 36 hours of birth, each piglet was weighed and blocked in groups of two by sex and similar birth weights. Within each block, one piglet was chosen at random and provided a 0.1cc injection of Multimin 90. This injection contained 1mg of Manganese, 1.5mg of Copper. 6.0mg of Zinc, and .5mg of Selenium. Post-injection, each piglet was weighed at days 3, 7, 14, and at weaning. 350 pigs were used for the experiment. Following the study, average daily gain was calculated to measure growth performance and the data was analyzed using SAS and the GLM procedure. The Multimin 90 injection proved to have no significant effect on the average daily gain of the piglets at weaning. Over the course of 21 days the treatment pigs had a total average daily gain of 175.12 while the control pigs had an overall average daily gain of 181.95g. It was observed that the piglets displayed a linear trend for overall average daily gain from birth to weaning.

Large Animal Model of Acute Arthritis for Stem Cell-Based Regenerative Medicine

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Synovitis is an acute inflammatory response of the synovial membrane to joint trauma or infection and is thought to be a major role player in progressive joint deterioration as seen in osteoarthritis. To study synovitis, researchers have relied on synoviocyte cell culture to mimic and modify the inflammatory events postulated to underpin synovial inflammation. Unfortunately, synoviocytes de-differentiate and lose their phenotypic features when grown in monolayer, limiting our ability to appropriately interrogate the synovial environment ex vivo. It is, therefore, the overall goal of this project to develop an ex vivo technique to study the role of the synovium in joint inflammation. Specifically, our objectives are to establish a culture technique that maintains porcine full thickness synovial explant viable for up to 14 days and to determine the responses of the synovial explant to an inflammatory stimulus such as Interleukin-1 (IL-1). The fibrous joint capsule and synovial membrane will be removed as full thickness plugs using aseptic technique in block from the joint, and placed in complete medium in a transwell system. Synoviocytes will be monitored for viability, composition, and secretory function through histology and cell function assays. Supernatant will be evaluated for the production of pro-inflammatory markers such as TNF α. Our hypothesis is that the biological and mechanical composition of a synovial plug containing fibrous capsule and intact synovial villi will produce a useful model for researching acute arthritis, and render us able to explore possible applications of mesenchymal stem cells (MSCs) in synovitis.

Conflict Minerals in the DRC: Addressing the Implications of a Dodd Frank Act Repeal

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In July of 2010, the US Congress introduced Section 1502 of the Dodd Frank Act, which intended to halt mineral-driven conflict in the Democratic Republic of the Congo by holding companies accountable for the purchase of conflict minerals. Seven years after the legislation's implementation, the administration of President Trump pushed for the rollback of Section 1502—a threat that has drawn backlash from human rights activists. Though the driving force behind the repeal may be to favor domestic corporations, there is evidence that the Dodd Frank Act actually has done further harm to the stability of the DRC. Previous papers have investigated this concern and suggested that the policy did backfire both in the short term (2011-2012) and the medium term (until 2015). The issue now becomes increasingly relevant with the ruling by the Securities and Exchange Commission in 2017 to suspend the enforcement of the conflict minerals policy. The purpose of this paper is (1) to provide a more recent analysis to previous quantitative studies by including data up to 2018 and (2) to observe short-term changes since the 2017 suspension. Methods in this study are quantitative: an econometric model is used to track different forms of conflict per region over time. The conclusion addresses potential impacts of the decline in enforcement.

Testing Insecticidal Efficacy of Diatomaceous Earth on Alphitobius diaperinus

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Alphitobius diaperinus, the lesser mealworm, is a cosmopolitan pest commonly found in commercial chicken houses. Lesser mealworms are resistant to many of the insecticides used to control their populations, so a non-chemical management method could be a viable possibility. This non-chemical treatment was tested in order to determine the dosage of Deadzone needed in order to yield a moderate to high mortality in Alphitobius diaperinus and prove to be a possible control in broiler chicken houses. Containers were filled with clean pine shavings with carrot and chicken feed for groups of 20 mealworms for adults and larvae of the lesser mealworm. The containers were given a treatment of Deadzone at 0.213g, 0.416g, and 0.852g per container based on dosage per surface area. A positive control of Tempo and a negative control was also treated in similar conditions. Mortality was checked daily for one week for all treatments. The average percent mortality for adult mealworms at 0.213g was 2%, for 0.426g it was 5.75%, and for 0.852g it was 9.25%. The average percent mortality for larval mealworms at 0.213g was 2%, for 0.426g it was 5.75%, and for 0.852g it was 9.25%. Abbott's formula and the Schneider-Orelli were used to account for mortality in the treatment populations due to sources other than the diatomaceous earth product. There was no significant efficiency for treatments because there was never 100% mortality for both adults and larvae, and there was no significant difference between treatment groups. It can be determined that the diatomaceous earth product Deadzone is an ineffective insecticide to use to manage the populations of Alphitobius diaperinus in broiler chicken houses.

Examining the role of hypoxia in Tribolium castaneum molting

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Insects grow discontinuously, acquiring nutrients during intermolt periods and then molting when sufficient nutritional status is achieved. The ultimate signal that an insect is ready to molt remains unclear, though changes in oxygen supply and demand have been proposed to play a role. Recently, a decrease in oxygen (hypoxia) has been shown to be an essential signal for molting in larval mosquitoes. Hypoxia is detected by the hypoxia-inducible factor (HIF) pathway, a highly conserved pathway in metazoans. It remains unclear if the developmental role of HIF is conserved more broadly across insects. To test this hypothesis, the role of HIF signaling in development of the red flour beetle, Tribolium castaneum, was examined. Expression of the HIF transcription factor HIF-∝ was silenced using RNAi and HIF-∝ inhibiting drugs. Due to poor survival of the drug-injected larvae, we focused on RNAi using dsRNA injections into late-stage larvae and observing molting outcomes. Fourth-instar larvae injected with HIF-∝ targeting dsRNA exhibited abnormal molting. 85% of treated insects failed to eclose successfully, relative to 80% successful exclosing in controls. Injected larvae that did attempt to pupate displayed highly abnormal phenotypes and failed to properly sclerotize. Few of the pupae from treated larvae eclosed into adults, and those that did eclose did so abnormally, with pupal fragments attached to their abdomen, wings, and elytra, and die soon after eclosing. Control larvae pupated and eclosed normally at high frequency (80%). Currently we are determining the degree of HIF-∝ expression in dsRNA-treated larvae. In the future, this work could provide valuable insights into insect developmental physiology, and possibly uncover a novel target for insect pest control.

Physiological Mechanisms Regulating Metabolic Efficiency in Modern Broilers

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A shift in consumer interest and agricultural policy has led to the removal of antibiotic growth promoters (AGPs) in broiler production. Without AGPs, alternative methodologies must be developed to maintain current broiler performance and feed efficiency. This experiment aims to identify physiological mechanisms correlating with higher metabolic efficiency. Male Ross birds were evaluated for their ability to convert feed into weight gain, and ranked using feed conversion ratio (FCR). Lower FCR indicates that the bird has greater metabolic efficiency, thus the six highest and lowest FCR birds were selected for experimentation. Plasma samples were collected from each animal to check nutritional condition and circulating hormone concentrations relevant to metabolic activity. Muscle, liver, jejunum, and cecal tonsil tissues were also collected to measure gene expression which may be contributing to improved performance. Hormone data demonstrated that low-efficiency birds had a 1.60-fold greater concentration of corticosterone and a 1.47-fold greater concentration of growth hormone in circulation. In contrast, insulin-like growth factor (IGF) was 1.27 fold greater in high-efficiency broilers. RT-qPCR results from muscle tissues corroborated IGF1 hormone levels, with low-efficiency birds only producing 57% as much IGF1 as their high-efficiency counterparts. Further studies will focus on differences in expression of genes involved in gut nutrient uptake and inflammatory status. The stark differences in hormone prevalence between high- and low-efficiency animals suggests their involvement in metabolic activity and value as targets to improve broiler production.

Metabolite Profiling to Determine Changes in Fruit Quality during Postharvest Storage in Blueberries

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Globally, the United States is the largest producer of blueberries and Georgia ranks among the top states in production. Once harvested, blueberries have a relatively low shelf life due to loss of firmness and infections from plant pathogens. Therefore, amidst the expanding market, it is important to understand critical factors that maintain fruit quality and nutrient content of the fruit in order to store them properly. Dr. Nambeesan and her students have previously categorized the postharvest shelf life of specific blueberry cultivars. The southern highbush (hybrids of V. corymbosum, V. virgatum, and V. darrowiiCamp), commonly grown in southern states, includes two contrasting cultivars Suziblue and Rebel. Suziblue stores very well postharvest while Rebel fruits store poorly. Fruits are intensive reservoirs of metabolites such as sugars and organic acids. During fruit ripening, many physiological changes occur such as a decrease in acidity and an increase in sugars and anthocyanins. These processes eventually determine the quality, texture, flavor, and nutrition during harvest and postharvest storage. If we can identify specific sugars and acids in ripe fruit that predict fruit quality during extended storage, we can use these metabolites as markers to produce fruit that can maintain quality during extended storage. The objective of my study is to understand the metabolic network within these two cultivars that exhibit differences in storage quality and storage time. Suziblue and Rebel blueberries were harvested at six different stages of ripening: green, pink, ripe, eight days postharvest, thirteen days postharvest, and twenty-one days postharvest. Three replicates were harvested for each time period. The variation of harvest times will provide information and understanding of how metabolite profiles change over time from ripening to postharvest storage. In order to analyze the metabolites present, a gas chromatography mass spectrometer (GC-MS) was utilized. A method for the GC-MS was created and implemented. Certain metabolites visualized from the two blueberry cultivars will be quantitatively calibrated according to standards. In addition, a comparative analysis of metabolites present at each harvest period of Suziblue and Rebel will be conducted. This research will aid in the understanding of metabolic regulation in blueberries throughout ripening and postharvest shelf life.

Assessing Impacts of Amendments in Worm Casting Based Soil Compositions

John McGinnis, Biology Major, BIOL; Presented in 2019

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Certified organic growers struggle to find a consistent greenhouse soil mix (GSM) for growing vegetable transplants. Worm castings are used in many ways by gardeners and, when managed properly, could also serve as a suitable growing media by organic growers. This experiment evaluated several alternative GSMs, to determine the effect of worm castings on the growth and overall health of kale transplants. GSM treatments included those with and without worm castings (of varying percentages), as well as perlite and ground pine bark. Treatments were as follows: worm castings alone; a 4:1 ratio of worm castings and perlite; a 4:1 :8 ratio of worm castings, perlite, and bark; ground pine bark alone; a 2:1 ratio of bark and perlite; and, a 2:1 :4 ratio of worm castings, perlite, and bark. The treatments containing only pine bark and a 2:1 ratio of bark and perlite served as the controls. Days to seedling emergence was not effected by the various GSMs. However, treatments containing worm castings developed their first set of true leaves in approximately 2 weeks. Treatments containing worm castings, bark, plus perlite, developed larger, fuller true leaves. Similarly, the 2:1 :4 ratio combination resulted in the tallest plants over a two-week period, and the treatments without worm castings with the lowest average heights. An Anova test was conducted between the final kale plant heights of the kale grown in each of the treatments resulting in a significant difference between at least one of the treatments. To identify which treatments were significantly different, a turkey-kramer post hoc test was performed. Preliminary results of this experiment suggests no difference between the two treatments with a mix of all three, and the blended treatments outperformed plants grown with the individual components. The data also suggests worm castings perform best when added to a soil composition that contains both perlite and bark. This is presumably because perlite and bark improve drainage and increase oxygen to the roots.

Effect of advancing the age at photostimulation on broiler breeder egg production and reproductive efficiency

Charles Meeks, Avian Biology Major, Department of Poultry Science; Presented in 2019

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Through intense genetic selection for rapid growth rate and feed conversion, the modern broiler can reach market weight in 5 to 6 weeks. This has led to birds which have insatiable appetites, which is beneficial for growth, but problematic for optimal reproductive performance in the parent stock of these birds. A major factor in obtaining optimal reproductive efficiency in broiler breeders, the parent stock, is attaining an ideal body weight target and good uniformity at photostimulation (20-22 weeks of age). To prevent broiler breeders from growing too quickly and becoming too large for optimum reproduction, their dietary intake is severely restricted. Feed restricting broiler breeders has been a successful management tool for increasing the reproductive efficiency of these birds. While the current restricted feeding programs, such as skip-a-day feeding, improve the economic efficiency of broiler breeder operations, this management practice of feed restriction impacts animal welfare. If birds were managed to permit earlier photostimulation, there would be an improvement in bird welfare as well as potential economic gains. Therefore a broiler breeder trial was conducted with two rearing growth curves/photostimulation ages to determine the effects of advancing target body weight attainment and photostimulating at 15 weeks of age on flock uniformity, egg production parameters, hatchability and fertility through 65 weeks of age. A total of 2,400 females and 360 male Cobb broiler breeder chicks were received at one day of age and half were reared on either an advanced growth curve to reach target body weight (2.1 kg) at 15 weeks of age (early photostimulation) or reared on the conventional growth curve to reach target body weight (2.1 kg) at 21 weeks of age (control). Although there were no significant differences between the two groups in terms of egg production or fertility, the total number of eggs and peak production was higher for the control when compared to the early photostimulated birds. The body weight of hens photostimulated at 15-weeks was elevated at pre-peak production, compared to the control hens, which resulted in a significantly greater ($p < 0.05$) number of double yolked eggs.

Response of creeping bentgrass (Agrostis stolonifera L.) and weed species to plant growth regulators

Madison Moore, Undecided; Minor in Turf Management Major, Department of Crop and Soil Science; Presented in 2019

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Plant growth regulators are often applied to creeping bentgrass putting greens to increase turfgrass color, putting green quality, and tolerance to several environmental stresses. However, frequent use of plant growth regulators may decrease creeping bentgrass recovery from wear and competition with common turfgrass weed species. Several plant growth regulators are utilized in turf and response of new creeping bentgrass cultivars is unknown. Therefore, the objective of our research was to evaluate the response of several creeping bentgrass cultivars and common turfgrass weed species to plant growth regulators. Research was conducted in the greenhouse complex at the Athens Turfgrass Research and Education Center in Athens, GA. Creeping bentgrass cultivars (‘Penncross’, ‘L-93’, ‘007’, ‘V-8’, and ‘TourPlay’) and weed species (large crabgrass and goosegrass) were seeded on February 20, 2019 into 4-inch pots containing a soilless media. Fertilizer (7N – 7P2O5 – 7K2O) was applied at the time of seeding at a rate of 24.4 kg ha-1 N. Greenhouse temperatures were maintained at 34/26 C (day/night) with average midday (1200 and 1300 hr) solar radiation ranging from 636 to 754 µmol m-2 s-1. Irrigation was supplied through an overhead irrigation system calibrated to deliver approximately 3.8 cm of water wk-1. Plants were maintained at a 2.5 cm mowing height and allowed to mature in the greenhouse over a one month period. Prior to plant growth regulator application, plants were mowed to 2.4 cm with hand-held grass shearers. Treatments were arranged in a 7 x 2 x 2 factorial (seven plant species x two plant growth regulators x two plant growth regulator rates) within a randomized complete block design with 4 replications. The experiment was blocked against a temperature gradient imposed from the presence of a wet wall evaporative cooling system at one end of the greenhouse. Plant growth regulators were applied using a CO2 powered spray chamber equipped with XR8002VS nozzle tips calibrated to deliver 187 L ha-1 at 221 kPa. Plant growth regulator treatments were applied on March 19, 2019 and consisted of trinexapac-ethyl (48 and 96 g ai ha-1) and prohexadione calcium (116 and 231 g ai ha-1). An untreated check was included for comparison. Plant pots were cut to 2.4 cm after two weeks of growth and above-ground plant tissue was weighed to obtain biomass (g). Growth inhibition was determined by comparing treated pots with the untreated check within each replication.

The Relationship Between Mouthguard Use and the Perceptions of Safety and Concussions in Collegiate Club Ice Hockey Athletes

Tourner Moseley, Biological Science Major, Department of Poultry Science; Presented in 2019

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Mouthguards are a mandatory piece of safety equipment in many sports where sports-related concussions and facial injuries occur, such as ice hockey. Though previously mouthguards were required as protective equipment, the American Collegiate Hockey Association (ACHA) now only recommends mouthguards be worn. The purpose of this research is to show the need for the study of mouthguards as a required piece of safety equipment in collegiate ice hockey players. This study aimed to explore ACHA athlete perceptions on the use of mouthguards for the prevention of oral or dental injuries, facial injuries, and concussions. A survey regarding athlete mouthguard perceptions was distributed to 190 Division III ACHA athletes via email. We hypothesized that most players would not wear mouthguards and most players would not believe wearing a mouthguard would reduce the likelihood of sustaining a concussion. Of the athletes who responded, 35.7% (30/84) reported wearing a mouthguard in some fashion while playing ice hockey; 96.7% (29/30) of those who reported wearing a mouthguard reported wearing them as directed by the manufacturer. 69.4% (59/85) of players believed properly wearing a mouthguard would reduce the likelihood of sustaining a concussion and 67.1% (57/85) of players believed properly wearing a mouthguard would reduce the severity of a concussion. The majority of survey participants perceive mouthguards to reduce the likelihood/severity of concussions, but only 36% wear a mouthguard during collegiate ice hockey. It is likely that non-compliance is due to discomfort and the inability to talk while mouthguards are in place.

Investigation of Chromosome Breaks in Canine Ocular Neoplasms of Melanocytes

Adrea Mueller, Honors Interdisciplinary Studies, Pathology Major, Veterinary Pathology; Presented in 2019

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In veterinary and human pathology, melanomas are neoplasms of melanocytes. They arise from melanocytes that occur throughout the body. These melanocytes are not uniform in their biological behavior and the neoplasms arising from them are similarly diverse. Benign melanomas originating from the epidermis in the skin in humans and animals have been renamed melanocytomas. These benign neoplasms originate from dermal melanocytes. The malignant counterpart, dermal malignant melanoma, is commonly seen in both people and animals and, in both species, often metastasize leading to death. Ocular melanocytic neoplasms originate from a different population of melanocytes than those in the skin, and in dogs, ocular melanocytic neoplasms are rarely malignant. Recent studies have shown that chromosome breaks are an indicator of genetic instability in melanocytic neoplasms and may serve as an indicator of malignancy potential. Our hypothesis is that terminology used for human and canine dermal melanocytic neoplasms may be incorrectly extrapolated to the eye. The goal of this study is to evaluate the presence of chromosome breaks in canine ocular melanocytic neoplasms compared to dermal melanocytic neoplasms and non-neoplastic tissue using canine ocular and dermal melanocytic cases previously submitted to the Diagnostic Ocular Pathology Service. Tissues were evaluated histopathologically for criteria that would allow categorization into benign or malignant neoplasia. Unstained sections were cut from each case block and the slides stained immunohistochemically to identify chromosome breaks. Diamidinophenylindole was used to identify the location of the nuclei within the cell. Tissue containing non-neoplastic melanocytes from both the eye and skin served as controls. Chromosome breaks that occur in nuclei will be quantified. Our expectations, based on previous literature, are that malignant melanomas will contain significantly more chromosome breaks than the benign and non-neoplastic cases, and that ocular melanocytic neoplasms will have fewer chromosome breaks than dermal melanocytic neoplasms. The results of this study will allow for better pathology-based prognosis of ocular melanocyte-containing neoplasms.

Predation of the Brown Marmorated Stink Bug Halyomorpha halys by the Chinese Mantis Tenodera sinensis Between Varying Life Stages

Daniel O'Connell, Entomology Major, Department of Entomology; Presented in 2019

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The objective of this research project was to understand how differences in life stages affect the predator-prey interactions between a multivoltine invasive agricultural pest, the brown marmorated stink bug, and a univoltine natural enemy found in the United States, the Chinese mantis. We performed laboratory predation trials in which we added mantids of the same life stage (1st instar, 2nd instar, or adult) to arenas containing 5 stink bugs of the same life stage (1st instar, 2nd instar, or adult) and recorded levels of stink bug mortality at 24 and 48 hours of exposure. Results were averaged and compared to average mortality among control groups, which consisted of 5 stink bugs of the same instar as the experimental group, but were not exposed to praying mantids. Our results indicated that the lowest average mortality occurred between 1st instar mantids and 2nd instar stink bugs, and the highest average mortality occurred between adult mantids and stink bugs. We believe that this research will help us better understand mantids as a natural enemy and biological control agent of the brown marmorated stink bug.

The effect of terpenoids on the foodborne pathogenic bacteria Salmonella Newport in vitro

Kristen Pisani, Animal Science Major, Department of Animal and Dairy Science; Presented in 2019

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Foodborne illnesses infect over 85 million people in America every year, and cause over 3,000 deaths. Salmonella is the second most common cause of human bacterial foodborne illness, and sickens millions each year. However, Salmonella can also cause illness in cattle, swine, and poultry. Therefore it is important to control Salmonella populations in food animals on the farm to ensure animal health and human food safety. Due to concerns over antibiotic resistance, producer profit, and ethical standards, the use of antibiotics to control Salmonella is not the best solution to this preharvest food safety problem. Consumers have expressed interest in natural control of these pathogens through various diet and management techniques. One of these particular techniques involves the use of natural antimicrobial chemicals such as essential oils, that have the ability to kill or slow the growth of pathogens as supplements or treatments both pre and post-harvest. The effect of the essential oils, camphor and eucalytol, on the growth of the foodborne and Animal Health pathogen, Salmonella Newport, was determined using a pure culture in vitro system. Pure cultures of S. Newport were grown overnight in Tryptic Soy Broth (TSB), and were inoculated into fresh TSB tubes (n = 3/essential oil concentration) that contained camphor or eucalytol at the following concentrations: 0, 0.54, 1.09, 3.28, and 9.85 mM. Optical density (600nm) was determined every 30 minutes to determine maximum specific growth rate (h-1) and total bacterial growth of S. Newport was compared against controls. Both Camphor and Eucalytol decreased ($P < 0.05$) maximum specific growth rates at concentrations > 3.28 mM. Total microbial growth was also decreased by the inclusion of these essential oils at concentrations greater than 3.28 mM. Collectively, our results indicate that the essential oils camphor and eucalytol, show significant antimicrobial activity against Salmonella Newport. These essential oils should be investigated further as a potential treatment to be utilized as a non-traditional approach to increasing food safety and animal health in food animal production, by examining their efficacy against other foodborne pathogenic bacteria and in studies that more accurately mimic conditions found in the animal gastrointestinal tract.

An Examination of Teacher Candidates Progress in Developing Written Student Learning Objectives and Assessments: The Final Year

Emily Potter, Agricultural Education Major, Department of Agricultural Leadership, Education, & Communication; Presented in 2019

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Agricultural Education teacher candidates face a series of unique challenges throughout the completion of their teacher preparation program, the most significant of those being the development of their personal teaching style. The main component in this process is the strengthening of their abilities to develop curriculum, specifically student learning objectives and assessments. The purpose of this study was to determine the progress teacher candidates made in their ability to accurately write learning objectives that correspond with their developed assessments. The objectives of this study are to determine the percentage of teacher candidates that write corresponding learning objectives and assessments; to identify the percentage of teacher candidates that can correctly write learning objectives with the ability to be assessed using the revised Bloom's Taxonomy model; and, to identify the progress made by individual teacher candidates at the development of learning objectives and assessments throughout their teacher preparation program. This study was conducted using two submitted assignments through the AGED 4350/6350 course. Data was taken from the teacher candidates first instructional segment submitted and the final learning segment submitted at the end of the indicated course in order to examine their growth throughout the semester. The learning objectives of each instructional segment were broken into two parts - the objective performance and objective criteria - and then compared to the formative assessment methods. In addition, the learning segment objectives were evaluated, when present, and compared to the summative assessment methods. Using the teacher candidates initial instructional segment, 64% of the learning objectives were accurately assessed using the indicated written formative assessment. The final learning segment indicated that 45% of the learning objectives were met by the formative assessments. The data also indicated that there was group improvement in the ability to write appropriate learning objectives according to revised Bloom's Taxonomy, and a decline in the ability to write objectives using the Performance-Cirteria-Condition method. It is concluded that there is a general group misunderstanding of the purpose of formative assessments, and a high understanding in writing learning objectives. It is recommended that the program provide added practice to students in developing and understanding formative assessments.

The impact of birth order, birth weight, and teat location on overall growth performance of neonatal pigs

Christian Powell, Animal Science Major, Department of Animal and Dairy Science; Presented in 2019

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This study looked at the impact of birth order, birth weight, and teat location to determine the overall growth performance of neonatal pigs from birth to weaning. We know that piglets establish a feeding order based on teat location within 72 hours of birth, but it is unknown what factors influence teat selection. It is our hypothesis that birth order and birth weight have an impact on which teats the pigs nurse. In the study 66 piglets from 5 litters where used to determine teat placement at birth, days 3, 7, 14, and at weaning. Teat placement was based on the location of the teats on the sow. Teats were numbered in pairs starting with the most cranial pair being number 1 and moving proximal down the udder ending at 7 or 8 depending on the number of teats present. Sows were monitored during their farrowing to determine the birth order of the piglets. At birth, piglets were ear notched with the pig number based on birth order and the number was written on it's back for easy viewing while piglets suckled. Piglets were processed fully following SOPs within 48 hours of birth. Teat placement was monitored, and weights were recorded birth, days 3, 7, 14, and at weaning. When looking at the weights of the piglets based on teat location it showed overall normal gain from birth to weaning among each set of teats. Teats 1 had an average weight of 3.3 lbs. (n=4) at birth and a weaning weight of 11.6 lbs. (n=8), with an average daily gain of 0.44 lbs. Teats 3 had an average weight of 3.4 lbs. (n=3) at birth and a weaning weight of 10 lbs. (n=7), with an average daily gain of 0.34 lbs. per day. Teats 5 had an average weight of 4.1 lbs. (n=2) at birth and a weaning weight of 10.7 lbs. (n=8), with an average daily gain of 0.35 lbs. per day. Teats 7 had an average weight of 3.9 lbs. (n=2) at birth and a weaning weight of 9.7 lbs. (n=5), with an average daily gain of 0.31 lbs. per day. The data collected from this study shows that there is no correlation between birth order and teat preference. As well as no correlation between birth weight and teat preference. When looking at the teat order of the pigs there was little variation in where they feed after day 7, and most piglets nursed the same teat location from day 3 of birth until weaning. Overall, this study showed that there was no correlation to birth order and birth weight and teat placement. Showing that piglets pick teats randomly and that we cannot determine why they nurse the teats that they do.

Analysis of Magnetic Resonance Imaging and Spatiotemporal Gait Parameters in Response to Tanshinone-IIA Loaded Nanoparticle Treatment in a Pig Model

Sowmya Radhakrishnan, Animal Science Major, Department of Animal and Dairy Science; Presented in 2019

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Stroke is a leading cause of long-term disability and death in adults in the United States and can lead to long-term physical impairments. Stem cell therapies, such as induced pluripotent-derived neural stem cells (iNCSs), are being tested pre-clinically as a potential treatment option for stroke due to their regenerative capabilities. However, iNCSs show reduced survivability in the cytotoxic environment of a brain after an ischemic stroke. Treatment with Tanshinone IIA nanoparticles (Tan-NPs) are expected to reduce inflammation and cytotoxicity post-stroke. The objective of this study was to determine if Tan-NP treatment will mitigate acute cytotoxicity and reduce motor function impairments in a pig ischemic stroke model. Stroke was induced via middle cerebral artery occlusion and an intracisternal injection of PBS (n=2) or Tan-NPs (n=2). was administered 1 hour post-stroke. Magnetic resonance imaging (MRI) was performed at 24 hours post-stroke (24hrPS). White matter integrity and diffusivity were assessed via fractional anisotropy (FA) maps and apparent diffusion coefficient (ADC) maps, respectively. At 24hrPS, FA maps showed less loss of white matter integrity in Tan-NP pigs as compared to PBS pigs (-19.66% vs. -30.11%, respectively) and ADC maps showed less reduction in diffusivity in the Tan-NP treated pigs as compared to the PBS pigs (-37.30% vs. -46.33%, respectively). In addition, gait analysis was conducted pre- and 2 days post-stroke (2dPS) to assess changes in motor function. At 2dPS, spatiotemporal gait parameters in Tan-NP pigs remained relatively unchanged while PBS pigs showed a decrease in cadence (116.96 steps/min vs 64.78 steps/min) and stride length (77.44cm vs 63.19 cm, respectively), an increase in cycle time (0.55s vs 0.93s, respectively) and step time (0.27s vs 0.49s, respectively), spend less time in swing % of cycle (43.22% vs 33.25%, respectively), and have reduced mean pressure (2.88au vs 2.67au, respectively) of the left front limb. These results indicate that the administration of Tan-NPs may decrease the cytotoxicity of the brain after stroke and lead to greater functional recovery. If Tan-NP treatment reduces cytotoxicity in the brain after stroke, this may lead to better survival and long-term integration of iNCSs after transplantation in future studies.

Effects of 25-OH and superdosing phytase on bone development and bone mineralization in broilers under heat stress

Macy Rowan, Biological Science Major, Department of Poultry Science; Presented in 2019

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Due to the demand in production, an increase in the growth rate and metabolism of commercial broilers has produced negative effects, particularly in the weakening of their leg bones. Heat stress has also contributed to the general welfare of the poultry by exacerbating these structural issues. An increasing scrutiny on the agricultural industry has made regulations and continuous research necessary to improve the general welfare of animals worldwide. This study was focused on the addition of 25-hydroxycholecalciferol (25-OH vitamin D3 or 25-OHD) and phytase into poultry feed to help with bone development and mineralization in broilers facing heat stress. Our research team hypothesized that the addition of phytase and 25-OHD will improve the bone quality and overall performance in heat stressed broilers. In this research, broiler starter, grower, and finisher diets were all adjusted with different levels of phytase and 25-OHD to birds randomly divided into four treatment groups. All birds received either single dose phytase (treatment one), super dose phytase (treatment two), single dose phytase and 25-OHD (treatment three), or super dose phytase and 25-OHD (treatment four). To study the effects of these supplements, growth performance was measured and bones were scanned using dual-energy X-ray absorptiometry (DEXA) to measure the bone mineral density. Although there were no significant differences observed within the growth performance parameters or DEXA scanning, there are measurements that numerically increased with each treatment group, such as in the calcein analysis bone growth. Additionally, treatments three and four provided numerically higher results, indicating that the combined use of phytase along with 25-OHD may be the correct path for future research rather than phytase alone.

Use of Micro-CT machine to study effects of 25-OHD and super dosing phytase on femur bone development and mineralization in broilers under heat stress

Macy Rowan, Biological Science Major, Department of Poultry Science; Presented in 2019

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An increase in the growth rate of commercial broilers has negatively impacted their bones by weakening the femur, tibia, and wing bones (humeri). Heat stress has also contributed to the general welfare of the poultry by worsening bone development and mineralization due to an increased metabolic rate. A study was conducted to evaluate the role of 25-hydroxycholecalciferol (25-OH vitamin D3 or 25-OHD) and super dosing phytase on broiler bone development and quality for 42-day heat stressed broiler birds. Bone quality was also observed with body weights for possible correlations. We hypothesized that 25-OHD and phytase would improve bone quality on heat stressed broiler birds throughout the six-week period. A total of 800 1-day old Cobb-500 male chicks were randomly assigned to four treatment groups with eight replicates. Treatments included: 1) single dose phytase; 2) super dose phytase; 3) single dose phytase + 25-OHD; and 4) super dose phytase + 25-OHD. Femurs were collected and scanned using Micro-CT for 3D structural analyses at days 22 and 42. In the overall findings, treatment groups fed the phytase with the 25-OHD had higher bone quality and mineralization at day 22; particularly treatment four had significant differences compared to the rest of the treatment groups. The cortical tissue volume, cortical bone volume, cortical bone mineral content, total bone volume, and total bone mineral density had higher values for treatment groups three & four, which means higher bone structure and mineralization compared to the other treatment groups at day 22. There were also more number, volume, surface, and porosity of closed pores for treatments three & four at day 22. For day 42, the overall bone quality and mineralization was similar among all treatment groups, but there were numerically higher values for the treatment four group. There were not any significant differences among treatments for the growth performance, but there were numerically higher values for treatment three & four groups which correlates with the bone scanning results. Phytase with 25-OHD additives could be used to potentially improve bone quality and mineralization on heat stressed broilers especially earlier in their growth period.

The Effect of PEMF Therapy on the Biomechanics of Performance Horses

Ashlyn Rustin, Animal Science Major, Department of Animal and Dairy Science; Presented in 2019

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Pulsed electromagnetic field (PEMF) therapy is a non-invasive treatment that involves pulsing electromagnetic fields in tissue to promote healing. While this type of therapy has become increasingly popular in human athletics, its usage for the preparation and recovery of equine athletes is relatively unknown. The purpose of this study is two-fold: (1) to validate a high speed motion capture system to assess kinematic changes in the equine gait, and (2) to evaluate the effect of PEMF therapy on limb kinematics in sound performance horses. Initial data was collected on three separate sessions of 10 UGA owned horses clicker trained to trot down a 15m concrete pad. Video footage was collected by three high speed cameras placed 10m past the recording frame and placed to record parallel and at 45-degree angles from each side of the line of travel. Temporal, linear, and joint angles were assessed on each horse at each time point to determine the repeatability of measurements. Following this analysis, 10 actively competing performance horses between the ages of 5-17 are assigned to one of two treatment groups, PEMF treatment (PEMF) and control (CTL). Horses maintain regular exercise for the 2 wk study, with PEMF horses receiving two scheduled treatment sessions one week apart (days 0, 7) while CTL horses receive two standard grooming sessions. Prior to beginning the study (day 0), all ten horses undergo a baseline kinematic analysis to be used as an individual control for each horse. For this analysis, each horse is fitted with markers placed on joint centers of the lower limbs and recorded at the trot using a high speed camera (XcitexTM, Woburn, MA) positioned parallel to the path of travel. Following baseline analysis, PEMF horses receive one 45 min full-body treatment administered by a certified MagnawaveTM practitioner. Kinematic data collection as described above is performed on all horses at days 0 and 7 before and after treatment and again on day 14. Data is analyzed using SAS version 9.4 (Cary, NC) with treatment and time as variables. Preliminary data indicate that temporal variables (swing, stance, and stride duration) have the highest accuracy, with optimization of camera angle important in collecting accurate joint angle and linear measurements. Future outcomes of this study should elucidate the effects of PEMF therapy on the performance of equine athletes in regards to the improvement of stride length and gait quality.

Determining Accuracy of a Novel Culture System for Mastitis Pathogens in Dairy Cattle

Jade Samples, Animal Science Major, Department of Animal and Dairy Science; Presented in 2019

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Mastitis, defined as inflammation of the mammary gland commonly caused by bacteria, results in substantial economic losses to the U.S. dairy industry. A group of pathogens, termed "environmental streptococci" (ES) and identified by standard culturing techniques, is rising. However, due to the limitations of standard techniques, including a diagnosis time of 48 hours, diagnosis of ES includes various species of true streptococci in addition to streptococci-like bacteria that may respond differently to antibiotic therapy. Thus, the ability to more accurately and rapidly determine the bacterial culprit is imperative. A new system, AccuMast®, claims to allow accurate differentiation of bacteria, including ES, in 16-24 hours using colorimetric differentiation of bacterial colonies. The purpose of the current study was to test the accuracy of AccuMast® in identifying and differentiating true streptococci and streptococci-like bacteria in milk from mastitic dairy cattle. Milk samples were aseptically collected from 8 cows that had previously diagnosed cases of ES mastitis. Samples were plated on standard blood agar plates and AccuMast® plates to make presumptive identifications. Results were then compared between the two culturing techniques. Bacterial isolates were also biochemically identified by the API®20 Strep system. As expected, all of the milk samples cultured on the standard blood agar contained ES. The AccuMast® system indicated that 5 of the 8 milk samples presented as true streptococci, with the other 3 being inconclusive. While AccuMast® appeared more accurate than standard techniques, difficulties were noted during the present study which may preclude adoption on a farm. These include difficulty in differentiating shades of color, potential differences depending on incubation time, and presence of colorless colonies that did not fit the identification system. While standard-plating techniques could not identify beyond ES, the presumptive genus matched the biochemical test in 75% of the cases. Moreover, biochemical testing revealed that only 3 of 8 samples (an accuracy of 37.5%, $p=0.004$) were correctly identified by AccuMast®, bringing into question the validity of AccuMast®. In conclusion, AccuMast® plates may be a viable alternative to current methods given the reduced time to identification, but when compared to biochemical testing, sheds doubt on the accuracy of the system.

The Role of Methylation in Embryonic Development of Oncopeltus Fasciatus

Zachary Sanchez, Entomology & Cellular Biology Major, Department of Entomology; Presented in 2019

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Mammals such as humans possess highly methylated DNA: however, DNA methylation in insects is usually at low levels or undetectable. It has recently been found that Oncopeltus fasciatus (milkweed bugs) have a significant level of methylation. It is known that dnmt1 is the main gene responsible for maintaining methylation through cell divisions. Previous studies have revealed that females treated with ds-Dnmt1 have reduced fertility, inability to produce fully-formed eggs, and an abnormal cellular presentation of the follicular epithelium which envelops the oocyte. To understand the developmental phenotype, an investigation was launched to understand the role of dnmt1 in embryos. I believe that DNTM1 is essential for the development of embryos prior to gastrulation. By examining the embryos of RNAi treated females before and after gastrulation, it is seen that there is a difference in developmental progress. It appears development ceases shortly after blastocyst formation and not able to continue to gastrulation. The analysis was performed with confocal microscopy to look at the embryo itself and Real-Time qRT-PCR is used to quantify the presence or absence of dnmt1 expression in these embryos. I speculate that methylation plays more of a role in the development of embryos rather than as a transcriptional regulator as seen in mammalian systems.

Reproductive toxicity of RoundUp residues in broiler breeder roosters

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RoundUp Ready cultivars constitute a large portion of the crops grown in the United States for animal feed due to their relative ease of production contributed by their resistance to RoundUp and other glyphosatebased herbicides (GBHs). As a result, these feedstuffs are at risk of increased exposure glyphosate throughout production. Levels of these residues are maintained well below their lethal dose, but little work has gone into investigating the tissue-specific toxicity of GBHs. The purpose of this experiment was to evaluate the toxic effects of RoundUp and its active ingredient, glyphosate, on broiler breeder rooster sperm production. A total of 144 Cobb 500 broiler breeder roosters were assigned to individual cages at 25 weeks old and allowed 2 weeks to adapt to cages and a basal diet. At 27 weeks old, roosters were randomly assigned to 1 of 4 treatment diets: 0.30% humic acid (HA), control, 1.25mL RoundUp added per kg of feed (low RU) and 2.5 mL RoundUp added per kg of feed (high RU). An HA treatment was used parallel to the control diet as HA is a reported neutralizer of the glyphosate already present in the basal feed. The treatment period lasted 18 weeks and was followed by a 4-week recovery period on basal feed. Following 13 weeks of treatment, at 40 week of age, 2 representative birds from each treatment were euthanized and testicular samples were collected and prepared for histological evaluation. At the conclusion of the experiment, following 4-week recovery period with control feed, testicular samples were taken from 2 representative birds and prepared for histological evaluation. The epithelial height and diameter of the seminiferous tubules were analyzed using ImageJ. The results showed that added herbicide tended to decrease epithelial height (control = 10.33 ± 1.13 um; HA = 11.1 ± 1.30 um; low RU 8.253 ± 1.12 um; high RU 9.68 ± 1.123 um,) and increase luminal diameter (control = 39.53 ± 2.23 um; 34.227 ± 3.2 um; low RU 41.253 ± 2.12 um; high RU 42.98 ± 1.253 um). The HA treated group had an increased ($p < 0.05$) in epithelial height and decreased luminal diameter when compared to the other treatments. A greater degree of vacuolation in Sertoli cells was present in treatments that had added herbicide ($p < 0.05$). These results indicate that presence of RoundUp residues in the feed of broiler breeder stock may contribute to the gradual decline in broiler breeder fertility.

An Analysis of the Impact Globalization Has Had on American Cotton Producers

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The goal of this paper is to begin an assessment of the impact globalization has had on American cotton producers by identifying potential variables by which impact can be measured. To begin this paper, we first established whether or not a proper analysis of how globalization has impacted American cotton producers exists by conducting a literature review of all related research, and by conducting interviews with industry experts. Next, we attempted to identify several ways by which the impact of globalization on American cotton producers can be measured, both by asking industry experts for their opinions and by conducting a basic analysis of historical price data to identify trends which warrant further study. By conducting our literature review we saw that though there are several major studies which look at how globalization has impacted other points in the American cotton supply chain (primarily the translocation of the textile industry) most of those were conducted 10+ years ago and none of them focus on American farmers. In our interviews with industry experts we were told that the creation of the WTO has greatly impacted the U.S. government's ability to stabilize its cotton market with price supports and crop insurance, and that the promise China made upon entry into the WTO to open its domestic markets to international trade has not come to fruition. We learned that due to improved agriculture implements, seeds, and fertilizers developing countries have been able to become much more productive producers of cotton which certainly impacts American producers. Finally, we discovered that income data for American cotton farms for the past several decades is not easily accessible for analysis, and that industry experts believe price volatility is a variable which also deserves further study. Through this research project we were able to ascertain that further research is needed in order to understand the real impact globalization has had on American cotton producers. We identified price volatility as a variable that should be further studied for its potential impact on farmers and established that surveys will need to be taken of cotton farmers to develop a database of farm income data for the past several decades in order to analyze the true impact of globalization on American cotton farmers.

Girls' Perceptions of Health and Well-Being: An Exploration of Factors that Impact Recruitment Into the Biological and Health Sciences

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Girls in low-income, inner city or rural areas are at a disadvantage related to healthcare knowledge and resources. There is high precedence of malnutrition, disease, and mental illness among this population. An open dialogue is needed with girls in these areas to provide them with what is needed to lead healthy lives and acknowledge their full potential. This research provides an understanding of what girls in these areas know about women's health, their perceptions of healthcare support, and options for careers. This study gleans insights on best-practices for outreach programs geared toward enhancing the knowledge and interests of girls from disadvantaged areas. I executed data collection using the focus group approach of middle schoolers who have not participated in a STEM-related CPB in the aforementioned locations, and analysis of data collected. Objectives guiding this project are: 1) Determine participants' knowledge about female health issues (e.g., nutrition, mental health, reproduction, disease); 2) Determine participants' perceptions on support related to health and wellbeing; and 3) Determine participants' perceptions about biological and health sciences careers. This research gained information on girl's interests and support related to engagement in health sciences related activities; as well as obstacles that they face that may obstruct them from engaging in health sciences related activities.

A Breakeven Yield Analysis of Wild Hog Control in Row Crops

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Wild hogs are known to cause damage to agricultural crops throughout the United States, with some estimates upwards of $1.5 billion. Commodities affected often include corn, soybeans, wheat, rice, sorghum, and peanuts. Further damage is often sustained to infrastructure and the environment. At the present time there has been little done on a widespread scale to address this problem. Most prevention has taken place at small local levels or from individual farmers. Some of that is due to limited funding for wild hog control and minimal incentives for private funding. When a farmer pays to control wild hog populations it provides a positive social benefit to neighboring farmers and the overall community. During a time of depressed commodity prices and rising input costs, farmers are faced with the challenging decision of whether to engage in control mechanisms when there is a lack of certainty they will directly benefit from such activities. Thus personal gain (or a reduction in expected loss) must be measurable to avoid issues of free-rider problems, i.e. letting the neighbor spend the money on control to one's own benefit. It is with this understanding that farmers are more likely to engage in control mechanism. Using data collected in 2014 by the United States Department of Agricultural National Agricultural Statistics Service, I estimate the average cost of different control mechanisms used by farmers engaged in row crop production. I find that average reported expenditures on control methods ranged from about $400 for non-electric fences to almost $2,000 for shooting pigs on sight. Given a distribution of prices, the additional yield necessary to cover these additional costs of production are determined for peanuts, corn, soybeans, and wheat. Alternatively, one could look at this additional yield as the potential damage threshold necessary to engage in control mechanisms. Any yield loss greater than a particular threshold results in an incentive to engage in that particular control activity if that loss can be prevented. Farmers are expected to be able to use this information to make better informed decisions on whether to engage in preventive control mechanisms prior to sustaining economic losses from wild hog damage.

Creation of a Website Platform to Present Research and Results from the UGA AgWET Project

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In an effort to better communicate research conducted at the University of Georgia within the College of Agricultural and Environmental Sciences, the revised purpose of this project was to create and maintain a website for the ongoing Agriculture Water Efficiency Team (AgWET) project based on research-supported communication plan and integration. The AgWET project was developed to address the implementation of technology to efficiently utilize water on Georgia crops. Using soil moisture sensors to make irrigation scheduling decisions, the AgWET project was comprised of three unique teams of researchers: 1) Technology subgroup; 2) Social Science subgroup; and 3) Outreach and Education subgroup. In effort to cohesively gather and share the research created by all three subgroups, this research sought to perform a comprehensive literature review of effectively communicating scientific information to audiences through websites to engage various audiences with the research project at UGA. Through this review, along with collaboration from web designers in the Office of Communications and Creative Services, viewers were able to be directly targeted based on average reading level and content structural preferences. It was necessary to first build a cohesive website framework that is easily accessible and understood for those whom have never visited the site before. This initial research-based framework is adaptable and will be able to be updated with new information and material as the overall AgWET project persists. The current home page of the site features the project logo, a message detailing the overall goal of the project, and a collaborated video highlighting the project. Through the navigation bar, viewers can access the respective sections for the three unique research teams, where information on each respective page will be organized to best suit the materials gathered. Finally, the site will feature a contact page with an embedded form to contact the AgWET researchers for more general information, as well as profile highlights and contact information for the project team leads.

Isolation of Microbial cultures from different carbon sources to assess organic matter stability in soil

Joshua Thedford, Environmental Chemistry Major, Department of Crop and Soil Science; Presented in 2019

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Soil organic matter is comprised of many different types of carbon and different sets of microbes have adapted to decompose that carbon. I am working on a study with the long-term goal of understanding how organic matter persists in soils. One of the main mechanisms for this persistence appears to be the association of organic matter with small, high-surface area iron minerals. This project's broad outline involves making co-precipitates of iron and organic matter that likely reflect these persistent forms of organic matter in soils and then measuring the microbial availability of that organic matter. In order to accomplish this, I am conducting the key step of isolating microbes that can decompose different types of organic matter. I will then test these microbial isolates ability to decompose carbon in the iron-organic co-precipitates. I will measure the decomposition through the production of $CO2(g)$, as that is the end-product of microbial decomposition of the organic matter. I will determine the growth rates and general behavior of the microbial communities that I isotope from the soil using different carbon sources and also quantify the microbial communities using 16s DNA sequencing. First, I will isolate a microbial culture from an active, carbon-rich rooting zone by placing them in solutions of selective media with either 1mM or 3mM of glucose, sucrose, or lactate. Microbial growth will be measured using optical density measured every 12 hours over a 3-day period. After this, I will test the rate of decomposition of the iron-organic co-precipitates by these different isolated communities and also use 16s DNA sequencing to identify the microbial community members. Overall, my work will help identify which microbial communities are best suited to decompose the most persistent and resistant organic matter in soils.

Effect of RNAi Control on Diachasmimorpha longicaudata Entomopoxvirus in Parasitoid Wasps

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As a parasitoid wasp, Diachasmimorpha longicaudata completes part of its life cycle within a host, usually a tephritid fruit fly, that it shouldn't use "it" very vague eventually kills. D. longicaudata also has a unique symbiotic relationship with Diachasmimorpha longicaudata entomopoxvirus (DIEPV), utilized by the wasp to weaken the immune system of its larval host. Unlike pathogenic viruses, the pattern of replication for DIEPV is tied to wasp development and is tissue specific, meaning it may be under control of its wasp host. Previous research shows that DlEPV virus replication in D. longicaudata plummets at one day past emergence, but the mechanism of control is remains unknown. My research will focus on answering the question, "Is there control on the part of the D. longicaudata wasp to regulate DIEPV replication using RNAi from the Argonaute-2 protein?" Argonaute-2 is produced by ago2, which is the gene at the key step in the RNAi pathway. To reduce Argonaute-2, ago2 was knocked down and the effect on virus replication was observed to observe. The methods pursued were to first create a RNAi knockdown of ago2 by the injection of dsRNA into wasps, then use quantitative PCR to check for knockdown in dissected venom glands. Finally, viral replication was quantified by checking the number of genome copies, as well as the transcription of key viral genes. Results are shown using QPCR counts of ago2 mRNA copies in both control and knockdown samples as a metric to determine if RNAi is effective. Lower counts of mRNA will show that the RNAi pathway can work in Diachasmimorpha longicaudata, proving RNAi as a useful tool for future research in this species. Lower mRNA also shows that Argonaute-2 may have a role in reducing and controlling DIEPV replication in the wasp. These results are significant because it allows us to identify how wasps are controlling virus replication to maintain mutualism.

Geospatial Vehicle Routing of Stochastic Gleaning Opportunities of Post-Harvest Food Losses

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We analyze the state's agricultural budget data in order to quantify in-field food losses at the county level and consider the potential for recovery of surplus production. Gleaning with the 55+ fleet of semi-trucks from the Georgia Food Bank Association is a variant Vehicle Routing Problem (multi-vehicle pickup and delivery) with stochastic customers, fixed multiple depots, and hard time constraints. This coalescence of variables renders traditional branch-and-bound techniques ineffective. We conduct a county-level geospatial analysis of food loss proximity to Georgia's food banks, to demarcate discrete depot routing regions. We test various algorithms to optimize the waiting heuristic for dynamic re-optimization after an a priori best route is established with stochastic pickup information. Our geospatial near-analysis finds a mismatch on the county level between urban food insecurity and rural agricultural production; GFBA assignment of counties to food distribution regions does not match distances.

The Effect of Escherichia coli on Development of Kissing Bugs

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The kissing bug, the main vector of Chagas disease, requires the bacterial symbiont Rhodococcus rhodnii for its growth and development. In fact, without R. rhodnii, the kissing bug is unable to molt and advance through the instars, leading to a premature death. Kissing bug numbers have been effectively controlled through pesticides, but multiple occurrences of resistance have been reported. Paratransgenesis is an approach to controlling population numbers or disease transmission through the manipulation of bacterial symbionts. This technique has not been adopted in the field for multiple reasons, one being the major gap in our understanding of the functions of the normal microbial flora in kissing bugs and how the microbial flora interacts with other microbes such as Escherichia coli. We investigated if E. coli can persist in the gut of first instar Rhodnius prolixus nymphs that hatched from surface sterilized eggs. We also tested the ability of E. coli to rescue the development of sterile nymphs and if R. rhodnii and E. coli can co-exist in the gut. Nymphs were fed blood containing R. rhodnii only, E. coli only, and a mixture of both. Over the next 21 days, kissing bug growth and development was monitored daily. DNA extractions were taken, and qPCR was used to estimate the number of each type of bacteria during different developmental stages. Nymphs fed E. coli alone suffered developmental delays and other developmental consequences.

The effects of Ethanolamine on E. Coli O157:H7 and S. Typh

Madison Walker, Animal Science Major, Department of Animal and Dairy Science; Presented in 2019

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One of the most impactful foodborne pathogens in the food supply includes Enterohemorrhagic Escherichia coli O157:H7 (EHEC) which is best known by its most famous member E. coli O157:H7. This deadly foodborne pathogen causes bloody diarrhea and hemorrhagic colitis, and can even cause death. Escherichia coli O157:H7 lives in the gut of cattle and other ruminant animals, where it does not cause illness. Many microbes found in the gut of food animals communicate via quorum sensing using signaling molecules that are compounds found in the gastrointestinal tract. One of the compounds that has been shown to act as a signaling or virulence regulatory molecule in EHEC is Ethanolamine. By interfering with microbial communication, we can potentially inhibit pathogen growth and virulence. Ethanolamine is an amine/alcohol that is derived from decarboxylation of the amino acid serine, and acts as an antihistamine. Ethanolamine can also be used by E. coli O157:H7 as a nitrogen source in nitrogen limiting conditions. In the present study, Pure cultures of E. coli O157:H7 were grown overnight in aerobic Tryptic Soy Broth (TSB), and were inoculated into fresh TSB tubes (n = 3 tubes per concentration) that contained ethanolamine at the following concentrations: 0, .02302 M, .04605 M, .0921 M, .1842 M, and .3684 M. Optical density (600nm) was determined every 30 minutes to determine maximum specific growth rate (h^{-1}) and total bacterial growth of E. coli O157:H7 was compared against controls. Ethanolamine did not affect ($P > 0.1$) growth rate of E. coli O157:H7 in this rich growth medium. Pure cultures of E. coli O157:H7 were grown overnight in an anaerobic minimal nutrient growth medium to induce E. coli O157:H7 to struggle. Ethanolamine was anaerobically added to anoxic minimal media tubes containing ethanolamine at the following concentrations: 0, .02302 M, .04605 M, .0921 M, .1842 M, and .3684 M. Optical density determination again demonstrated that ethanolamine did not impact the growth rate of E. coli O157:H7 in these fermentations. Collectively our results indicate that the use of ethanolamine to regulate growth of E. coli O157:H7 to reduce this pathogen in food animals needs considerable refinement.

Effects of camphor from Juniperus ashei on the growth rate and survival of Salmonella Typhimurium, S. Newport, and Escherichia coli O157:H7

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Escherichia coli O157:H7, Salmonella Typhimurium, and S. Newport, are foodborne pathogenic bacteria, linked to food animals, that pose a significant risk to human health around the world. Intervention strategies that reduce pathogenic bacterial populations in animals prior to harvest have the potential to greatly enhance food safety. Camphor is a monoterpene essential oil that is naturally produced in many plants that food animals consume, including Juniperus ashei and Rosmarinus officinalis. Camphor killed and slowed growth of E. coli O157:H7, S. Typhimurium, and S. Newport in pure culture growth experiments. Camphor treatments varied in concentration from well below biologically-encountered levels (0.4975 mM) to potentially dangerous (to a consuming animal) levels (15.92 mM). TSB medium tubes containing E. coli O157:H7 and Salmonella (with duplicates in the original run and triplicates in the second) were incubated at 39 °C and growth rates were determined to compare maximum specific growth rates. For each bacterial species examined, 11 camphor concentrations were used. Camphor solutions(Sigma Aldrich Chemicals, St. Louis, MO, USA) was prepared by dissolving into 95% ethanol, and equivalent volumes of ethanol were added to all tubes, including controls. The statistical interation model was used to determine the effect of concentration and time on bacteria population. y=+1x1+2x2+(x1-x1max)(x2-x2max)(ki). Collectively, our results suggest that camphor could be an effective preharvest intervention strategy to reduce E. coli O157:H7 and Salmonella populations in cattle before entry to the food chain.
ln(abs)=.0959 time(hr) -.0782 Conc (mM) - 2.393+(time-2.393)(Conc-4.216)(-.0724)
ln(abs)=.287 time(hr) -.1896 Conc (mM) - 1.676+(time-2)(Conc-3.085)(-.0916)

To Eat or Not to Eat: the Athens Community's Willingness to Try Edible Insects Based on Prior Knowledge, Preferences, and Biases

Anne Whatley, Entomology Major, Department of Entomology; Presented in 2019

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While eating insects may seem revolting to many Westerners, over two billion people eat them regularly. As an important source of protein, vitamins, and minerals, over 1,900 species are eaten world-wide. It was hypothesized that adults with prior knowledge of edible insects as an alternative protein source will be more willing to try insects than those who did not have any previous exposure. To examine peoples' perceptions about edible insects, a survey about the importance of insects was taken by many members of the community. One question asked if they would like to try a dish containing edible insects. Those who expressed willingness to try were offered two similar chocolate chip cookie recipes: one contained cricket powder, the other with a whole, roasted cricket. Those who tested the samples took a post-survey to express their opinions and preferences about the cookie(s). The number of individuals who tried the cookies, which option they chose, and their opinions about edible insects after consumption were all recorded to determine if there was a shift in perception about entomophagy after trying an edible insect dish. The results of the matrix style survey questions will be statistically analyzed to show any trends within the Athens community. It is anticipated that those who knew more about edible insects beforehand will be more willing to try insects than those who had no previous exposure. It is further expected that the cookies containing insect powder will more popular than cookies with whole insects. Overall, crickets contain as much protein as beef, gram for gram, while emitting less greenhouse gasses and reducing water, land, and feed usage. With growing populations and a decrease in arable land, insect farming could provide a sustainable alternative to livestock farming to meet future global food demands.

Role of the putative type 3 effector HopAF1 (Aave_1373) in the virulence of Acidovorax citrulli, the cause of bacterial fruit blotch of cucurbits.

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Bacterial fruit blotch (BFB) is a destructive disease of cucurbit crops, such as watermelons and melons. BFB can result in up to 100% fruit yield losses by inducing symptoms like dark-green, water-soaked lesions on seedlings and fruit rot. BFB is caused by the gram- negative bacterium, Acidovorax citrulli. However, despite its destructive potential, relatively little is known about the molecular mechanisms of pathogenicity and virulence of A. citrulli. HopAF1 is a type III system secreted effector protein that is conserved in the genomes of many diverse plant pathogenic bacteria. In Pseudomonas syringae, HopAF1 was reported to suppress plant immunity by blocking ethylene production in Arabidopsis thaliana. Interestingly, all A. citrulli genomes screened thus far, contain a homolog of HopAF1, but most other plant pathogenic Acidovorax species lack this effector. The objective of this work was to determine if the A. citrulli HopAF1 homolog, Aave_1373, is important for virulence in melon plants by interfering with the plant's ability to produce ethylene. For this study, A. citrulli population dynamics were measured in melon seedlings after inoculation with wildtype strain AacA5 and the Δ1373 mutant (AacA5Δ1373), using quantitative real-time polymerase chain reaction (PCR) assay. The experiment was conducted twice and each treatment was replicated 3 times. The statistical significance of differences between the two strains was determined according to the Student t-test. AacA5Δ1373 reached statistically lower population levels in melon seedlings than AacA5. The results indicated that Aave_1373 contributes to A. citrulli virulence on melon seedlings. To investigate how Aave_1373 contributes to A. citrulli virulence, we used gas chromatography with flame-ionization detection to measure ethylene production of inoculated melon seedlings. Out of the three trials, we detected an ethylene peak in only one replicate. At 24 h after incubation (hai), one melon seedling inoculated with AacA5Δ1373 showed a peak for ethylene at 1.5 (area: 348). At 48 hai, the ethylene signal peak areas for AacA5Δ1373 and AacA5 were 551 and 288, respectively. Thus far, results from the ethylene production experiments are inconclusive. Further trials are in progress to determine the effect of Aave_1373 on A. citrulli induction of ethylene released by melon seedlings.

Quality Change in High Pressure Processed Beef: A Study on How Edible Coatings and Spices Can Mitigate the Effects

Vivian Yang, Food Science Major, Department of Food Science and Technology; Presented in 2019

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Contamination of beef with Shiga toxin producing Escherichia coli (STEC) poses a significant safety risk to Americans, who have the fourth highest beef consumption in the world. The first major outbreak from STEC contaminated beef occurred in 1993, and outbreaks remain a constant threat. Although possible contamination of beef causes many cases of illness each year, methods to preserve the quality of rare beef while ensuring safety are still in development. One of the most promising ideas for safely processing raw beef is high pressure processing (HPP). Unfortunately, studies have repeatedly found that HPP treatment can cause textural and visual changes that may affect the consumer acceptability of the processed meat. The objective of our study is to minimize the color change that occurs in raw beef during high pressure processing. This study attempted to minimize the color change in raw beef during HPP by creating a series of tallow based edible coatings with or without spice colorants that were applied to the outer surface of beef patties. Patties (coated and control) were processed at either 450 MPa for ten minutes, 600 MPa for five minutes, or 600 MPa for ten minutes with three replicates prepared for each treatment. The effectiveness of the various coatings at minimizing color change during HPP was determined by measuring the L*,a*, and b* values of beef samples using a handheld colorimeter before processing, immediately after processing, and after one week of refrigerated storage. Color change in the samples was compared by calculating the average Delta E value that quantified the perceived color change in each sample from pre-processing to after one week of refrigeration post-processing. Results reveal that for the more gentle treatments (450 MPa x 10 min and 600 MPa x 5 min), tallow-coated and turmeric-coated patties exhibited the least color change (initial color pre-processing vs. of after one week of refrigerated storage). For the most extreme treatment (600 MPa x 10min) the plain tallow and chili powder/ tallow coated patties exhibited the least color change. These findings indicate that lower processing pressures and a tallow-based coating are effective in mitigating the color changes that occur in beef patties during high pressure processing.

The Effect of Prenatal Exposure to Bisphenol-A (BPA) and Other Endocrine Disrupting Chemicals on the Sprague Dawley Rat Development

Ansley E Almond, Applied Biotechnology Major, Department of Entomology; Presented in 2018

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Obesity, heart disease, and diabetes are more prevalent in minority populations in the U.S. This could be due to the higher levels of exposure to endocrine disrupting chemicals (EDCs) found in plastics, the environment, and a variety of other sources. These exposures could occur anytime during the lifetime of an individual, however, exposures during the prenatal period have a greater potential for causing harm during development and in adulthood. We hypothesized that prenatal exposure to EDCs would impair development of the offspring, predisposing them to metabolic and cardiovascular disorders in later life. To test this, Sprague Dawley dams were treated orally with EDCs such as Bisphenol A (BPA; 5µg/Kg BW), Bisphenol S (BPS; 5µg/Kg BW), Bisphenol F(BPF;1µg/Kg BW), Bis(2-ethylhexyl) phthalate (DEHP; 7.5mg/Kg BW), or a combination of BPA and DEHP from day 6-21 of gestation. These doses of bisphenols are much lower than the total daily intake doses suggested by the EPA. After weaning at 3 weeks, both male and female offspring were followed until twelve weeks of age, allowing us to observe them from when they are juveniles through adulthood. Body weights, food and water intake were measured once every week and compared to control rats. Results indicate that prenatal exposure to EDCs did not affect food or water intake in the offspring. However, there was a significant difference in body weights. When compared to control rats, females exposed to BPA + DEHP, BPS and BPF, and males exposed to BPA + DEHP, BPS and BPF weighed less on average. Depending on the gender, the endocrine disrupting chemical with the greatest effect varied. We observed that the males were most affected by BPS and the females were most affected by BPA + DEHP. These results indicate that prenatal exposure to low doses of EDCs can have long-lasting effects on the development of rats through adolescence and adulthood potentially setting the stage for non-communicable diseases in later life.

Analysis on the Outlooks of Alternative Protein Sources with Blind Tastings of Food Samples Containing Cricket Powder

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Crickets (Acheta domesticas) are interesting creatures that are helping increase sustainability while serving as another food source for the growing population. These insects are eaten by 2 billon people in the world and encompass a large amount of protein, minerals, and vitamins such as omega 3, calcium, B12, and 6 fatty acids. This research focuses on data collection on individual's views on insects as an alternative food source with a pre and post survey administered during a blind taste test. The survey will be distributed to at least one hundred participants for the analysis. Surveys will also be categorized based on an individual's prior knowledge and comfortability with insects; for example, an entomology student's form would be separated from a student that has a different major that might have less of a well-informed basis of insects. After the tasting is completed the participants will be informed of the ingredients in the food they have tasted as well as played an educational video about the growth of insects in the edible industry and their benefits to the growing population. Once this is completed the post-survey will be administered with the goal of trying to find out if exposure to insect base foods effects people's acceptance of alternative food sources.

The Impact of Genetic Selection on the Conversion of Vitamin D to Active Form and the Metabolism of Calcium and Phosphorus

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In the commercial poultry industry, genetic selection of broiler chickens for the past 60 years has led to birds with a much faster growth rate. This has caused the modern broiler to have more skeletal problems, in particular leg weakness. Vitamin D plays a significant role in calcium and phosphorus homeostasis as well as bone formation and development. However, there is no published works on the impact genetic selection has had on the enzymes involved in the conversion of dietary vitamin D to its active form in the liver and kidney, or on genes involved in calcium and phosphorus metabolism. UGA maintains a flock of birds known as the Athens Canadian Random Bred (ACRB) birds, that represent broiler chickens before intensive genetic selection began, which allow for the changes in broiler chickens that are associated with genetic selection to be studied. The purpose of this project was to determine the impact that genetic selection has had on the metabolism of vitamin D in the liver and kidney, as well as receptors for hormones involved in calcium and phosphorus metabolism. Kidney and liver samples of eight ACRB and eight Cobb broilers were collected at day 21 posthatch. Total RNA was extracted from tissues using the RNeasy Mini kit and quantified using UV spectrophotometry. One microgram of total RNA was reverse transcribed, and quantitative real-time PCR was used to evaluate mRNA levels for genes involved in conversion and activity of vitamin D [vitamin D 25-hydroxylase (CYP2R1), vitamin D 24-hydroxylase (CYPR24A1), and vitamin D receptor (VDR)]. Levels of mRNA for hormone receptors involved in calcium and phosphorus homeostasis [parathyroid hormone receptor (PTH1R and PTH3R) and calcitonin receptor (CALCR) were also measured. mRNA levels for CYP2R1, the gene that codes for the enzyme responsible for the activation of vitamin D in the liver, were found to be higher in the liver of the ACRB birds compared to Cobb. Furthermore, CYP24A1, a gene that codes for the enzyme that converts vitamin D from its active to inactive form, was found to be much higher in Cobb broilers. One of the parathyroid hormone receptors, PTH1R, was higher in the liver of ACRB birds than the Cobb birds. PTH3R was more frequent in both the liver and the kidney of the ACRB broilers. These results indicate that altered vitamin D metabolism and related hormonal signaling have been compromised by genetic selection and may contribute to the skeletal weakness in modern broiler chickens.

Terminal Leaf Die-Back Disease of Pecan is Caused by a New Fungal Species in the Genus Neofussicoccum

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Neofusicoccum, a member of the Botryosphaeriaceae family, is a fungal pathogen of woody hosts. It is a threat to pecans (Carya illinoinensis) throughout the South as it damages the above ground parts of plants. Terminal die-back is the most common symptom, resulting in dying or browning of terminal leaflets, and eventually entire compound leaves, scattered throughout a tree. The pathogen often remains dormant until the host's immune response is suppressed by environmental factors such as drought. Some orchards in Georgia have begun displaying terminal die-back. The causal fungus has been identified as a member of the genus Neofusicoccum, but the species is not yet known. Additionally, the disease has become more prevalent in Texas, and we are interested in determining if the casual fungus is the same as the species in Georgia. To determine the species of the disease, we studied the morphology and phylogenetic relationship of samples to those of known species such as Neofusicoccum ribis. Isolates were grown in order to examine colony morphology and subjected to UV light in order to induce and describe sporulation. For phylogenetic analyses, we sequenced a total of 9 isolates from Georgia and Texas using ITS, BTUB, EF-1a and BotF15 genes. All sequences were aligned and subjected to phylogenetic analyses. Results indicated that the isolates collected from Georgia and Texas are phylogenetically similar to each other but distinct from other Neofusicoccum species. These results show that terminal die-back is caused by a new fungal species that needs to be fully described and named.

Economic and Environmental Trade-off Analysis of Food Waste Reduction Solutions in the United States

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Approximately one-third of all the food produced in the United States is wasted each year. This research analyzes the efficacy of 27 solutions proposed by ReFED (Rethink Food Waste through Economics and Data) under three separate categories (preventive, recovery, and recycling) that contribute to the reduction of food waste nationwide. The selected parameters for the trade-off analysis were total economic benefits, reduction in greenhouse gas emissions, and water conservation. We developed an integrated index to locate the best options for reducing food waste in the United States. We also developed a case study for the Campus Kitchen Program at the University of Georgia to understand the impact of scale on the total economic benefits related to the reduction of food waste. Our analysis suggests that preventive solutions for reducing food waste are much better off in reducing food waste than the recovery and recycling solutions at the national level. Based on the integrated analysis, we found that standardized date labeling is the best solution in terms of economic impact, reduction in carbon emissions, and water conservation on per ton of food waste avoided at the national level. We also found that at the local level, the economic benefit reported by ReFED for the various food waste reduction options could be as low as four times. We hope that our research will help reduce food waste in the United States by promoting the adoption of economically viable and environmentally friendly food waste reduction practices. We also hope that our research will help in generating an accurate assessment of economic benefits related to various options for reduction of food waste at the operational level.

Thermotherapy for Treatment of HLB-Infected Citrus Trees

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In Florida citrus yield losses of 41% in average have been attributed to the spread of citrus Huanglongbing (HLB), a disease caused by Candidatus liberibacter asiaticus. Among multiple approaches to address this issue, preliminary research supports the potential of thermal treatment to reduce the level of inoculum in planta and extend the productive life and yield of infected trees. However, application of excessive heat has resulted in tree defoliation, defeating the purpose of the treatment. The objective of this project was to design a thermotherapy that would extend the productive life of HLB-infected citrus trees. We are achieving this by determining the heating time-temperature combinations that do not kill the citrus leaf, but that does potentially kill the pathogen responsible for HLB. Two-year-old potted orange trees were treated by immersing select branches of the orange trees in a water bath at 50 °C, 52.5 °C, or 55 °C for selected durations of time. The selected incubation times were determined through preliminary experiments with the longest incubation time resulting in the death of the leaves within one day of treatment. For 52.5 °C, intervals of 40 s were used which ranged from 0 min to 2.7 min. For 55 °C, intervals of 20 s were used which ranged from 0 min to 1.3 min. For 50 °C, intervals of 3 min were used which ranged from 0 min to 12 min. The effect of heat treatment was determined through measurements of chlorophyll fluorescence. Leaf decay or recovery was monitored for up to three days after treatment. All experiments were carried out in triplicate. After treatment at 52.5 °C, it was determined that exposure to the hot water bath for 40 s and shorter did not result in defoliation of the citrus trees, but exposure for 1.7 min and longer did result in defoliation. After treatment at 55 °C, exposure to the hot water bath for 20 s and shorter did not result in defoliation of the citrus trees, but exposure for 40 s and longer did result in defoliation. These laboratory results are discussed in the context of the practical, in-field application of the proposed heat-treatment.

The Effect of Sow's Litter Size on Piglet's Growth and Performance Rates from Farrow to Wean

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The objective of this study was to determine if nursing pressure had an effect on the growth and performance rates of piglets from the time of farrow to weaning. Cross fostering techniques were used to assign ten sows a set litter size within four days of farrowing. Three sows nursed ten piglets, three sows nursed twelve piglets, and four sows nursed fifteen piglets over the term of the study. Each sow was fed a lactation feed diet ad libitum and the piglets were weighed at birth, day 7, 14, and weaning. Death loss was recorded and factored in to the analyzed data. Each piglet's weight was analyzed and an individual daily gain for each piglet, as well as an average daily gain for each litter size was calculated. It was determined that the average daily gain of piglets from sows nursing ten piglets was 248.26 grams/day, sows nursing twelve piglets was 218.71 grams/day, and sows nursing fifteen piglets was 205.56 grams/day. However, sows nursing 10 piglets had the highest death loss, 34.3% compared to 21.3% for sows nursing 12 piglets and 16.7% for sows nursing 15 piglets. Overall, litter weight gain was the highest for sows nursing 12 piglets, 74.6 kg compared to 65.2 kg for sows nursing 15 piglets and 49.1 kg for sows nursing 10 piglets. Therefore, it was concluded that greater nursing pressure would decrease the overall growth rate of neonatal piglets, but that sows nursing 12 piglets had the highest overall productivity based on total weight weaned.

Enhancing Georgia Extension Agent Communication Training

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Extension agents serve as the bridge between the university and the general public, providing information, problem-solving help, and many more services to citizens of all ages and backgrounds. As Extension agents are hired, they receive communication training to prepare them for this important role. However, much of the information available on methods and content of communication training for Extension agents is outdated or vague. Therefore, this project explored the most effective methods of communication training to prepare these individuals for their careers in Extension. The goal of this project was to make a recommendation to the Georgia Cooperative Extension to help optimize communication training provided to their agents by exploring previous methods of training, analyzing the success of past trainings, and discussing which areas of improvement to recommend for future communication trainings. Data for this research was collected via email surveys sent to the participants after completing communication training conducted by UGA's Communication and Creative Services in August 2017. It consisted of three questions: if they would like to participate in the survey and to rate 20 capabilities both before and after the training as strongly disagree, disagree, neither agree or disagree, agree, or strongly agree. This data was then analyzed and conclusions were drawn. The results of this research are that the communication training did, overall, improve the agents' understanding of skills such as how to access the UGA CAES database, how to interview with a reporter, and how to create interactive content. For example, it was found that 33% (n=7) felt they could utilize branding requirements for UGA Extension before the workshop and 95% (n=20) felt comfortable utilizing those branding requirements after the training. Similarly, 38% (n=8) felt they could create well-organized and visually appealing marketing materials before the workshop and 90.5% (n=19) felt confident creating marketing materials after the training. Some of the other competencies did not have as drastic results before and after the communication training. Therefore, our recommendations include what to use again in future trainings and suggestions on what can be improved or added.

Science Communication shared via Facebook on the Deadly 2018 Flu Outbreak

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Communicating complex scientific ideas and concepts to the public can be a difficult, albeit necessary task taken on by the media. Sometimes readers can become confused or misinterpret the scientific information provided by the media. This confusion could be from lack of knowledge, the way the information was written, or complex information not being presented in a way the audience can understand. In today's society, the majority of adults receive their daily news through articles and videos shared on the internet, mainly Facebook. Using information gathered on Facebook, this research analyzed news reports based on the current and deadly flu outbreak of 2018. A quantitative content analysis on news stories related to the flu outbreak was completed for this research. The news stories were gathered with an in-depth search on Facebook for all news stories, both written and video, through the use of 15 common key words and phrases. The transcribed stories were analyzed following a protocol for a quantitative content analysis, in which themes and detailed coding were determined based on the content of each article or video. Those results were then compiled into a report that was analyzed by a researcher in epidemiology as she determined the accuracy in language, terms, and information presented to the public. The results provided insight into how the media is portraying the science behind the flu outbreak along with how factual their reports were. This research is imperative for the future of science communication because it gives insight into the current media's ability to convey scientific information to the public in an accurate and well perceived manner. This research will provide recommendations for media and scientists on how to provide factual and relevant information to the public in order to educate individuals on crucial topics related to our health.

Using Pre-Calving Mammary Secretions to Predict Udder Infection Status in Dairy Heifers

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Mastitis is an inflammation of the mammary gland generally caused by bacteria. Mastitis in dairy heifers leads to loss of productivity in lactating animals because of damage done to the developing mammary gland. Heifers are the future of each milking herd, so it is critical to develop effective protocols for treatment of mastitis to minimize damage and optimize future milk production. The goal of this study was to acquire a time and cost effective management practice for diagnosing and treating heifer mastitis. This study analyzed mammary secretions from 28 heifers (106 quarters) to more easily determine infection status of heifers. Secretion samples were acquired from heifers and scored on a system from 1 to 3. Score 1 was classified as thick and honey-like. Score 2 was less viscous in movement, but not as thick as score 1. Score 3 was characterized as being water-like. The hypothesis in this trial was scores of 1 and 2 are not infected, while scores of 3 are usually infected with Staphylococcus aureus, coagulase-negative staphylococci, or streptococci. Quarters with secretion scores of 3 were treated with the antibiotic Spectramast DC. The data collected in this trial are split into two groups based on presumed infection status. The first group is PI (presumed infected and treated), and the second group is PNI (presumed not infected and not treated). Group PI had a success rate of 76.09% ($P < .05$) in identifying if a quarter was infected. Group PNI had a 95.00% ($P < .01$) success rate in predicting if a quarter was not infected. Additionally, there was a 96.88% cure rate (31/32 quarters) of quarters that were confirmed to be infected and treated according to trial protocol. This secretion scoring system is a user-friendly management tool for producers to inexpensively and relatively accurately determine if a heifer is infected, and if it is necessary to treat her. Many dairy producers do not have the time or resources to obtain mammary secretions for bacterial culturing, thus monitoring heifer secretions may act as a fast, reliable alternative to typical culturing methods.

Effect of Micronization on the Gastric Digestion of Tart Cherry Puree

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Phenolic compounds, such as those found in tart cherries, have been linked to antioxidant, anti-allergenic, antiviral and cancer-reducing properties. The best way to reap these benefits is by maximizing the amount of antioxidants available during digestion. This research was conducted in order to investigate the changes in phenolics content and antioxidant capacity of micronized tart cherry puree during the gastric phase using a static in vitro digestion method. In this study, the sample consisted of commercially frozen tart cherry puree. After the sample was thawed, the particle size was reduced using Megatron MT5000 at 15000 rpm and then homogenized at 200 MPa. A Malvern laser particle size analyzer was then used to determine the particle size distribution by dispersing the sample in deionized water until a set point of 10 -20% obscuration was achieved. Next, the digestion process of the human mouth and stomach was simulated using a static in vitro digestion model. During preparation, the samples were incubated in a boiling water bath (37 °C and 200 rpm. Then, the samples were digested in 6 mL of salivary stock for 5 min (mouth digestion) followed by 12 mL of gastric stock for 2 h (stomach digestion). Samples were collected every 30 min for 2 h and analyzed to determine the change in particle size, total phenolics content, total solids, and FRAP values. Based on the results, there was a significant increase in polyphenol release at 30 min (780 to 1136 mg GAE/kg f.w.) with a reduction in particle size from ~800 m to ~100 m. This indicates that as particle size decreases, more polyphenols are released as enzyme interaction occurs. These results provide useful information regarding the beneficial properties of tart cherry puree based on its phenolic content, which can also be applied to similar samples.

Evaluation of Warm-Season Annual Grasses for Southeastern Forage-Finished Beef Systems

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A problem that southeastern forage-finished beef producers face is a lack of high-quality forages during the summer months. Warm-season perennial grasses, such as bermudagrass, dominate southern pastures from June through September and are often of insufficient nutritive value to meet the demands of growing and finishing cattle. Warm-season annual grasses, such as pearl millet, have been shown to exhibit increased nutritive values and favorable agronomic traits. Furthermore, soybean hull supplementation has been shown to increase ruminal cellulase production, thus increasing digestibility of and animal performance on forage-based diets. A three-year study was designed to examine two varieties of pearl millet: 'Tifleaf 3' (PM) and 'Exceed Brown-Mid-Rib' (BMR), each with (+S) and without supplementation of soybean hulls, for use in a forage-finished beef production system. Each year 16 0.81-ha paddocks were randomly assigned to 1 of 4 treatments with 4 replications. Thirty-two steers were paired by weight to minimize variability among pairs; pairs were then randomly assigned to treatment paddocks. Rotational grazing was initiated when forage sward height was 45-60 cm and terminated in September, when steers were harvested under USDA inspection. Average daily gain (ADG) and total gain were calculated from fasted weights taken at grazing initiation and termination. Carcass data were collected 24-h post-mortem. Results from the first 2 years of data show supplemented steers exhibited greater ($P < 0.05$) final live weight, hot carcass weight, ADG, total bodyweight gain, and percent kidney-pelvic-heart fat than non-supplemented steers. Carcasses of steers fed BMR+S had a greater ($P < 0.05$) yield grade than carcasses of non-supplemented steers; however, carcasses of steers fed PM+S were similar ($P > 0.05$) to all other carcasses. A similar trend was observed for fat thickness. The PM+S carcasses exhibited more youthful lean maturity and had lighter red subjective color scores ($P < 0.05$) than all others. Similarly, PM+S carcasses had numerically greater L^*, a^*, and b^* values, but were similar ($P > 0.05$) to BMR and BMR+S carcasses. Data indicates pearl millet is a viable summer forage for southeastern forage-finished beef systems. Additionally, soybean hull supplementation can increase animal performance over forage alone.

Immunomodulatory effects of cortisol, vitamin C and thiamine on equine leukocytes function in an ex vivo bacterial sepsis model

Shyla C Giancola, Animal Science Major, Department of Animal and Dairy Science; Presented in 2018

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Bacterial sepsis and the systemic inflammatory response syndrome (SIRS) is a leading cause of morbidity and mortality in horses and foals. Both age and illness result in immune and endocrine impairment that effects disease severity and mortality. Innate immune cells play a vital role in the initial immune response, but their function is dysregulated in sepsis and SIRS. It has been shown that immunomodulatory factors, such as cortisol, thiamine, and Vitamin C, alter leukocyte function in human models; thus, there may be potential to improve septic horse and foal outcomes with this treatment. However, the effects of these compounds on equine immune function are unknown. Therefore, the objective of this study is to determine the concentration-dependent effects of cortisol, thiamine and vitamin C individually and in concert on equine leukocyte function. Our hypothesis is that ex vivo exposure to bacteria in the presence of cortisol, thiamine, and vitamin C individually and in concert will differentially modulate foal and horse leukocyte function. Neutrophil production of reactive oxygen species (ROS) production in the presence and absence of physiologically relevant concentrations of cortisol, thiamine, and vitamin C will be assessed. ROS production will be quantified using a previously validated fluorometric assay. We anticipate that these compounds will regulate neutrophil function in a dosedependent manner, and that there will be synergy between the compounds when they are used in concert. Results from this preliminary study will be used to determine effective doses for these immunomodulatory factors for future ex vivo and in vivo studies.

Investigation into the genetic mechanisms of salt tolerance of P. vaginatum through Genotyping by Sequencing and comparative bioinformatics analyses

Thomas Gottilla, Applied Biotechnology Major, Department of Entomology; Presented in 2018

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Paspalum vaginatum has been promoted as 'the environmental turfgrass' because of its ability to survive in high-salinity soils and hence to be irrigated with reclaimed water. The aim of my project is to understand the genetic basis of salt tolerance. Because most crop plants are salt-sensitive and soil salinity affects many crop-growing areas in the world, knowledge on salt-tolerance mechanisms could be critical in enhancing food crops. The genes responsible for salt tolerance can be studied through quantitative trait loci mapping. We have generated a mapping population by crossing two F1-sib lines that vary in their leaf sodium (Na) content. DNA extraction and preparation of libraries for identification of single nucleotide polymorphisms (SNPs) by genotyping-by-sequencing (GBS) is in progress. A subset of GBS libraries are currently being sequenced. Comparative analyses of gene families involved in stress responses between salt-tolerant and salt-sensitive species is another strategy for elucidating potential genetic mechanisms for salt tolerance. In particular, we aim to assess whether gene amplification and/or diversification has occurred in P. vaginatum (salt-tolerant) compared to sorghum (salt-sensitive) which may contribute to salt tolerance. Because Na and potassium (K) transport have been hypothesized to play a role in P. vaginatum's salt tolerance, I selected sorghum ion transporters and aquaporins from the Phytozome database for my initial analysis. Zinc finger genes were used as a control because of their highly conserved nature. The genes were used as queries to search the available draft genome sequence of P. vaginatum using the software program Exonerate, and homologous P. vaginatum genes were identified. Trees were then developed in Geneious and visualized in FigTree to identify potential gene amplification events. For the analysis, I selected 31 zinc finger genes, 40 aquaporin genes, 16 Na transporters, and 33 K transporters. In P. vaginatum, these resulted in the discovery of approximately 18 zinc finger loci, 18 aquaporin loci, 15 Na transporter loci, and 28 K transporter loci. The relationships between the P. vaginatum and sorghum genes displayed by the trees suggest that gene duplication is likely not a major factor in salt tolerance. Preliminary results for zinc finger genes also suggest that the draft genome of P. vaginatum may cause the number of genes identified to be understated.

Identification of Biomarkers Associated with Gallus gallus domesticus Sperm Mobility

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Gallus gallus domesticus have been intensively selected for efficient and rapid weight gain. This selection has led to broilers which have insatiable appetites, which is beneficial for cost-efficient meat production with minimal environmental impact. However, this selection pressure for raid gain also presents concomitant damaging effects on the reproductive fitness of the parent stock, Gallus gallus domesticus. To counter this impending issue with fertility in Gallus gallus domesticus, there is a need to identify proteins associated with fertility that can be used as biomarkers in selection programs aimed at improved reproductive fitness in Gallus gallus domesticus. Previous research demonstrated that sperm mobility is a quantitative trait of the domestic fowl that can be used as the primary determinant of sperm fertilizing capacity. Sperm of low and high mobility were separated and quantified using a Percoll density gradient (PDG) centrifugation technique. Protein from the low and high mobile populations were enriched and prepared for 2-dimensional electrophoresis (2-DE). The resulting proteomic profiles between the low and high mobile sperm populations were compared and analyzed using BioRad's PD-Quest. Proteomic profiles differed with respect to mobility, low and high. Those proteins that differed in intensity between the low and high mobile groups were excised from the gel and sent to UGA's Proteomic and Mass Spectrometry Core Facility to be identified by LCMS/MS. Several proteins known to be associated with mammalian sperm mobility, such as Sperm associated antigen-6 (SPAG6), were found to differ between the two avian sperm populations. The proteins that were more prominent in the highly mobile population can be used as biomarkers in genetic selection programs aimed at improving fertility in male Gallus gallus domesticus.

The Work-Life Balance Dilemma - How Female Teachers Cope with the Demands of Teaching and Family Life

Megan Hise, Agricultural Education Major, Department of Agricultural Leadership, Education, & Communication; Presented in 2018

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The purpose of this study was to begin the process to pinpoint the reasons as to why female agricultural teachers appear to have problems balancing work and family life. The issue I chose to focus on was the overwhelming number of job openings within the agricultural education industry across the state and not enough teachers to fill them. The basic design of this study was to send out a short survey via email to obtain basic background information about participants. After I gained approval of the questions for the survey the next task was to search the Georgia Agricultural Education website and go through the directory of teacher to pick out sixty women to initially contact. During my time searching the directory for possible participants, I was able to utilize the website, Qualtrics, to begin making my survey. It was upon completion of the survey that I began to send out my initial email asking for participation in my study. If they responded to my first email, I then sent them a personal link for the survey. Once I had read over their responses, I made the decision to randomly pick seven of the fourteen participants to discuss a date and time to have an online interview. During the interviews, I was able to ask more in-depth questions about their responses to find out more about their experiences being a mother as well as an agricultural teacher. Analyzing these responses gave me an insight as to what my future as a female agricultural teacher may be like. The main question I built up to during the interviews was what thoughts they had on ways to improve work life balance. This stumped just about each teacher I spoke with, but they all responded with similar ideas and statements. Their opinions ranged from: not feeling guilty about saying no, communication is key, need family support, always remember you have a life all the way to assuming that teaching is easier in middle school than high school. Listening to these teachers taught me that I will need a strong support system and the ability to make a decision and to keep it. That one person can only do so many tasks before running themselves dry and ruining their passion for teaching agriculture. I was specifically told that I must make time to spend with family or time for myself. That this is the key to keeping myself from loosing my mind and not ruining my drive to teach.

Magnetic Resonance Imaging T2 Weighted Sequences Demonstrate Acute Changes in Cerebral Hemisphere, Ventricle, and Lesion Volumes in a Pig Model Stroke

Zachary T Jones, Animal Science Major, Department of Animal and Dairy Science; Presented in 2018

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Stroke is a leading cause of death and long-term disability in the United States. To improve patient diagnosis and management, magnetic resonance imaging (MRI) is increasingly being used due to its sensitivity and specificity in detecting tissue-level changes post-ischemic stroke. The modern establishment of ischemic stroke pathophysiology extends far beyond the impairment of blood circulation and is the result of a multitude of highly complex mechanisms. In order to further understand the tissue-level implications of acute ischemic stroke, we hypothesized acute ischemic stroke would result in volumetric changes in cerebral hemispheres, ventricles, and infarctions.. Ischemic stroke was induced by permanent occlusion of the middle cerebral artery (MCA) in adult male castrated Landrace pigs. T2 Weighted (T2W) sequences were collected pre-, 1, and 89 days post-stroke. To confirm ischemic stroke 1 day post-stroke, MRI T2 Fluid Attenuated Inversion Recovery (T2FLAIR) and Diffusion Weighted Imaging (DWI) sequences were assessed and exhibited territorial hyperintense lesions characteristic of an edematous injury. Hypointense lesions observed on corresponding Apparent Diffusion Coefficient (ADC) maps confirmed areas of restricted diffusion indicative of cytotoxic edema, thus confirming permanent cauterization of the MCA resulted in a porcine model of ischemic stroke. T2W sequences demonstrated an increase in ipsilateral cerebral hemisphere volume and a consequent decrease in ipsilateral ventricle volume 1 day post-stroke. T2W sequences further complemented T2FLAIR, DWI, and ADC findings by revealing corresponding hyperintense infarctions 1 day post-stroke. 89 days post-stroke cerebral tissue death resulted in reduced ipsilateral cerebral hemispheric volume, an increase in ipsilateral ventricle volume, and a decrease in hyperintense ischemic volume. These results closely human patient pathophysiology thus suggesting our porcine model of ischemic stroke is a robust model that can be utilized to test potential stroke therapies at both acute and chronic time points This study demonstrate MRI, specifically T2W sequences, provide high anatomical resolution and accurate in-vivo assessment of stroke pathophysiology that can be used to improve our current understanding of stroke pathophysiology.

Investigating the effects of diet on larval development in Hermetia illucens

Emilia Kairys, Entomology Major, Department of Entomology; Presented in 2018

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Insects have been proven to be useful in forensic investigations involving the death of a victim, as various insects tend to colonize the corpse after death. Black Soldier Flies (BSF) are one such species. The larvae of BSF are detritivores that will feed on different types of decaying organic matter, such as animal waste, compost, and decomposing animal tissue. Because of their habit of feeding on animal tissue, the life cycle of the BSF can be useful in determining the postmortem interval of a victim based on how old the BSF specimens are. Previous studies have looked at the effect of diet on the development and life cycle of the BSF, and found that the larvae take longer to mature when fed a grain-based diet versus a diet based on animal tissue. With this experiment, I hope to find out more about the life cycle of the BSF and the effect diet has on their development. There will be three groups of BSF, being fed three different diets. One group will be fed a grain-based diet, which will serve as the control. The other two groups will be fed animal tissue, one group with cow tissue and the other, with muscle tissue from a pig. Their development through the larval stage will be monitored, taking note of final size before pupation and how long it takes to reach said point. Knowing more about the effects of diet on BSF development can provide forensic entomologists with a stronger basis for determining post-mortem interval, and eliminate the need for assumptions in forensic investigations.

Cow Serum No More: Why Platelet Product Is The Answer For Stem Cell Growth

Hannah Kemelmakher, Animal Science Major, Department of Animal and Dairy Science; Presented in 2018

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Platelet lysate (PL) has been extensively used for the laboratory expansion of human mesenchymal stem cells (MSC) in order to avoid fetal bovine serum (FBS), the industry standard, which has been found to procure host immune reactions, contain batch-to-batch variation, and promote sample contamination. Our objectives were to evaluate the inflammatory profile of equine monocytes cultured with equine PL (ePL) and to determine if ePL may be a viable alternative growth medium. Equine monocytes were isolated and incubated with donor horse serum (DHS), FBS, and individual donor ePL or pooled ePL from all horses. Monocytes were stimulated with lipopolysaccharide in the presence of 1, 5 or 10% DHS and/or pooled ePL. After 6h of incubation, cell culture supernatants were assayed via ELISA for production of the pro-inflammatory cytokines tumor necrosis factor alpha (TNF-α) and Interleukin 1β (IL-1β) as well as for the anti-inflammatory Interleukin 10 (IL-10). Equine monocytes incubated with pooled ePL produced significantly less TNF-α and significantly more IL-10 than monocytes incubated in FBS. A statistically significant difference was not identified for the production of IL-1β. Pooled ePL added to LPS-stimulated equine monocytes resulted in a significant reduction in TNF-α and IL-1β production. IL-10 production was not significantly upregulated by the addition of ePL to LPS-stimulated monocytes. Finally, the addition of ePL to LPS-stimulated monocytes in the presence of various concentrations of DHS resulted to statistically significant decrease of TNF-α and IL-1β compared to the control groups. This is the first study to demonstrate that ePL suppresses the release of pro-inflammatory cytokines from stimulated equine monocytes. These results encourage further exploration of PL as a homologous media substitute for FBS but also opens the possibility of investigating its use as means to suppress cell-mediated inflammation.

What Makes People Happy? Explaining the Cross-National Variation of Life Satisfaction

Jacqueline Kessler, Environmental Economics & Management Major, Department of Agricultural and Applied Economics; Presented in 2018

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Life satisfaction varies widely across countries. Differences in income explain a large part of this variation, but not all. The purpose of this study is to identify the country-level indicators, in addition to income, that best explain the cross-national variation of mean life satisfaction. To do so, I collect life satisfaction data and key economic, political, social, and environmental variables (including GDP per capita, unemployment rate, level of corruption, social capital, and CO_2 emissions) from widely-used sources, such as the World Values Survey and the World Bank's World Development Indicators. I use multivariate regression analysis to test my hypothesis that there exists a statistically significant relationship between the aforementioned variables and mean life satisfaction, and to calculate the relative contribution of political, social, and environmental variables vis-à-vis economic factors. The importance of this study is to capture what national-level indicators best serve as predictors of life satisfaction, in order to understand how a country's policies and developmental strategies may affect the well-being of its citizens.

Optimal Anopheles quadrimaculatus Larval Density for Laboratory Rearing

Sierra King, Entomology Major, Department of Entomology; Presented in 2018

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Mosquitoes are reared in labs all over the world so researchers can study disease-vectors, and simulate mosquito management to protect human and animal lives from these insects. Some mosquito species are most successful when the larvae are living in dense groups, but will experience significant mortality when overcrowded. We have attempted to determine an ideal larval rearing density for Anopheles quadrimaculatus in a 468 sq. cm surface area. This was determined for groups at larval densities from 100 to 800 larvae per 468 sq. cm. increasing at increments of 100. A control of 200 larvae per 468 sq. cm was used. All larval treatment groups had 600 mL of deionized water in a 468 sq. cm. area at the same temperature and humidity, and received the same amount of food. Effectiveness was defined based on larval survival, growth rates, time of pupation, and size of emerged adults. It was determined the most effective concentration of mosquito larvae was 200 larvae per 468 sq. cm. Data was analyzed with a one-tailed T-test with significance at $p<0.05$ for adult body and wing size for males and females. Producing larvae at the optimal rearing density will save the researcher time, increase larval survival, and yield adult insects with improved health and lifespan. Based on these results, researchers will be able to modify laboratory procedures to efficiently produce large populations of healthy adult mosquitoes for laboratory testing of insecticides with consistent and reliable replication.

Determining the LD50 rate of radiation on Acer buergerianum seeds

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Acer buergerianum, Trident Maple, is a commonly used ornamental shade tree. However, it displays invasive tendencies due to a very large number of seeds produced that have <90% germination rate. For this project, we investigated the LD50 of cobalt-60 irradiation. Once the LD50 rate can be determined, we will treat seed with that radiation rate with the goal of inducing sterility. In this study, there were 4 treatments, 5 replications, and 50 seeds in each replication. Treatments included a control and three irradiation doses expressed in grays (Gy) that were attained by varying durations of isotope exposure: 50 Gy, 100 Gy, and 150 Gy. Seeds were then placed in cold stratification at 40º F for 100 days. Seeds were then planted on mist benches in trays containing Fafard (Agwam, MA) germination substrate mix. After 3 weeks, germinated seedlings were moved to 1 gallon containers containing Fafard Nursery Mix. At 10 weeks, the survival percentage was evaluated, and then normalized against the control, resulting in survival rates of 85.62% for 50 Gy, 84.56% for 100 Gy, and 55.63% for 150 Gy. Using linear regression, we were able to determine the equation for LD50, which was LD50= -0.1342(x)+1.15 (x equals 50 in this equation) that results in an LD50 of 157.86 Gy. We will repeat this trial in late spring 2018, including two more treatments (200 and 250 Gy) to corroborate year 1 results.

Examining the role of hypoxia in Tribolium

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Juvenile insects develop through discrete stages, known as instars, each separated by a molting event. Th signals perceived by the insect to initiate a molt include physiological queues, such as hormonal changes, and other signals, such as nutritional status. In mosquito larvae, a decrease in oxygen availability (hypoxia) was recently found to be a critical signal necessary for molting. It is currently unknown if the hypoxia signaling pathway (HIF) signaling molting is restricted to mosquitos or broadly conserved across insects. We aim to determine if the hypoxia signaling pathway is a regulator of molting in the red flour beetle T. castaneum. We are attempting to block the action of the hypoxia silencing transcription factor, HIFα using the inhibitor PX-478. To do so, we had to determine the critical period in which larvae could be treated with PX-478. Adult T. castaneum were placed into containers with 100g flour and 5g torula yeast and kept at 32.4°C and at ambient humidity. Beetles were allowed a 48 hour window to mate and lay eggs, then removed. Larvae began hatching approximately 2-3 days after adults were removed. Baseline growth data was established by measuring body length (mm) of larvae aged 3 days to 19 days. We have determined the growth rate of T. castaneum larvae in our lab and developed a methodology to stage the larvae. Larvae must be dosed with PX-478 4 days post-adult to allow sufficient time to consume PX478. Using this information, we developed a system to dose beetles with PX478 by placing 3 females and one male into a 1.5 ml ventilated microcentrifuge tube with a 250mg flour and 12.5mg of yeast, in a 3:1 ratio of females to males. Adults are allowed to mate and lay eggs, then removed at 48 hours. Four days after removal of adults, larvae will be treated with PX-478. With this baseline data, we are now beginning experimental manipulations of the system by administering controlled doses of PX-478 to larvae.

Genetic Improvement of Sulfur-Containing Amino Acids by Manipulating Genetic Loci Controlling Protein Subunits in Soybean

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Soymeal is often referred to as the gold standard among protein sources used in the feed industry for its exceptional amino acid profile. However, soybean protein is deficient in sulfur-containing amino acids cysteine and methionine, respectively, which are needed in the animal diet for optimal growth and skeletal development. To aid in the development of soybeans with increased sulfur-containing amino acids, an F6 RIL population (n=368) was developed by crossing breeding line SQ97-0263_3-1a, lacking the 7S α', 11S A1, 11S A2, 11S A3 and 11S A4 soybean storage protein subunits, with high protein tofu-type cultivar 'Harovinton', possessing each of the storage protein subunits. The RIL genotype for each of the storage protein subunits in the F6 population was characterized using flanking KASP SNP markers tightly linked to each storage protein subunits QTL and RILs were placed into one of 16 groups based on the inheritance of the parental alleles at each locus. Harvested seed from each RIL was ground and subjected to near-infrared reflectance (NIR) analysis to quantify the sulfur-containing amino acids and other seed components. Results indicate that significant differences ($P < 0.05$) were detected among genotypes for total protein (507 – 373 g kg-1), cysteine (16.1 – 10.5 g kg-1) and methionine (14.7 – 11.6 g kg-1) and among groups for total protein (456 – 418 g kg-1), cysteine (12.65 – 11.50 g kg-1) and methionine (13.23 – 12.15 g kg-1). Selection of RILs containing the highest cysteine and methionine concentrations will aid in the development of nutritious soymeal containing higher sulfur-containing amino acids.

Association of Apple Fruit Growth with KRP Polymorphisms

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Commercially, fruit size is a valuable trait in many fruit crops including apple. Identifying and characterizing genes that regulate fruit growth can help in generating tools for optimizing fruit size. A negative regulator of the cell cycle, the Kip-Related Protein (KRP) has recently been identified as a gene possibly associated with reduced cell production during fruit growth in apple. Expression of an apple KRP (MdKRP4) gene in Arabidopsis resulted in smaller leaves and prominent serrations. Previous studies have determined that a single nucleotide polymorphism (SNP) in MdKRP4, within its coding sequence, converts a serine (S) to a phenylalanine (F), potentially altering its function. The objective of this study was to evaluate this polymorphism across multiple apple genotypes with the use of leaf samples collected from the USDA apple germplasm collection in Geneva, New York. DNA was extracted from the leaves of 100 genotypes. Kompetitive Allele Specific PCR (KASP), a fluorescence based method for SNP allele detection was employed to determine the specific genotype of each apple species as homozygous wildtype, heterozygous, or homozygous for the SNP. Primers specific to each allele were developed and have been validated through preliminary analysis. These primers are being tested across the panel of apple genotypes. With this information a comparative analysis of apple phenotype and MdKRP4 SNP will be conducted. It is hypothesized that apples homozygous for the MdKRP4 SNP resulting in the S-F conversion are associated with smaller fruit size. This research is expected to generate a new tool for understanding fruit growth regulation using SNP genetic markers. This process can alleviate the conjecture of prospective fruit size by using the KASP assay.

Canine Ocular Melanomas and Melanocytomas

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According to the literature in veterinary and human pathology, the term melanocytoma refers to benign neoplasm of melanocytes originating from the epidermis in the skin. These benign neoplasms can occur both focally and multifocally and rarely progress to malignancy. In veterinary pathology, a melanoma is a term used to refer to malignant neoplasms of melanocytes in the skin. These neoplasms have similar biological behavior to the human counterparts. In ocular veterinary pathology, the terms melanoma and melanocytoma have been used interchangeably. The hypothesis is that although ocular melanocytes are unassociated with epidermis, it is valid to use the term melanocytoma to describe a benign neoplasm of ocular melanocytes. The goal of this study is to evaluate clinical cases to determine if the parameters used to define a dermal melanoma and a dermal melanocytoma translate to similar neoplasms of the eye. Between 2007 and 2017, there were 25 cases diagnosed as canine ocular melanomas and melanocytomas that were submitted to University of Georgia Diagnostic Ocular Pathology Service. These 25 cases were evaluated histopathologically for criteria that would allow categorization into either melanoma or melanocytoma. The results of this study will allow for better pathology-based prognosis of ocular melanin-containing neoplasms.

Monitor Plant Growth and Health Using Normalized Difference Vegetation Index

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Continuous, non-destructive monitoring of plant growth and early detection of plant stress is important to avoid losses. The traditional method of manual scouting catches issues after they have become visible to the human eye, which may be after the damage has occurred. Remote monitoring of plants grown in poorly accessible areas is another area gaining importance. We propose a mechanism of continuous remote monitoring of plant growth using Normalized Difference Vegetation Index (NDVI, calculated from the fraction of red and near infrared light reflected by the canopy). Our study demonstrates that plant growth monitored using NDVI can be used as an effective indicator of plant vigor or stress. Healthy plants absorb most of the red light that falls on them and reflect much of the near infrared light, whereas it is the opposite for plants under stress. The study used spinach and lettuce in a greenhouse with three different fertilizer treatments - normal, low and no fertilizer. Two different species were chosen to observe if the NDVI values varied for different crops. The different treatments were to demonstrate that NDVI readings show the difference in growth rate for each treatment type. Each species-treatment type was monitored by Decagon's Spectral Reflectance Sensor. The NDVI readings were captured using a datalogger. It was programmed to record NDVI readings every one hour for each species-treatment type. The NDVI readings for each species-treatment type plotted against time demonstrate the different growth rate of plants based on the fertilizer level. This is well correlated with leaf area measured for that species-treatment type using the software EasyLeafArea from digital images captured at regular intervals. We also observed that spinach, with greater chlorophyll content than lettuce has higher NDVI values, because the extra chlorophyll helps absorb more red light. This was validated by measuring the Chlorophyll Content Index of spinach (CCI of 44) and lettuce (5.1) using a chlorophyll meter. The study shows that continuous monitoring of plants using NDVI sensors is an effective indicator of plant growth and is useful for early detection of stress. The different growth rate shown by the NDVI readings for different treatments could be used to decide different input strategies when applied to agricultural fields.The study also shows that NDVI values are higher for crops with higher chlorophyll content.

Diagnosing Ketosis in Early Lactation Dairy Cows - Which Test is Best?

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Developing a plan to control ketosis is essential to production profitability in a dairy herd. Ketosis lowers quality and production of milk, increases vet bills, and increases treatment supplies costs. The objective of this study was to assess ketone levels in Holstein dairy cattle using two diagnostic methods: Urine Ketone Strips (Ketostix, Bayer Corporation, Elkhart, IN) and a Precision Xtra Blood Ketone Meter (Abbott Diabetes Care, Abingdon, UK). Additionally, this research aimed to comprise a ketosis management plan for the UGA Teaching Dairy for cows displaying clinical and subclinical ketosis. For this study, a group of 11 periparturient cows were purposively selected based on expected calving dates and calving history. Body Condition Scores (BCS) for all cows were assessed weekly for 12 weeks. Urine (spontaneous or induced) and blood (coccygeal vein or artery) were collected bi-weekly post-calving in order to evaluate the two diagnostic methods. Both of the diagnostic methods reflected a 90.9% incidence of subclinical ketosis. Blood and urine ketone diagnostics indicated a 27.3% and 63.6% incidence of subclinical ketosis, respectively. 72.7% of the cows in the study had a BCS of 3.5 or above pre-calving. Of those, 87.5% displayed clinical or subclinical ketosis. When qualitatively comparing the accuracy of both tests, the blood ketone meter proved a more reliable and accurate method than the urine ketone strips. The blood ketone meter provided a digital level of ketones, while the urine ketone strips provided a subjective scale of ketones. The blood ketone meter and associated supplies were collectively more expensive than the urine ketone strips, with costs approximately $1.30/cow and $.30/cow, respectively. As students are the primary source of labor at the UGA Teaching Dairy, ease of use was critical in comparing the quality of the two ketone tests. Collecting blood samples for the Handheld Ketone Meter required training and practice, but using the device was easily learned by students. Collecting urine samples proved to be unpredictable, and carrying urine ketone strips at all times was essential for timely collection. In conclusion, the Handheld Blood Ketone Meter was best for accurately monitoring ketosis in a University dairy herd, but could prove expensive if used excessively. Additionally, the development and implementation of a ketosis management plan could reduce costs and yield a healthier, more productive herd.

Developing an Economic Component of the Peanut Risk Index

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The Peanut Risk Index (Peanut Rx) is an extension – based tool that enables peanut growers to numerically assess their risk to Tomato Spotted Wilt Virus (TSWV) and other fungal diseases. The risk index is based on several factors that contribute to the risk of fungal diseases of peanuts. In an attempt to minimize risk, extension specialists from the southeast have partnered with industry professionals to develop fungicide programs tailored to each level of disease risk. We want to develop an economic tool as a component of the Peanut Risk Index that will enable growers to determine their expected adjusted net revenue given their chosen fungicide program (low, medium, or high risk). Using fungicide cost data from UGA Extension Budgets, we calculate an average total cost for a low, medium, and high risk program. We can determine a break even adjusted net revenue for different Rx risk levels to identify equivalent yield-risk combinations. This provides the additional yield needed to cover additional fungicide costs when moving to a higher risk level, or the maximum loss in yield to maintain equivalent adjusted net revenue when moving to a lower risk level. Statistically, we can predict how much yield will be lost or gained by switching fungicide programs. By analyzing data from previous field trials using multiple regression analysis, we predict yield as a function of risk level and program selection. This prediction will ultimately indicate the expected change in yield given the computed risk and new program selection. Understanding the expected change in yield provides peanut growers with better information to make informed decisions on how to best mitigate production risks associated with TSWV and other fungal diseases.

The Effects of Seeding Density of the PC3 Cell Line on in Vitro Viability

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Prostate cancer cells express receptors for Gonadotropin-releasing hormone (GnRH). The purpose of this experiment was to test the efficiency of GnRH conjugated with the cytotoxin saporin in inducing apoptosis in GnRH+ prostate cancer cells. Saporin is a ribosomal inactivating protein which inhibits protein synthesis, inducing cells to undergo apoptosis. If the GnRH-saporin conjugate induces apoptosis in cancer cells, it could be further investigated as a chemotherapy agent. To test the efficiency of GnRH-saporin conjugate in inducing apoptosis of cancer cells, PC3 prostate cancer cells were treated with different doses of GnRH-saporin. PC3 cells (1 X 106 cells) were first seeded in T-75 flasks and grown in 12 ml of RPMI-1640 medium supplemented with L-glutamine, 10% fetal bovine serum (FBS), and 1% Penicillin-Streptomycin (10,000 U/mL) for approximately 3 days until confluence was reached. At confluence, 1 X 10^6 cells were plated in 200 µl of stock RPMI-1640 medium in a 96 well plate. The wells were treated with 1.5 X 10^-5, 1.5 X 10^-6, 1.5 X 10^-7, and 1.5 X 10^-8 µmol GnRH-saporin conjugate in 96 well plates. The control group had no supplementation. At 72 hours the cells were labelled with an apoptosis kit containing Annexin-5, which binds to early apoptotic cells, and propidium iodide, which binds to dead cells. The early apoptotic and dead cell percentages were quantified in a flow cytometry. Preliminary results show that all wells had very little to no live cells. Also, a clear-yellow coloring to the media was noted, which indicates that the seeding density was high. If there are too many cells, the nutrients will be used up, leading to cell apoptosis. A second experiment was run to determine the ideal seeding density. 96-well plates were seeded with 1 X 10^5 or 1 X 10^4 cells and grown in RPMI-1640 with and without 10% FBS. Cell viability was measured using Trypan blue staining at 72 hours of cell culture. The cell viability was above 95% for cells seeded at 1 x 10^4 cells/well, while it was 66% and 72% in wells seeded at 1 X10^5 cells/well, indicating that future experiments need to be conducted at 1 x 10^4 cells/well. Further experimentation with PC3 cell lines using the proper seeding density will be conducted to determine the effects of the conjugated toxin.

Mineral Supplementation of Neonatal Pigs

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Iron deficiency is a problem in newborn pigs and is due to minimal placental transfer from dam to offspring. Piglets are routinely given an iron injection to maintain proper growth and increase survival rates. Our study looks at the possibility that piglets could also be lacking in other key minerals needed to properly sustain themselves. 111 piglets from 9 litters were used for this study. Within the first 24 hours of birth the piglets were processed following standard SOPs. During processing 0.1 mL of Multimin 90 (providing 6 mg Zn, 1 mg Mn, 0.5 mg Se, and 1.5 mg Cu) was injected IM to determine if it effected growth and survival rates. These injections were given to the piglets with odd numbered ear notches on the left side of the neck and the iron injection on the right side. Our even numbered ear notched piglets were our control group and only received the iron injection in the right side of the neck. Piglets were monitored daily to check for any adverse reactions or unforeseen health concerns. On days 7, 14, and at weaning piglets were weighed and data recorded. Overall, piglets receiving the supplemental mineral injection (n=57) gained 226.7 g/day compared to 211.6 g/day for the control animals (n=54), with total 20-day lactation gains being 4,534 g for mineral supplemented piglets compared to 4,232 g for the control animals. Piglets with a birth weight of 1.2-1.6 kg had the largest response to the supplemental mineral injection gaining 239.5 g/d compared to 208.1 g/day for the controls. This is an increase gain of 31.4 g/day or 628 g over the 20-day lactation period. Piglets under 1.2 kg receiving the mineral injection gained 186.3 g/d compared to 170.7 g/day for the control piglets, while mineral treated piglets over 1.6 kg grew 240.5 g/d compared to 244.2 g/d for the control piglets. Death loss for the mineral supplemented piglets (19.7%) was similar to the control piglets (20.9%). This data indicates that the additional mineral supplementation increased daily weight gain in piglets during lactation and that the middle weight pigs had the greatest response. Increased weight gain of 300-600 g over a 20-day lactation period would have significant economic impacts on pork producers.

Optimization of Bone Development in Laying Hens for the Prevention of Osteoporosis

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Calcium is stored in the bones and released for biological processes such as eggshell formation. Since commercial laying hens have been genetically-selected for high egg production, early egg production, and prolonged egg production, commercial laying hens have developed fragile bones. Having an increased susceptibility to osteoporosis decreases the quality of life of the laying hens, and has led to economic losses in the poultry industry. Adding vitamin D¬3 (cholecalciferol) or higher bioactive form of vitamin D3 (25-hydroxycholecalciferol) to chicken diets has been adopted by the poultry industry to solve this problem. However, the mechanism by which cholecalciferol affects bone metabolism is not fully understood. Few studies have examined the effects of various concentrations of 25-hydroxycholecalciferol and 1,25-dihydroxycholecalciferol on chicken osteoblast development. This study aimed to determine the effects of 25-hydroxycholecalciferol and 1,25-dihydroxycholecaciferol on osteoblast differentiation and mineralization using an in vitro model, mesenchymal stem cell (MSC) culture. Von Kossa (VK), Alizarin Red (AR), and Alkaline Phosphatase (ALP) stains were done on chicken MSC isolated from chick compact bones. The staining showed that the osteogenic media (OM) induced MSC differentiation into osteoblasts when compared to the control group. In addition, there were inhibitory effects in osteoblast differentiation and mineralization for 10nM 1,25-dihydroxycholecalciferol when compared to OM. Likewise, increasing the dosage of 25-hydroxycholecalciferol (250nM to 1000nM) demonstrated inhibition of osteoblast differentiation and mineralization. The results showed that both 25-hydroxycholecalciferol and 1,25-hydroxycholecalciferol inhibited chicken osteoblast differentiation and mineralization. This may indicate that 25-hydroxycholecalciferol could convert in the osteoblast to 1,25-dihydroxycholecalciferol exerting similar effects as 1,25-dihydroxyvitamin D. However, more research must be conducted to determine if high concentrations of 25-cholecalciferol perform an inhibitory function or if the high dosage is toxic to the osteoblasts.

Role of DNA Methylation in Female Oncopeltus fasciatus

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Like many species, Oncopeltus fasciatus uses an epigenetic control mechanism known as DNA methylation. Specifically, one gene governs a methyl transferase known as DNMT1. A knockout of this gene via double stranded RNA in female milkweed bugs was performed to observe how the absence of this gene affects the organism. Adult females were injected with either dsRNA or buffer solution for a control five days after reaching maturity and paired with an untreated male. Their eggs were harvested every 2 days following injection, counted, and then assessed for viability 5 days post-harvest. To assess ovarian structure with fluorescent microscopy, half of the females were dissected one week post-injection, and the other half were dissected two weeks post-injection. The hypothesis that the knockout will show a reduced viability in the eggs and an altered ovarian structure was tested. Results showed that by knocking out the DNMT1 gene, the egg viability had decreased significantly to 0% viability or less than 5% viability whereas the buffer injected females showed nearly full viability for eggs. The fluorescent microscopy showed that a reduction in follicular cells in dsDNMT1-group females, in comparison to the buffer injected females , with the most pronounced difference appearing at two weeks post injection. This is likely a result of the methyl transferase being necessary in the semi-conservative replication process during mitosis in which the transient divisions show less and less methylation with each division.

Fall conditions trigger an altered metabolic rate in monarch butterflies, Danaus plexippus

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Long-distance migration requires physiological changes to prepare for and sustain energetically costly movements. Some migrants, such as the monarch butterfly (Danaus plexippus), atrophy reproductive organs and enter reproductive diapause prior to undertaking their fall migration. It is likely that other physiological changes accompany this diapause to allow migratory monarchs to survive the 3,000-km migration each year from breeding sites as far north as Canada to wintering sites in Central Mexico. It has been shown that N. America migratory monarchs demonstrate a lower flight metabolic rate than monarchs from resident populations in Costa Rica and South Florida that breed year-round and do not migrate. In this study I investigated whether similar differences in flight metabolism are present between migratory vs. non-migratory monarch generations within the eastern North American population, which might indicate plasticity in flight metabolic rate. I reared monarch caterpillars in incubators set to conditions that mimicked temperatures and photoperiods of either fall (migratory) or summer (non-migratory) generations. As adults, the monarchs were tethered to a flight mill to induce 10 minutes of continuous flight. Oxygen consumption was measured immediately post flight as a proxy for metabolic rate. Results showed that monarchs reared under fall conditions demonstrated a significantly lower resting and flight metabolism than monarchs reared under summer conditions. These findings suggest that the pre-migratory physiological state is associated with changes that conserve energy during flight, and that monarchs are able to undergo trans-generational shifts in metabolism.

Re-examination of Fiber Content in Tree Nuts and Peanuts

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According to the 2015-2020 Dietary Guidelines for Americans, we currently do not consume enough fiber. Although the importance of dietary fiber to one's health is becoming more widely known, many are unaware of insoluble and soluble dietary fiber (IDF & SDF, respectively), which are components of total dietary fiber (TDF) that play important, but different, roles in human health. Adequate intake of SDF may ameliorate the risk of chronic diseases such as colon cancer and irritable bowel syndrome, while IDF may reduce the risk of developing type II diabetes. These health benefits highlight a need to know the IDF and SDF levels in foods, and not just the TDF content. The USDA National Nutrient Database for Standard Reference (SR28) only reports TDF levels in foodstuffs, and for some items like tree nuts and peanuts, there is a lack of specificity (i.e., presence or absence of skins, cultivars, etc.) as well as adequate data. This study reports on the content of IDF and SDF in selected tree nuts and peanuts using an automated system from ANKOM Technologies that can separate TDF into its IDF and SDF fractions, allowing for quantitation of these previously unreported components. Tree nut and peanut samples were immersed in liquid nitrogen and then ground to a fine particle size using a food chopper. Samples were sealed in ANKOM XT-4 filter bags and defatted via immersion and agitation in ether. IDF and SDF were fractionated using ANKOM's TDF Analyzer, running an automated AOAC 991.43 program with proprietary IDF and SDF filter bags. Ash and crude protein contents of digested samples were determined by a dry ashing and the Kjeldahl method, respectively. With this pioneering technology, raw blanched 'Nonpareil' almonds were found to possess an average TDF content of 12.6 ± 0.45%, whereas the Database reports a value of 9.9 ± 0.3%. Average almond IDF and SDF levels were 11.8 ± 0.5% and 0.9 ± 0.1%, respectively. The average TDF content for Runner peanuts was 11.0 ± 0.8 %, with IDF and SDF fractions being 10.1 ± 1.3% and 0.93% ± 0.5%, respectively. 'Schley' pecans had an average TDF value of 9.45 ± 0.95%, with IDF and SDF fractions at 8.6 ± 1.1% and 0.85 ± 0.3%, respectively. The importance of IDF and SDF in one's daily diet, coupled with a lack of quantitative data on their contents in foods like tree nuts, highlights the significance of this research. The data generated here will be provided to the USDA for consideration of updating their Database.

Connecting Athens Vegetable Demand and Supply

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In 2016, the adult obesity rate of Georgia was 31.4%. That same year, children between the ages of 10 and 17 had a combined overweight and obesity rate of 32.2%, making Georgia 18th in the country for this category. This research assesses how to improve the quantity of nutritional foods sold within the city of Athens, Georgia by focusing on the local food system. Specifically, it looks at the demand and supply sides of two vegetables: collard greens and kale. Demand was determined through examining United States Department of Agriculture nutrition guidelines and estimating with Athens population statistics. Supply was calculated through estimating potential yield and comparing with Census of Agriculture data and Georgia Farm Gate Value Reports. The Athens population has a demand of 56,897,568.75 pounds of vegetables per year. Right now, collards growers can meet 83.34% of this demand and kale growers can meet 45.52% of this demand. The research aims to understand how yield and sales can be refocused to meet all of the demand. There are a number of potential approaches to facilitate connecting local suppliers with the Athens population. Institutional implementation and expansion and creation of economic markets are two. These results are summarized in a policy brief that was written with the intent to be used as supporting evidence for the future food systems chapter of the Athens-Clarke County long-term sustainability plan.

Interactions Between Delusory Parasitosis Sufferers and the Medical Community

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Delusory Parasitosis (DP) is a multifaceted delusional disorder in which an individual believes that they are victims of parasitic arthropods, which may include spiders, mites or worms, among others. Sufferers of this condition often face both visual and tactile hallucinations that result in self-mutilation of the affected areas, which can be difficult for doctors to diagnose due to a lack of entomological training and awareness of this condition. Furthermore, once a diagnosis is made, convincing a patient that the cause of the sensations is a delusion can be very difficult considering the stigma and misinformation regarding mental illnesses. This project aimed to determine the relationship between reported symptoms and reported medical response which was done through phone interviews and testing of environmental samples provided by the individual. Misdiagnosis and poor interaction between the medical community and DP patients has alienated these individuals and has resulted in off-label usage of drugs and insecticides and at an average rate of one per individual. These misdiagnoses can be explained by the types of medical care solicited. Patients most commonly visited their general practitioners or dermatologists, at rates of 36 and 34 percent respectively. Individuals who consulted specialists more likely to make a correct diagnosis of DP, neurologists and psychiatrists, did so only 6.8 percent of the time. Because of this disconnect between the individual seeking treatment for the putative problem (parasites) and the individual obtaining medical treatment for the actual underlying condition medical care that is the beneficial, diagnosis rates were low, with 53 percent of individuals claiming no diagnosis made, and 23 percent reporting the incorrect diagnosis of scabies. By understanding these relationships between the patient's symptoms and the response in the medical community, strategies can be created to help medical professionals properly diagnose DP and appropriately treat patients.

Sphingolipid Manipulation of Mesenchymal Stem Cell Morphology and Immunosuppressive Potency

Isaac Steinmetz, Biological Science Major, Department of Poultry Science; Presented in 2018

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Successful biomanufacturing of cell therapies requires an efficient, high yield production of homogeneously potent cells, but mesenchymal stem cells (MSCs) have been shown to have heterogeneous immunosuppressive potency within populations and between donors. The objectives of this project are to investigate the possibility of rescuing MSC potency by testing the immunosuppressive impact of several sphingolipid manipulating factors (SMFs) and by using high content imaging to investigate morphological changes that may predict MSC potency.

In these studies, we evaluated MSC activation by IFN-gamma (IFN). To improve MSC immune response, the cells were treated with two SMFs, amitriptyline and myriocin, and then fixed with paraformaldehyde after 24 hours. They were then stained with two fluorescent labels, a nucleus dye, DAPI (4',6-Diamidino-2-Phenylindole, Dihydrochloride), and a cytoplasm dye, FITC (Fluorescein), imaged with a fluorescence microscope, and analyzed. Images were analyzed using CellProfiler and R studio to conduct multivariate statistical analysis using principle component analysis (PCA) and logistic regression to determine any morphological changes caused by the SMFs. PCA was used to analyze cell outlines in control and treated cells, and PC1 provided a clear separation between treated and untreated cells. Furthermore, a partial separation was observed in PC1 between treated and control cells in just the high potency donors. In can be concluded that we can discern between control and treated cells based on morphology using PCA. This was deduced based on the PCA analysis, which depicted a leftward shift in cell outline of PC1 in both high and low potency cells when treated with IFN.

Effect of Teat Location on Piglet Development

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The purpose of this project was to determine whether or not teat location had an effect on the rate of growth in neonatal piglets. It was expected that piglets nursing from the cranial teats would grow at a faster rate than those nursing from the caudal teats due to the former having closer proximity to the heart. In order to measure the growth rate, piglets were numbered on their backs during processing and on day 4 were observed during nursing. The nursing order was determined and recorded. On days 7, 14, and 21 piglets were weighed and growth rate based on teat location was established. Piglets nursing from teats 1-4 (cranial teats), 5-8 (middle teats), and 9-12 (caudal teats) gained on average 252.7 g, 235.3 g, and 178.4 g respectively. The hypothesis that piglets nursing from the front teats grow at a faster rate was strongly supported by the results.

Effects of Condensed Tannins in Lespedeza cuneata on Oxidative Stress in Performance Horses

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Lespedeza cuneata, common name sericea lespedeza, has been increasing in popularity in the small ruminant industry as a potential anthelmintic alternative to chemical dewormers. This is because many of the parasites that pose a problem for small ruminants are becoming increasingly immune to available anthelmintics. L. cuneata is a warm season, perennial legume that grows well in poor conditions making it a good choice for pastures where more common forages are difficult to grow. Most research around the lespedeza's anthelmintic effects points to the high levels of condensed tannins found in the plant. Condensed tannins are also thought to enhance antioxidant capabilities; however, this has not been extensively studied. Health benefits from L. cuneata, such as reduced oxidative stress and treatment of inflammatory conditions, have been noted in human research. Sericea lespedeza has a nutrient profile comparable to other high quality equine forages and may prove to be advantageous as a feed source if it is able to reduce oxidative stress that performance horses are commonly subjected to. This study was a continuation of a study to determine if feeding lespedeza hay improved antioxidant capacity and reduced oxidative stress in response to a bout of moderately intense exercise. Twelve horses were used in a 6-week feeding trial. The horses were placed in stalls for 6-7 hours each day and fed 1% of their body weight in either sericea lespedeza hay or Russell bermudagrass hay. At the conclusion of the feeding trial all twelve horses underwent an incremental standardized exercise test (SET). Blood was collected via jugular venipuncture pre and post SET. Blood was analyzed for antioxidant capacity via assaying total, reduced, and oxidized glutathione, as well as malondialdehyde (as measured by the Thiobarbituric Acid Reactive Substances assay), and plasma protein carbonylations generated during oxidative stress. Between the two treatment groups there was no significant difference in the plasma protein carbonylation and malondialdehyde concentrations. Analysis showed that the bermudagrass hay used had a negligible amount of condensed tannins, <0.02mg/g. The lespedeza hay contained 1.94 mg/g; however, this is lower than concentrations reported in other studies.

Evaluating the Effects of Microbial Activators on Plant and Soil Health

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Biodynamics is a method of organic agriculture that strives to create a diversified and balanced farm ecosystem, and emphasizes regenerative practices to promote stewardship of the earth. A multi-year experimental plot was established at UGA's student farm (UGArden) in Athens for the purpose of testing and demonstrating biodynamic growing practices under southeastern conditions. Two different rotations of vegetables and cover crops were grown in replicated plots using either organic or organic plus biodynamic practices. Implemented biodynamic practices included manure, herbal, and mineral additions to the compost, soil, and plants, in addition to following suggested work days from a biodynamic calendar. Biodynamic practices are believed to increase soil microbiological activity leading to improved plant health. Soil microbial population diversity was estimated using two methods. During the fall of 2017, roots of vegetable crops from either the biodynamic or organic subplots were cleared and stained according to standard protocols and examined microscopically for evidence of vesicular-arbuscular mycorrhizal (VAM) fungal colonization. No evidence of VAM colonization was observed in any of the crop roots. Total DNA was isolated from soil samples from each subplot and fungal internal transcribed spacer regions (ITS) were amplified and sequenced to determine fungal diversity. Soil and plant health parameters were assessed at the start of the project and repeated at the end of each crop rotation through spring semester 2018. Soil tests for nutrient status and percent organic matter were taken at the start of the fall/winter crop in September 2017 and repeated after removal of all winter crops in March 2018. Broccoli yields were determined from each subplot in December 2017. Biodynamic broccoli yields were significantly higher than the organic broccoli yields, as tested by a two-tailed T-test. This work is part of a longer term project to identify inputs and practices that increase productivity and sustainability in organic agriculture.

Monitoring for rapid shifts in carbon mineralization and iron availability during soil oxygen changes

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Shifts in soil oxygen levels can strongly impact nutrient availability and microbial activity. Different sets of microorganisms thrive under anaerobic (no oxygen) and aerobic (oxygen rich) conditions. Some anaerobic microbes can use soil iron minerals (Fe(III) oxidation state) as an electron acceptor and dissolve them, releasing any bound nutrients, such as phosphorus. However, it is unclear how quickly microbial communities can shift between aerobic and anaerobic metabolisms in response to a change in oxygen concentration. The focus of this study is to quantify microbial activity during shifts in oxygen concentrations by measuring carbon dioxide (CO2) release and to monitor for the use of iron minerals as an electron acceptor by measuring the production of reduced iron [e.g., Fe(II)]. To do this we filled test tubes with soil and incubated them under aerobic or anaerobic conditions for a week and then exposed the test tubes to the opposite conditions (e.g., switched aerobic to anaerobic and vice versa) and sampled them a 5 minute intervals for a total of 30 minutes for carbon dioxide and iron (II). The results show a steady increase of carbon dioxide during the incubation week and rapid flux of CO2 during the switch in in conditions. Surprisingly, the flux of CO2 during the week long acclamation period was similar during anaerobic and aerobic conditions. We are current quantifying Fe(II) and CO2 from the 5 minute interval sampling and this data will be presented and discussed.

Expression and Purification of Recombinant Campylobacter jejuni Proteins in an E. coli Expression System

Elizabeth E Umanah, Applied Biotechnology Major, Department of Entomology; Presented in 2018

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The bacterial plant pathogen Pseudomonas syringae is a powerful model organism used to study host/microbe interactions. Due to its high genetic tractability, the P. syringae genome can be precisely modified down to the individual base pair using a genetic technique termed allelic replacement. However, the creation of allelic replacement vectors is typically cumbersome, labor intensive, and requires specialized design for each vector making it the rate-limiting step in P. syringae genetic manipulation. Currently, our lab has designed a straightforward approach to generate allelic replacement vectors. This is based on standardized oligonucleotide tails (standardized tail construction of allelic replacement vectors) to facilitate the rapid and efficient assembly of multiple DNA fragments. The goal of this research is to optimize this approach for speed and efficiency of use by deploying ST-CARV to rapidly generate gene knockouts and identify P. syringae virulence genes. The results from this research will allow for the effective development of allelic replacement vectors and characterization of virulence genes.

Fruit zone leaf removal effect on crop yield and wine quality potential in Cabernet franc.

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Fruit zone leaf removal is used to manage grape quality in vineyards. Common industry practice is to pull leaves after fruit set has occurred to produce an average fruit zone coverage of one to two leaf layers. That conservative leaf removal practice has likely become standard due to documented reduction in anthocyanins when red grapes were highly exposed to radiation in the arid, western US. Since anthocyanins are impacted by both light and temperature, questions remain about the timing and extent of leaf removal required to improve wine quality in relatively new wine regions, many of which display contrasting radiation and temperature patterns to those of well-established regions in drier climates. We evaluated the effects of no leaf removal and pre-bloom and post-fruit set removal of six fruit zone leaves on crop yield and fruit composition in a seven-year-old Cabernet franc vineyard located in Rabun County, Georgia. We hypothesized that pre-bloom leaf removal would reduce crop yield and that both leaf removal timings would increase total grape phenolics and anthocyanins and reduce juice titratable acidity. Crop yield was unaffected by leaf removal treatment. Total titratable juice acidity was reduced by an average of 14% by both leaf removal treatments when compared to no leaf removal. Total grape phenolics were increased by an average of 25% by both leaf removal treatments, and total grape anthocyanins were increased by 14% by only pre-bloom leaf removal, when compared to no leaf removal. Based on first-year findings of this multi-year trial, the removal of six fruit zone leaves is recommended to reduce acidity and increase grape anthocyanins and phenolics as these compositional attributes are associated with improved wine quality in red-fruited cultivars such as Cabernet franc.

Pantoea ananatis Transposon Library

Sydney Wagner, Applied Biotechnology Major, Department of Entomology; Presented in 2018

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Pantoea ananatis is a gram-negative, phytopathogenic bacteria that causes leaf blight which then can later cause bulb rot in onions in Georgia. This disease is an issue both during the growth of the bulb, and post-harvest, especially for growers of Georgia's own Vidalia sweet onions as it greatly impacts the development of the plant and consumer desirability for the bulb. A transposon is a special genetic element within genomes that encodes for enzymes to cut itself out of a genome and "jump" around causing new mutations. Scientists have closed transposons into plasmids which can be used as a tool to generate a mutant library. A mutant library is a collection of bacteria that are assumed to have a random mutation (through our transposon method). With the availability of an extensive mutant library we are able to better understand how infection of the leaves can occur and its impact on the development of the bulb.

Evaluation of LMH cells as a tool to study effects of growth hormone in the liver of broiler chickens

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Growth hormone (GH) controls growth and body composition in all animals, including birds. It has many target tissues in growing birds including liver, muscle, and adipose. The action of GH on its target tissues happens when it binds growth hormone receptor (GH-R) located on the surface of the cell and activates intracellular cascades. Pathways activated by GH in birds have not been determined, even though understanding this would increase knowledge of factors regulating growth and metabolism. The purpose of this project was to determine if LMH cells, a chicken liver cell line, are a suitable model to investigate GH signaling and its effects on growth-related and metabolic gene expression in birds. Specific objectives were 1) to determine if LMH cells express growth-related genes and 2) to compare mRNA expression for these genes with levels in liver tissue from fast and slow growing birds. LMH cells were cultured with and without serum (n=5 replicates), and liver samples were collected from slow-growing (ACRB) and fast-growing (Cobb) broiler chickens at post-hatch day 21 (D21; n=5 replicates). Total RNA was extracted using the Qiagen RNeasy mini kit with on-column DNase digestion and quantified using UV spectrophotometry. Total RNA (0.5 µg) was reverse transcribed, and quantitative real-time PCR was used to evaluate mRNA levels for GH-R, insulin-like growth factors 1 and 2 (IGF1 and IGF2), IGF receptor (IGF-R), and IGF binding proteins (IGFBP) 1, 2, 3, 4, 5, and 7. Data was statistically analyzed in SAS using one-way ANOVA followed by test of least significant difference. All genes measured were detectable in LMH cells and D21 liver. In LMH cells, the presence of serum did not affect levels of any genes ($P>0.05$), and there was no difference in expression between slow- and fast-growing birds ($P>0.05$). There were differences in expression levels between LMH cells and D21 liver for all genes. Levels of mRNA for IGF-R, IGFBP1, and IGFBP3 were higher in LMH cells than in D21 liver ($P<0.05$). Levels of mRNA for GH-R, IGF1, IGF2, IGFBP2, IGFBP5, and IGFBP7 were higher in D21 liver than LMH cells ($P<0.05$). Altered expression between LMH cells and D21 liver indicate that differences likely exist in the regulation of these genes in cell lines and liver tissue. Nonetheless, since LMH cells express GH-R and other growth-related genes, they still may be suitable to use as a model to study GH signaling in the liver of birds.

Supply Chain Logistics for the Commercialization of Carinata

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Carinata, an oilseed brassica plant, represents a new opportunity for biofuel in the Southeastern United States. The plant offers a twofold solution to the pressing issue of carbon emissions: oil extracted from carinata seed can be used to produce bio jet fuel, diesel, and other renewable products while the leftover meal serves as a high protein feed for livestock. However, before the industry can be established, infrastructure must be in place. The goal of my research is to locate the facilities necessary to establish and maintain a successful industry for carinata and to obtain statistical and logistical information about such facilities. I have contacted Georgia Farm Bureau, the Georgia Feed and Grain Association, and the Georgia Department of Agriculture to locate grain elevators, feed mills, and crushing facilities throughout the state of Georgia. I have individually contacted owners and managers of each facility to obtain data on capacity and crop intake. Data is recorded in an excel spreadsheet and maps displaying physical location have been created. Grain elevators are located mainly in southern Georgia. Feed mills are more spread out across the state; however, there is a slight concentration within the northeast corner. The state's grain industry is comprised mostly of corn, wheat, and soybeans. Seed crushing facilities are exclusively within northern Georgia. It was determined that such facilities operate under food grade standards and could not process carinata. Therefore, data was not provided. Location was relatively easy to find but obtaining capacity and crop data proved more difficult. Many facilities showed little interest in carinata and were hesitant or unwilling to provide information. Corn and soy dominate the market and it will take more education and research on carinata before the grain industry is willing to adopt it.

Does XopJ play a role in host specificity of Acidovorax citrulli, the causal agent of bacterial fruit blotch of cucurbits

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Bacterial fruit blotch (BFB), caused by Acidovorax citrulli, is an economic threat to the production of cucurbits such as watermelon and melon. Although BFB causes economically significant crop yield losses, the factors that determine host-preference and virulence of A. citrulli remain largely unknown. A. citrulli strains can be divided into two groups (I & II) that differ in pathogenicity. More specifically, group I strains infect melon fruits, while group II strains infect watermelon fruits. Research has revealed several three type 3 secreted effectors in the genomes of group II strains that are absent in the genomes of group I strains. We hypothesize that these effectors, all XopJ homologs (Aave_2166, Aave_2708, and Aave_2938), contribute to the ability of group II A. citrulli strains to specifically infect watermelon fruit. The objective of the study is to determine the role of XopJ in A. citrulli host specificity among cucurbit species. Our lab generated a transformant of the group I A. citrulli strain, M6 (M6::pBBR2708), that constitutively expresses the XopJ homolog, Aave_2708. The stability of the plasmid containing Aave_2708 was verified by transfer plating the transformant five times on plates without the antibiotic, kanamycin. Transformants were then cultured on a kanamycin-amended agar plate. After verifying plasmid stability, we confirmed the expression of Aave_2708 in this mutant by measuring mRNA levels using reverse transcription real-time PCR analysis. We then compared the virulence of the mutant and its parental wild-type strain (M6) in melon seedling inoculation assays using syringe and spray-inoculation. BFB severity was assessed by measuring the area of symptomatic seedling tissue using ImageJ software. Bacterial population dynamics over time were also measured using real-time PCR analysis. Statistical significance of the treatment factors was determined according to a one-way ANOVA test with at least 14 replications of each treatment with JMP software. Results from the seedling inoculation trials did not reveal a consistent difference in BFB severity between M6::pBBR2708 and M6. Furthermore, a comparison of bacterial populations at 0 and 3 days post-inoculation revealed no significant difference between M6::pBBR2708 and M6, indicating that Aave_2708 does not play a role in bacterial colonization of melon seedlings.

Dermatan Sulfate Epimerase Expression in Equine DSLD Tissues

Madeline G Young, Biological Science, Animal Health Major, Department of Poultry Science; Presented in 2018

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Equine Degenerative Suspensory Ligament Desmitis (DSLD) is a disease that occurs in a wide range of horse breeds and often results in mortality. Our lab has shown that the key histopathological sign of DSLD is a buildup of an abnormal version of decorin, a tendon proteoglycan, within connective tissue throughout the body. In addition, we have found that DSLD horses have increased levels of the chondrogenic growth factor BMP-2. Finding increased levels of BMP-2 was interesting because it stimulates the growth of cartilage and could therefore be involved in the lesions seen in DSLD horses. These findings indicate that the abnormal decorin with the BMP-2 growth factors could be the cause of the prolific production of decorin in the connective tissue of DSLD horses. Therefore, it is imperative to understand the mechanism behind the synthesis of the deviant decorin. We have turned our attention to dermatan sulfate epimerase, an enzyme responsible for the proper glycosylation of decorin. The levels of epimerase expression in connective tissue was determined utilizing immunohistochemistry staining on control horse and DSLD horse tissues. Dermatan sulfate epimerase levels were found to be relatively equal between DSLD and control horse tissues. This finding indicates that another enzyme may play a greater role in the pathogenesis of DSLD or that the epimerase expressed in DSLD horses is abnormal. Both of these possibilities will be explored in future studies through gene expression analysis, PCR, and immunohistochemistry staining.

Quantifying a Correlation between Maize Leaf Color and Nitrogen Stress

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The purpose of this experiment was to determine if off-the-shelf camera technology could be used to quantify nitrogen stress in maize. The data from this experiment would be used to further research in making maize crops less dependent on nitrogen fertilizer. Five different levels of nitrogen fertilizer were given to the plants ranging from no dose to the recommended dose. One month after the kernels were planted, the top leaf of each corn stalk was cut off for sampling. Pictures were taken of the samples with a Fujifilm Finepix F600 EXR camera to record their color for nitrogen stress. To ensure lighting conditions, the leaves were placed in a cardboard box lined with white paper to attempt to normalize the colors for further processing. No strong signal was found in any of the color channels, possibly due to complications with finding proper lighting conditions. Future work will focus on eliminating excess light while taking pictures of leaf samples in order to not skew the data. The RAW picture format should also be used, instead of JPEG, to eliminate any unnecessary filters while taking the picture. Implementing these conditions in further study will determine whether or not a consumer grade camera can be used to conduct this experiment.

The Goldilocks Phenomenon: Determining Optimal Larval Density for Rearing Anopheles quadrimaculatus in a Laboratory Setting

Katie Bennett, Applied Biotechnology Major, Department of Entomology; Presented in 2017

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Anopheles quadrimaculatus is the main malaria vector within the United States and is being used as a model for studying other Anopheles species. Worldwide, the impact of controlling Anopheles populations could lead to a decrease in malaria cases. To test methods of controlling Anopheles, laboratory colonies need to be maintained for research. It is difficult to develop the ideal Anopheles habitat in a laboratory setting, and because all labs do not have the same facilities, uniform conditions are not possible. The objective of this study was to determine optimal larval rearing conditions for A. quadrimaculatus in our laboratory. The main concern for rearing A. quadrimaculatus is the density of the larval stage in the rearing tray (35 cm X 20 cm X 12 cm). The volume of water used was 350 mL per tray, for a depth of 0.5 cm. Initial density was 1,000 larvae per tray, as stipulated in the CDC Anopheles quadrimaculatus rearing manual. As larvae developed through succeeding instars, growth-induced crowding required daily thinning, to maintain optimal density. With final thinning, the optimal density ended up being ca. 400 larvae per tray. Low density (<200 larvae per tray) resulted in high larval mortality and a higher pathogen infection rate. Overcrowding (>400 larvae per tray) increased larval death rates and reduced pupal production. Optimal larval survival and pupal emergence was produced with 350-400 larvae per tray at the final instar. In nature, stage-specific larval mortality ensures optimal larval density to maximize emergence of healthy robust adults. In the laboratory, culling larvae mimics this process, yielding larval densities that maximize numbers and fitness. Other factors important to good survival of the colony are food availability and room temperature, both of which impact colony success depending on the lab conditions. Too much food will cause infection, but not enough food will result in malnutrition. All of these factors are important to standardize when rearing large numbers of mosquitoes.

Mammary Gland Response to the Infusion of Mastitis Remedies in Dairy Heifers

Jessie M. Bentley, Animal Science Major, Department of Animal and Dairy Science; Presented in 2017

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Approximately 75% of bred dairy heifers are known to have mastitis, a bacterial infection of the mammary gland. This economically important disease results in a chronic inflammation of developing milk-producing tissues, resulting in reduced milk production and quality when heifers calve. The purpose of this study was to control mastitis by treating heifers during late pregnancy in attempts to cure and prevent infections with pathogenic bacteria. Mammary secretion samples were collected from 29 heifers (30-60 days before expected calving date) and processed for bacteriology, differential leukocyte counts, and somatic cell counts (SCC) to determine initial infection status. Following sample collection, 4 treatments (untreated control, nonlactating cow antibiotic, teat seal, and nonlactating cow antibiotic + teat seal) were randomly administered; after treatment, secretions were monitored at 24, 48, and 72 h. Responses to treatments were assessed at calving. Treatment means, expressed as % of quarters cured and % new infections prevented, were separated using SAS 9.3 Proc GLM for Windows. Results demonstrated that treatment with nonlactating cow antibiotic and nonlactating cow antibiotic + teat seal were both 100% effective ($P<0.05$) in curing infected quarters, compared to untreated controls (62.5%). Treatment with teat seal was 87.5% effective in curing infected quarters but not significantly different from controls. SCC (a measure of mammary inflammation) were lower in quarters treated with nonlactating cow antibiotic (125 x 103), teat seal (264 x 103), and nonlactating cow antibiotic + teat seal (181 x 103) compared to controls (974 x 103). All treatments ranged from 95 to 100% effective in preventing new infections. The 87.5% efficacy exhibited by teat seal was unexpected because this product was developed to prevent new infections, and, being an inert substance, has no therapeutic properties. However, mammary secretion samples collected 24, 48, and 72 h after treatment showed elevated concentrations of neutrophils and TNFα in response to teat seal, both of which are known to provide antibacterial activity. Results suggest that cure rates with nonlactating cow antibiotic and nonlactating cow antibiotic + teat seal make them suitable mastitis treatment remedies and practical means of reducing this disease in dairy heifers. All 4 treatments (including control) were equally effective in preventing new infections.

An Evaluation of the Effects of Adding Humectants and Rhizo-Supplements, With and Without Fertilizer, to Seedlings Grown in a Controlled Greenhouse

Ruqayah Bhuiyan, Horticulture Major, Department of Horticulture; Presented in 2017

Faculty Mentor: Paul Thomas, Department of Horticulture

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We evaluated two Schaeffer's Inc. products traditionally used in farm field production, in a controlled greenhouse environment to assess suitability for greenhouse industry use. The two products, Dynahume SW (Y), a humectant, and Rhizozyme Supreme (X), which is primarily microbes and mycorrhizal fungi, were applied to common vegetable and bedding seedlings to assess the benefits to plant growth. 480, 10 cm square pots were filled with Jolly Gardener commercial potting media. The five species seeded were basil, marigold, salvia, zucchini, and tomato. Plants were established as seeds to match the vegetable and bedding "start" or "plug" industry standard practices. Baseline Electrical Conductivity of the combined 1X -1Y treatments was established at 1.12 mS, which is equivalent to a common 100 ppm solution of fertilizer and is a suitable level for seedlings. Treatments were added to the soil before germination. Each enhancer had four levels of concentration: 0, ½, 1 (baseline), and 2 times the baseline. The baseline concentration was made up of 1mL of enhancer per 50mL of water, and so on. There were sixteen treatments. There were three replications of each treatment totaling 48 plants/species. Two identical groups of the above treatment array were planted, with one group receiving two application of 50mL of 20-10-20 at 200ppm, and a second group as the non-fertilized control. The experiment was a split plot design with standard fertility as the main effect. We evaluated three growth parameters: the condition of the roots, the levels of chlorophyll in the leaves, and the dry weight of the upper portion of the plant. The entire fertilized group showed a significantly greater growth and chlorophyll levels than the non-fertilized group. Within the fertilized group, Salvia treated with Dynahume (Y) stunted the growth of plants at 2y, but at levels ½y plus 2X, Salvia exhibited the largest leaves and highest levels of chlorophyll. Overall, at the 2Y level Dynahume treated plants were significantly smaller than plants receiving 2X of the Rhizozyme treatment. Basil, however, exhibited enhancing growth when treated with Dynahume without fertility. In conclusion, the Schaeffer's products should be considered true enhancers, due to lack of quality growth in the non-fertilized group. When combined with traditional greenhouse fertilizers, the 2x-1/2y combination of the crop enhancers produced a superior plant.

The effect of sericea lespedeza on strongyle fecal egg counts in mature horses

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Parasite control in the equine industry is primarily accomplished through deworming programs that implement the use of anthelmintics, with the primary target in mature horses being cyathostomins (small strongyles). Due to their widespread use, resistance to these drugs is now a major problem that negatively affects the success of commonly used deworming programs. Though little work has been done investigating alternative worm control strategies in horses, research in small ruminants has led to the development of several novel non-chemical control methods for gastrointestinal nematodes, including feeding plants containing condensed tannins, namely sericea lespedeza (SL; Lespedeza cuneata). Thus far, studies in small ruminants have shown that condensed tannins act by inhibiting microbial enzymes, deprivation of substrates necessary for growth of microbes, as well as direct action on metabolism by inhibition of oxidative phosphorylation. As a forage, SL is readily consumed by horses and may have potential as an alternative treatment. The objective of this study was to analyze the effects of SL as compared with Russell bermudagrass (RB; Cynodon dactylon) with regards to parasite load in horses. Sixteen horses were divided into 2 treatment groups, each receiving 1.5% of body weight of either SL or RB hay daily over a 4-week period. Fecal egg counts (FEC) performed by mini-FLOTAC technique were conducted at d 0, 14, and 28 of the feeding trial as well as on d 42 (2 weeks after removing from diets). Horses were randomly divided and housed in 2 adjacent 7-acre pastures and brought into stalls for 6 h/d to consume treatment diets. Initial (d 0) FEC for horses on both treatment groups was high ($SL = 447 \pm 440$, $RB = 451 \pm 479$, $P = 0.98$). Horses showed increases in FEC by d 42 ($P < 0.001$), likely due to housing at a high stocking rate on contaminated pastures. At d 28 and d 42, FEC was not different between treatment groups ($SL = 317 \pm 345$, $RB = 505 \pm 432$; $SL = 1008 \pm 1183$, $RB = 1220 \pm 1164$ at d 28 and d 42 respectively). It was noted that in horses with FEC < 50 epg (5 horses), there was a difference ($P = 0.0082$) in FEC response between treatment groups, with SL horses showing no FEC increase, while RB horses showed an increase of approximately 100 epg by d 42. Results of this study indicate that 28 d on SL showed no decrease in existing parasite populations. Future studies should incorporate feeding SL in conjunction with a deworming program.

Targeting Postemergence Dallisgrass Control Using Cooling Degree Days

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Dallisgrass (Paspalum dilatatum Poir.) is a problematic rhizomatous perennial grass weed of managed turfgrass in the southeastern United States. Previous research evaluating mid-summer herbicide applications resulted in minimal dallisgrass control. Fall applications may increase control by enhancing herbicide translocation using the carbohydrate source/sink relationship. Furthermore, tracking cooling degree days (CDD) will allow for more precise herbicide applications during dallisgrass reproductive growth. Therefore, the objective of our research was to determine the appropriate rate of fall applied postemergence herbicides for dallisgrass control using cooling degree days. Field experiments were conducted at Pine Hills Golf Course in Winder, GA during 2016 and 2017. Research was conducted on a common bermudagrass [Cynodon dactylon (L.) Pers.] (3.8 cm) rough with a mature dallisgrass infestation. Plots (1.5 x 1.5 m) contained approximately 75% dallisgrass cover. Treatments were arranged in a 4 x 3 factorial (4 herbicides and 3 rates) within a randomized complete block design with 4 replications. Herbicide treatments were initiated on September 23, 2016 (5 to 125 CDD22C) and consisted of Drive XLR8 (quinclorac) at 1.5, 2.3, and 3.0 kg ai ha-1; MSMA (monosodium methanearsonate) at 6.1, 9.1, and 12.1 kg ai ha-1; Roundup PRO (glyphosate) at 5, 7.6, and 10.1 kg ai ha-1; and Tribute Total (thiencarbazone + foramsulfuron + halosulfuron) at 0.14, 0.18, and 0.22 kg ai ha-1. Methylated seed oil at 0.5% v/v was added to all Drive XLR8 and Tribute Total treatments. An untreated check was included for comparison. Herbicides were applied with a CO2 powered backpack sprayer calibrated to deliver 843 L ha -1 at 221 kPa. Visual ratings of % dallisgrass cover were recorded at 0, 4, and 21 weeks after initial treatment (WAIT) and converted to percent control by comparing back to % cover at trial initiation (0 WAIT). Initial dallisgrass control (4 WAIT) was greatest in response to Roundup PRO (100%), regardless of rate. Control with MSMA was 74 to 86%, regardless of rate, followed by (fb) Drive XLR8 (45 to 63%) and Tribute Total (25 to 47%) 4 WAIT. Long-term control (21 WAIT) was greatest in response to Roundup PRO (100%). All other treatments resulted in dallisgrass control of 85 to 95%, regardless of herbicide or rate. Targeted herbicide applications based on cooling degree days may have increased dallisgrass control; however, regrowth will be monitored through the summer.

Quantifying the Effects of Dynamic Variable Rate Irrigation at the Field Scale

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Presently, variable rate irrigation utilizes static prescription rate maps to apply water to within-field irrigation management zones. These maps are formulated at the onset of the growing season and are therefore not receptive to the environmental factors that change within the field. The overall objective of this study is to employ a dynamic variable rate irrigation system that receives a newly modified prescription map on a daily basis and quantify the changes in crop yield and water use efficiency when compared to conventional irrigation methods. The dynamic prescription maps will be the result of using installed soil moisture sensors in real time in conjunction with a modified van Genuchten model to develop irrigation recommendations and maintain the soil profile at approximately 75% of field capacity. These sensors are a part of the UGA Smart Sensor Array, which is an economical wireless soil moisture sensing system. The first objective is to calculate and map equal areas of the target field to create adjacent zones of dynamic variable rate irrigation and conventional irrigation. The second objective is to irrigate the field using the two treatments. The third objective is to compare the yields and water use efficiencies between the two treatments and disseminate the results to growers, extension agents, and irrigation service providers.

Virtual Reality for Marketing in Agriculture

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Augmented and virtual reality (VR) have become a new marketing tool to engage consumers and increase product knowledge. Companies such as Disney, National Geographic and Coca-Cola have used VR to promote their brands and create consumer interactions. Larger companies who wish to interact with consumers are using VR to create an educational and interactive environment. These efforts are leading to increased profits for companies investing in VR . The purpose of this study was to understand key aspects of using VR to engage with consumers and apply those aspects to agricultural marketing. The research objectives guiding this study were: Describe key concepts of marketing strategies with VR in relation to consumer engagement, establish recommendations for the agricultural industry to implement VR into marketing strategies, based on current VR marketing campaigns. This was a qualitative content analysis of VR marketing videos. By using keywords such as virtual reality, consumer engagement, and public places in a Google search, 15 videos were analyzed. Each video was analyzed by documenting the visual, text, and sound throughout the video and developing themes. After the videos were analyzed, 3 themes emerged. (1) unusual environments, (2) an educational aspect, (3) consumer engagement, (4) reputation. Thirteen of the videos showed consumers locations and environments that were vastly different than their current settings, such as walking with a man on the moon, petting polar bears from, and interacting with dinosaurs. Out of the 15 videos, 9 of them had an education component, such as learning about endangered species. In all videos, consumers were encouraged to interact with the content by posing for pictures or dancing with different animations. This interaction created consumer engagement. All of these major themes encouraged consumers to know more about different environments, and experience different places. Throughout all videos, the theme of reputation was seen, in that the companies were not promoting a specific product, but promoting their reputation. Agricultural companies must incorporate all of the themes to use VR as a marketing tool. To have a successful VR video, the company must make the interaction with consumers educational, interactive, show a unique environment, and highlight their reputation. It is recommended agricultural companies use VR to showcase the appealing aspects of the industry and build a positive reputation amongst companies.

Co-construction of Knowledge to Improve Student Learning

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nstruction methods within higher education are rapidly changing to provide students with more engaging and intellectually probing experiences. The method of instruction explored in this study was the method of co-construction. Co-construction allows for development of a group dialogue and greater familiarization with adaptable skills. The purpose of this study was to understand how the integration of co-construction methods of instruction within two courses impacted the level of knowledge and engagement among the students. The research objectives guiding this study were: To compare and contrast students perceptions of learning utilizing co-construction methods, and to evaluate the instructor's role and their intended reception of information integrating co-construction methods. To understand the research objectives of this study, student focus groups and interviews with the instructors were conducted. Two focus groups with 7-15 individuals in size were conducted in each of the two classes. Additionally, individual interviews were conducted with both instructors. Open-ended topics were centered around co-construction and the methods in which they identified to incorporate co-construction into the classroom. Both interviews and focus groups were audio recorded and transcribed. The transcription was then used to identify emerging themes. Results from the interviews with the instructors yielded two common themes: (1) flexibility/adaptability and (2) encourage independence & creativity. Throughout both interviews, the instructors emphasized the development of independent thought and drive expressed by the students in moments of uncertainty. The focus groups with the students yielded two common themes: (1) unstructured learning challenges and (2) thought provoking experiences. Students within each course identified moments of personal growth and cooperation through the application of new concepts integrated within group settings. Based upon the findings from the focus groups and interviews, flexibility and openness were insisted upon as necessary traits. Instructors should design and implement adaptable course outlines which provide thorough understanding of the topics, while encouraging deviation from specific tasks. To provoke deep levels of understanding and comprehensive learning, students should be flexible and comfortable within their environment. Also, a positive and encouraging environment should be maintained for effective implementation of co-construction.

Relationships and Trade Offs between Food Insecurity and Healthcare

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Every day, there are people who struggle due to instability in their life. Survival often requires tough choices regarding food, health, shelter, education, and other daily needs. When focusing on one area, such as food insecurity, making ends meet through to the end of the month can be identified through varying resources for assistance. However, when food insecurity intersects with health-based concerns, an increasingly complex set of issues arise. This research project focuses on the tradeoffs and unique characteristics between food insecurity and health care. The majority of literature focuses on how food insecurity increases the need for health care due to health issues related to poor nutrition. While this is important, there is also an opportunity to consider how food insecure families perceive and deal with weighing the options between food and health care needs. The target population for this study is individuals utilizing food pantries in and around Atlanta, Georgia. Using qualitative research methods, such as focus groups, in-depth interviews, and photovoice will aid in gathering information about people's choices regarding food insecurity and health from their own perspective. Couched in a larger multi-disciplinary project, this research will focus specifically on the intersection of food and health when analyzing the data. The findings will contribute to developing a more comprehensive understanding of this complex intersection, which is intended to inform the Atlanta Community Food Bank as staff consider potential interventions for assistance at the agency level.

Analysis and further processing of broiler breast meat with common quality defects

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The purpose of this this study was to visualize the differences in connective tissue structure between normal broiler breast meat versus broiler breast meat affected with white striping and woody breast, measure the quality differences, and develop a method of further processing the affected meat into a value added product. Sections of each classification of meat (normal, moderate and severely affected) were stained using Masson's Trichrome to view the tissue at both parallel and perpendicular orientations. Textural analysis was performed on the chicken breasts according to the Mullenet-Owens Razor Shear method. The pH of each type of breast meat was measured along with color measurements on the Hunter Labs scale. Examination of the microscope slides confirmed that the severely affected tissue had much more connective tissue, which appeared in thick, blue bands. The bands of collagen were less thick in moderately affected breast meat samples, and much more thin and less apparent in the normal breast meat. All three categories of breast meat had very similar pH values, with an average of pH 5.91±0.12. Considering the L* values from the spectrophotometry, the severe chicken breast showed an increase in lightening (L*=69.1± 0.5) as opposed to the less light color of the normal chicken breast (L*=64.5± 0.8), indicating that severe white striping can be detected through instruments. From texture analysis, the average of the maximum shear force values for the severe samples was found to be 6.9±0.87 N, whereas that of the moderate breast was of 4.8±0.60 N. The energy required to penetrate 20mm into the sample for the severe samples was 69.9±8.1 N.mm, and that of the moderate samples was 47.7±5.9 N.mm. The texture analysis data fort the normal breast samples could not be used because of freeze damage, but, it is clear that the severely affected meat requires more energy to shear than meat with only moderate defects. The histological analysis showed that excess collagen accumulates in bands parallel to the muscle fibers. Because of this structure, it will be possible to design a processing method in which the bands of connective tissue are altered, and then a functional ingredient and cooking methods will be used to further improve the texture of the final product. Upon product formulation, texture and sensory analysis will be conducted.

Assessment of Oxidative Stress and Serum α-Tocopherol Levels in Exercising Horses in Response to Level and Form of Vitamin E Supplementation

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Vitamin E is an essential antioxidant that is found primarily in fresh forages and commercial equine feed rations as synthetic all-rac-α-tocopherol acetate. Performance horses are thought to have a higher requirement due to increased oxidative stress and limited access to fresh forage. Of the eight stereoisomers of α-tocopherol (an isomer of vitamin E itself), RRR-α-tocopherol is preferentially transferred to tissues in the body and is the only isomer present in natural supplements. This study aimed to compare natural to synthetic forms of vitamin E, and to determine if supplementing above NRC recommendations is beneficial to exercising horses. Following a 14d washout period, 18 horses were divided into three treatment groups and fed the control diet plus (1) synthetic low (SYN-L), 1000 IU/d synthetic α-tocopherol acetate, or (2) synthetic high (SYN-H), 4000 IU/d synthetic α-tocopherol acetate, or (3) natural (NAT), 4000 IU/d micellized RRR-α-tocopherol. After a 7d acclimation period, horses began a 6wk exercise protocol, with standard exercise tests (SET) performed prior to and at the conclusion of the 6wk exercise protocol. Resting, pre-feeding blood samples were collected immediately prior to starting horses on treatment diets (d0), and at d7, 21, and 49 as well as pre-and 2hr post SETs. Initially and at pre-SET1, no differences in serum α-tocopherol were seen across treatment groups. At all other time points, NAT horses had higher serum α-tocopherol compared to SYN-H and SYN-L ($P<0.05$). No differences were noted between SYN-H and SYN-L at any time point. Protein carbonylation was not statistically different between treatment groups at any time point. Results indicate that natural vitamin E is superior to synthetic in maintaining serum α-tocopherol levels in response to exercise, but the effect of this on oxidative stress needs to be further elucidated. Supplementing with higher levels of synthetic α-tocopherol did not raise blood α-tocopherol levels.

Optimization of virulence assays for Fusarium oxsporum f. sp. Vasinfectum causing Fusarium wilt of cotton

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Fusarium wilt of cotton, caused by the fungus Fusarium oxysporum f. sp. vasinfectum (FOV) results in major yield losses of this major agronomic crop in Georgia. FOV can persist for several years in the soil without a host, making management difficult. Currently, there are six genetically distinct races of FOV, each of which varies in pathogenicity and virulence on different cotton cultivars. Race 4, a particularly aggressive and virulent race, has not yet been found in the Southeast, but genotyping efforts have identified genetically similar isolates. An understanding of pathogen biology, particularly variance in virulence and pathogenicity, is critical for the development of disease management strategies and resistant cultivars. However, cultivars from race differentials are no longer available, and the relationships between genotype, race, and virulence are no longer clear. Therefore, consistent methods to evaluate virulence are needed. The primary objective of the project was to evaluate the effectiveness of several inoculation methods using a small number of isolates of FOV so that the method providing the best resolution in inoculation trials could be expanded to a larger set of isolates on several varieties of cotton. In a set of four greenhouse experiments, four different fungal spore inoculation methods were each tested twice using three FOV isolates and a control. The methods tested included a root dip, in which a seedling was uprooted and dipped in inoculum, a soil drench, in which inoculum was added to the soil surrounding a seedling, an injection, in which a syringe was used to inject inoculum directly into the vascular system of the seedling, and a tray dip, in which a seedling tray was dipped into inoculum. All inoculations were conducted two weeks after planting. Six weeks after inoculation, disease ratings were conducted using a scale of 0-5, and the dry weights of seedling roots and shoots were recorded. Statistical analysis was conducted using JMP to determine which of the above methods resulted in consistent disease levels by isolate, but showed variation among the isolates, and which methods caused seedling stunting significantly different from the control. Isolates were then characterized based on the tray dip and injection inoculation methods. This helped to phenotype isolates as either root rotters or more predominantly vascular diseases, and demonstrated that these methods are best for more expansive inoculation trials.

Reducing the Risk of Salmonella Transmission by Sanitation of Breeder Hatching Eggs

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Breeder hatching eggshell sanitization is important to the poultry industry to reduce the risk of horizontal transmission of foodborne pathogens from hatchery incubators to the grow-out farm and eventually to the processing plant. We evaluated two different modes of application (Dip vs. Electrostatic spray; ESS) using three different sanitizers (Chlorine, Sanidate [peroxy acetic-acid; PAA] and Cecure [Cetylpyridinium chloride]), with water as a control. Concentration of sanitizers used for dip and ESS was 250 and 2,500 ppm for Chlorine, 0.1 and 1.0% for Cecure and 100 and 500 ppm for Sanidate. Eggs were dip-inoculated with Nalidixic acid resistant Salmonella for 5 min followed by 15 min of attachment, and subsequently dipped in sanitizers for 10 s or sprayed using ESS spray gun for 5 s. Eggs were broken, and the shells were placed in 0.1 % peptone water (PW) containing 200 ppm of Nalidixic acid and a neutralizer (thiosulfate [0.1%] for chlorine and PAA and lecithin [7000 ppm] for cetylpyridinium chloride). Serial dilutions were prepared in PW and plated on Aerobic Plate Count Petrifilm. The Petrifilm were incubated for 48 h at 37°C, enumerated and Salmonella populations were expressed as log CFU/mL. Although all three sanitizer treatments were more effective compared to the water control, dip method using Chlorine (250 ppm) resulted in greater Salmonella reduction on eggshells (3.08 log CFU/mL), followed by Sanidate (2.30 log CFU/mL) and Cecure (1.36 log CFU/mL). Minimal reductions in Salmonella population was observed with ESS spray, regardless of the sanitizer used. Chlorine (250 ppm) was the most effective in reducing Salmonella population on breeder hatching eggs overall.

Effects of Biostimulants on Growth and Development of Kale

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The objective of my undergraduate research project, Effects of Biostimulants on Growth and Development of Kale was to determine benefits, if any, of biostimulants on kale transplant production. The seven biostimulants (Bio Ag, Bio-Cozyme, Fulvic Acid, Humic Acid, Seaweed Extract, Crab (Chitin), and EM1) were selected for this experiment. These biostimulants were applied to kale transplants at the rate recommended by the manufacturer. The experiment was a randomized design with three replications. Biostimulats were applied as a spray at the stage kale transplants formed the first true leaves. EM1 and Humic Acid required a spray application every other day. The other four biostimulants a spray application. Application of biostimulants continued for 6 weeks, at which time kale plants were evaluated and measured. Characteristics recorded included chlorophyll, height and root strength. For chlorophyll, an anthocyanin meter was used to read the chlorophyll levels. For height, plants were measured from the base of the plant to the tips of the largest leaf. For the root strength, kale plants were removed from the growing trays and classified into three categories: weak, medium and strong rooting system. Upon taking an analysis of the biostimulants on the kale, the chlorophyll level readings showed that the crab or chitin had the highest chlorophyll readings with an average of 37.5. For the heights of the kale, the crab also had the highest readings of seven inches. For the root strength, I found that the Fulvic acid had the strongest rooting system with two strong rooting and one medium rooting kale plants. Overall, the results of this experiment showed a growth benefit in using biostimulants. One of the most notable biostimulants was the Crab Chitin. It outperformed all the other biostimulant treatments, and control treatment, rooting, chlorophyll level, and kale heights.

Mitochondrial Capacity in Young, Well-Controlled People with Type 1 Diabetes

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The role of mitochondrial capacity in the health consequences of type 1 diabetes (T1D) is not currently known. PURPOSE: This study measured mitochondrial capacity of young people with T1D compared to controls. METHODS: Participants with T1D (n=12) and controls (n=12) were tested for casual glucose, hemoglobin A1c (HbA1c), forearm adipose tissue thickness (ATT), and mitochondrial capacity. Mitochondrial capacity was measured in non-dominant forearm muscles using near-infrared spectroscopy as the rate constant of the rate of recovery of oxygen consumption after electrical stimulation exercise. RESULTS: T1D and control groups were similar in age, sex, height, weight, and race. T1D participants had a casual glucose of 133+52 mg/dL, and the controls measured 93+7 mg/dL, P= 0.06. HbA1c of T1D participants was 7.3+0.8% versus 5.2+0.4% for the controls, P<0.01. ATT was 0.6+0.2cm for T1D and 0.4+0.1cm for controls, P=0.03. There were no differences between groups in mitochondrial capacity (T1D= 2.0+0.5min-1 and control= 1.8+0.5min-1, P=0.24), or blood flow measured as the time to half magnitude of oxygen saturation (T1D= 8.8+2.8s and control= 10.3+3.0s, P=0.76). CONCLUSIONS: Young, relatively well-controlled people with T1D did not have reduced mitochondrial capacity or microvascular blood flow compared to controls. Future studies could evaluate poorly controlled or older participants with T1D to determine the effect of a longer history of T1D on mitochondrial capacity.

Proteins tha Bind with Chicken ZPC through Co-immunoprecipitation

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An undesired effect from the genetic selection for rapid growth and meat yield in poultry breeders has been an associated decline in fertility. The standard assay for the assessment of fertility is counting the sperm penetration holes in the glycoprotein coat that surrounds the ovulated egg, the inner perivitelline layer (IPVL). Although this is considered the standard assay for assessing fertility, little is known about the proteins on the surface of the avian sperm that bind with proteins of the IPVL, known as ZP proteins, during fertilization. Proteins involved in the sperm-ZP protein interaction have been elucidated in other species through co-immunoprecipitation (Co-IP) assays. We recently generated and verified antibodies against chicken ZPC, a major IPVL component that has been implicated in initiating sperm binding in avian species. Anti-chicken ZPC was precleared for use in a Co-IP assay in order to identify sperm surface proteins that bind with ZPC. The purified anti-chicken ZPC was coupled to magnetic beads (Dynabeads) to create a Co-IP column. The column, with anti-chicken ZPC coated Dynabeads, was treated with solubilized IPVL to capture ZPC. Avian sperm lysates were then incubated with the column containing immobilized ZPC. Following several column washes, the sperm proteins that remained bound with the immobilized ZPC were eluted and prepared for separation via SDS-PAGE. Following Coomassie staining, two prominent bands (around 75 kDa and 30 kDa) were excised and sent to UGA Proteomics and Mass Spectrometry Core Facility for protein identification by LC-MS/MS sequencing. Of note, three different proteins that have been reported to bind with ZP proteins in other species were all identified from the Co-IP: Angiotensin Converting Enzyme (ACE), actin, and HSP-70. The results suggest that these three sperm surface proteins — ACE, actin, and HSP-70 — may play an important role in avian fertilization and should thus be the subject of further investigation as potential candidates for fertility markers in broiler breeders. If these proteins are correlated with avian fertility, then a genetic selection program could be developed to address the declining fertility rates that are currently costing poultry integrators millions of dollars annually. Furthermore, this increased fertility would reduce the environmental impact of poultry production by reducing the need for more breeder operations to meet the increasing demand of poultry products.

Gait Changes Due to Growth in Swine

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Lameness is a major issue within the swine industry and has significant economic impact. Gait analysis has been used to study the changes that occur in how pigs walk due to lameness, and how lameness is effected by floor conditions. However, no exact standard to assess gait has been determined. Therefore, the objectives of the present study were to identify an ideal value to assess gait and in the future improve the accuracy of the results of some of these other studies. In this study, pigs were recorded every 50 lbs from 50 to 300 lbs in weight. Pigs were walked across the GAIT4Dog® mat (GAITRite®) until 6 replications were recorded for each weight measurement. Data were collected on GAITRite® computer program. Measurements for swing, stance, and stance as a percent of stride duration were compared over time for all of the weight increments. Data were then analyzed using SAS 9.4 PROC Mixed model. From 50 lbs to 250 lbs, there was a significant increase for front and rear limb values for stance, swing and percent stance of stride duration. From 250 lbs to 300 lbs, there was a significant decrease for front and rear limb values of stance, swing, and percent stance of stride duration. These changes to the gait parameters across the time points reflect the growth of the animal.

Clinging Strength of madagascar hissing cockroaches, Gromphadorhina Portentosa

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Some research has been conducted on the strength of various insects, and one study examined foot morphology and adhesion of Gromphadorhina portentosa (Madagascar hissing cockroach), but very little research has been conducted regarding the clinging strength of this roach. This experiment is a culmination of a series of experiments on the clinging strength of G. portentosa. Twenty adult roaches (ten male, ten female) of similar size were selected. Five of each sex were two experimental groups; five of each were controls. The roaches were maintained on a diet of dry dog food and fresh apple slices. The experimental apparatus attached a one end of a string to a ring glued to a roach. Each roach was placed on a horizontal wooden dowel. The string ran through two pulleys attached to second parallel dowel above the roach. The other end of the string was hooked to a graduated cylinder. Water was added to the cylinder until the roach was pulled from the lower dowel, and mass of the water was recorded. Data were taken once per week for x weeks. On average, the roaches could hold about 5 to 6 times their body, with the females having slightly greater clinging strength. Over the course of the experiment, there was a trend for both sexes to lose clinging strength. Some engineers have worked to attach tiny cameras to roaches in rescue efforts; roach movement can be remotely controlled. Our results could help guide their work. It is not known why the roaches appeared to become weaker over time; the length of the experiment was not significant compared with the roach's life span.

Spatial and Temporal Preferences of Gromphadorhina portentosa for Food and Shelter

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It is known that Gromphadorhina portentosa (Madagascar hissing cockroach) eats a variety of foods including apples and oranges. The purpose of this research was to use these different types of food to determine their preferences for hiding with or without their food. Ten plastic boxes (23cm x 29cm) were prepared by attaching a 10cm x 7cm piece of poster to two sides to create two shelters for the roaches. Thirty adult roaches of similar size were selected, and three were place in each box. Food was placed under one shelter; no food was placed under the other. One area was with food and the other was without food. The locations of the roaches were recorded each day, and the food was replaced. With each food (apples or oranges), the experiments were continued for roughly 30 days. The results indicated the roaches strongly preferred to hide away from the food source even though the food was consumed nearly every night. Analysis of the data across both food choices yielded a a P value of < 0.001. A previous similar study had similar results. These roaches strongly prefer not to mix their shelter spaces and feeding spaces. In the wild, the scent of the roaches' food may attract predators to their location. Additionally, the scent of the roaches may attract other insect herbivores that would compete for the food. Similar behavior has been noted in other animals (e.g., chipmunks and squirrels) that hide their food away from their shelter.

Insect Communication and Mating Behavior

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The objective of this reserch is to show the importance of insect communication as it relates to the mating behaviour thereby better understanding the role communication has on habitat preservation and manipulation. The primary focus was on insects mating behaviors, types of communications, types of pheromones, and their importance in nature. It was concluded that insects play crucial role in the ecosystem.

Georgia Timberland Investment Return Analysis

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Forestry in central Georgia has become a major industry over the past 30 years. Timberland investments have long been viewed as safe but bringing low returns to investors. Investors have always known a risk return trade off exists when investing in timberland. This tradeoff entails lower returns than other investment options, these lower returns are compensated by lower risk levels that have made timberland attractive. Considering current pricing and production trends, we wanted to examine whether timber was still a good investment when risk is factored in. The objective of this project is to compare the investment returns of timberland to those of more traditional investments, such as stocks and bonds. Using mean variance analysis and linear programming we developed the optimal portfolio under two conditions: considering risk and not considering risk. Under the no risk scenario stock returns still outperformed forest returns which is in line with historical performance. However, under the scenario considering risk, stocks were 3 times riskier than forest investments. This was calculated using the coefficient of variation, which standardizes risk and returns for each option. The 15 year return on stocks was 236% (15.7% per year), while the 15 year return on timberland was 139% (9.27% per year) return. This analysis shows that when risk is taken into account in the analysis, timberland is still attractive and explains why there has been increased investment in timberland in Georgia. The conclusions from this analysis are that risk adverse investors still find the reduction in timberland investment risk appealing, which more than compensates for the lower expected returns.

Development of a low-maintenance, low-cost tensiometer to improve irrigation accuracy

Jesse Lafian, Horticulture Major, Department of Horticulture; Presented in 2017

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This project tested the performance of a novel, prototype soil-moisture sensor. Over-irrigation, which is common in production agriculture and landscaping, can lead to root diseases and plant death, surface runoff of water and agro-chemicals, and leaching of agro-chemicals into groundwater. It can also increase drought risk for ecosystems, industry, and the public. Improving irrigation accuracy can mitigate these environmental impacts and increase profits for growers/landscapers. Irrigation is commonly scheduled based on soil-water content (SWC). This describes how much water is in the soil, but not whether plants can extract that water from the soil (not all water is available to plants). A more accurate way to schedule irrigation is to measure whether plants can access water in the soil. This can be done using tensiometers—instruments that measure how tightly water is bound to soil particles (i.e., soil water tension or SWT). Tensiometers thus describe whether water is available to plants. Traditional tensiometers are unsuited for large-scale use because they require continual monitoring and maintenance; they stop working when soil becomes too dry (SWT ~ -80 kPa). The purpose of this project was to test a novel, prototype tensiometer, invented by Jesse Lafian, called a Reservoir Tensi. This prototype was inserted saturated clay loam soil, contained in a porous clay pot. A Decagon T5 Laboratory Tensiometer was simultaneously inserted into the same pot. Readings from both devices were logged as the soil dried. The Decagon T5 stopped reading at ~120 kPa tension after ~2 days in the soil due to air entry, which is typical of conventional tensiometers. In contrast, the Reservoir T5 continued to dry for ~2 additional days (tension at that point was unknown due to difficulty of measurement) and responded when the soil was saturated again. This research demonstrates a significant improvement in tensiometer technology, as conventional tensiometers are unable to respond to changes in soil-moisture levels after they fail.

A preliminary evaluation of supplemental vitamin E form on serum α-tocopherol levels and oxidative stress parameters measured in response to a novel exercise challenge

Kendall Lee, Animal Science Major, Department of Animal and Dairy Science; Presented in 2017

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Vitamin E is a component of the antioxidant system and is commonly included in commercial horse feeds in the form of synthetic all rac-α-tocopherol acetate, an equal blend of eight stereoisomers. One of these stereoisomers, RRR- α-tocopherol, is the most prevalent in the body and the only isomer found in natural vitamin E sources. The purpose of this research was to assess the effect of supplemental vitamin E form on serum α-tocopherol levels and oxidative parameters in mature horses both at rest and in response to an exercise challenge. A 28d feeding trial was conducted utilizing 16 horses. Horses underwent a 2wk wash-out period where they were fed a low vitamin E control diet. Horses were then randomly assigned to one of four treatment groups, each receiving the control diet plus 4000 IU/d of vitamin E for 14d: (1) synthetic all rac-α-tocopherol acetate powder, (2) natural RRR-α-tocopherol acetate powder, (3) micellized RRR-α-tocopherol liquid, (4) micellized RRR-α-tocopherol powder. Blood was collected via jugular puncture at d 0, 7, and 14 of the supplementation period. At the completion of the feeding trial, horses began a two day standard exercise regime with blood collected 4hrs and 24hrs after the second exercise session. SET protocol was conducted by free lunging in an enclosed round pen at controlled and increasing speeds (220-450 m/min). Serum was analyzed for α-tocopherol at all time points. Whole blood was analyzed pre and post exercise for total glutathione (GSH-T). Serum α-tocopherol was higher on d7 and 14 as compared to d0 in all treatment groups with no differences observed between treatment groups. Serum α-tocopherol levels plateaued at d7 with no differences between d7 and 14. Average serum α-tocopherol levels were higher in horses supplemented micellized liquid and micellized powder as compared to horses supplemented synthetic and natural acetate powder over the three exercise time point sampled ($P<0.05$). Additionally, when treatment groups were pooled, horses fed micellized RRR-α-tocopherol maintained whole blood GSH-T levels following exercise, whereas horses receiving acetate bound forms showed a post exercise decrease in whole blood GSH-T ($P=0.03$). Findings of this study indicate that micellized RRR-α-tocopherol, as compared to acetate bound forms, is better able to maintain serum α-tocopherol levels and therefore antioxidant levels when horses are challenged with a novel exercise test.

Effects of various levels of synthetic Arginine supplementation on growth response in broilers

Brent Leonard, Biological Science Major, Department of Poultry Science; Presented in 2017

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Arginine (Arg) is an essential amino acid linked to acting as a partitioning agent, increasing the protein accretion muscle growth, and decreasing fat deposition. Since poultry lack the key enzymes necessary to synthesize Arg; it establishes a need to obtain it through their diet. The aim of this study was to evaluate the effects of varying synthetic Arg supplementation in broilers on body weight gain, feed intake, feed conversion ratio, tissue mass, and diameter of muscle fibers. One-day-old male Ross 308 broilers (n=600) were randomly divided into 5 treatments characterized by the percentage of arginine compared to the Ross 308 requirements. T1 received 70% of Arg (basal diet; 74% Arg:Lys ratio), T2 80% (85% Arg:Lys ratio), T3 90% (95% Arg:Lys ratio), T4 100% (Ross 308 requirement; 106% Arg:Lys ratio) and T5 110% (116% Arg:Lys ratio). The treatments were repeated 6 times (N=6) and had 20 birds per treatment. The trial lasted 42 days with starter (days 1-10), Grower (days 11-24) and Finisher (days 25-42) diets all based on corn and soybean. Body weight gain (BWG), feed intake, (FI) and feed conversion ratio (FCR) were measured on day 42. Fat and lean tissue weights were measured by Dual Energy X-ray Absorptiometry (DEXA) scanning on day 42. Muscle samples were collected on day 42 to make histology slides. The slides were used to measure the diameter of the muscle fibers utilizing the least diameter method. The BWG, FI, and FCR, tissue levels, and fiber diameter values for each treatment were averaged and compared by F test. For BWG ($P<0.0001$), T1 had the least followed by T2, and then T3, T4, and T5 which obtained similar values. Feed intake ($p=0.0088$) and FCR ($p<0.0001$) of T1 showed statistically lower and worse FI values and FCR values than T2, T3, T4, and T5, respectively. Tissue weights ($p=0.0430$) and Lean tissue ($p=0.0044$) measured by DEXA scanning showed similar results with T1 having the lowest value and T2, T3, T4, and T5 obtaining similar higher values. Neither fat tissues ($p=0.3761$) nor the diameter of the muscle fibers ($p=0.3789$) were impacted by Arg supplementation. Arg supplementation showed a tendency to increase body growth. The lowest Arg levels used in the study (70% of the requirement) decreased BWG, FI, tissue weight, and lean tissue and increased FCR in broilers during the experimental period. An adequate amount of Arg supplementation is necessary for broilers to enhance their positive performance traits.

LED Lighting Effects on Plant Morphology and Growth of Lettuce

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Vertical Farming under LED light is becoming increasingly popular, but there is a lack of scientific knowledge regarding which light spectrum yields the best growth and what, if any, beneficial effects far-red light may have on the growth and morphology of the plants. So, the objective of this study was to test the effects of different color LED grow lights (white versus two combinations of red and blue light, all with and without added far-red light) on morphological and physiological changes in red and green lettuce. We hypothesized that the addition of far-red light would increase leaf size and thus light interception by the plants, as well as plant dry weight and total leaf area compared to treatments that did not receive far-red light. Six LED lighting systems were constructed to expose plants to: 20/80% blue/red, 50/50% blue/red, or 100% white light. Two of each spectral treatment were constructed, one with and one without far-red light. Two cultivars of Lactuca sativa (Lettuce), ‘Red Salad Bowl’ and ‘Green Salad Bowl’, were used with six plants of each placed under each light treatment. By measuring the leaf length, dry weight, leaf area, leaf thickness, light interception, and leaf chlorophyll and anthocyanin content, plant responses to the different light spectra were quantified. Both lettuce cultivars showed the greatest leaf length under white light with far-red. Average lengths were 24.8 cm (Green Salad Bowl) and 21.8 cm (Red Salad Bowl). The shortest leaf length occurred with 50/50% blue/red without far-red, with average leaf lengths of 12.3 cm (Green Salad Bowl) and 12.6 cm (Red Salad Bowl). Red lettuce grown under white light without far-red had the greatest total leaf area (1462 cm2), while green lettuce had the greatest leaf area (1091 cm2) under 20/80% blue/red with far-red. Green and red lettuce grown under 50/50% blue/red without far-red had the smallest leaf area at 715 cm2 (Green) and 857 cm2 (Red). Green lettuce grown under 20/80% blue/red without far-red had the greatest dry weight, 3.6 g/plant. Red lettuce grown under 20/80% blue/red with far-red had a dry weight of 3.2 g/plant. Lettuce plants grown under white light without far-red had the lowest dry weights for both green (1.9 g/plant) and red (2.5 g/plant) lettuce. The treatment with the highest chlorophyll content for both cultivars was the 50/50% blue/red without far-red. Conclusions: Plants exposed to far-red light had greater leaf length, consistent with our hypothesis. This effect was seen in both cultivars and across all spectral treatments. Other results did not turn out as expected. The increased leaf length with far-red light did not increase total plant leaf area, dry weight, or

Communicating the Importance of Microbial Symbionts to the Public

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Spanning across the eastern seaboard from Maine to our own state of Georgia are Hemlocks (Tsuga canadensis and T. caroliniana) as well as the invasive and destructive sap-feeding insect Hemlock Woolly Adelgid (HWA). The successful management of this species will require the public and its support as well as continued research by professionals into both management policies and the basic biology of HWA and other adelgids. The University's mission, "to teach, to serve, and to inquire into the nature of things," serves as the foundation for this research project that aims "to inquire" into the interplay between adelgid life cycles and their microbial symbionts, and "to serve" and "to teach" the public about these concepts in an effective and meaningful way. We surveyed community members in Athens-Clarke County about their knowledge of adelgids, their life cycles, and their symbionts before and after a program designed to increase understanding of and to simulate aspects of adelgid biology. Specifically, we have designed an activity to demonstrate the life cycles of adelgids and the importance of the nutritional benefits that their microbial symbionts provide as a necessity of their host alternation life cycle. With a small group of trial college-aged participants (n=7) we have gathered insight into the effectiveness of this program as well as areas of improvement or modification of the program. Before the program most participants did not understand what an adelgid or a symbiont was or did. However, we found that most participants were confident they knew what an invasive species was. After participating in the program understanding of all three concepts (adelgids, symbionts, and invasive species) increased to 100%. Our qualitative assessment through written and verbal feedback highlighted multiple areas of improvement. Of particular interest is the difficulty of the concepts covered as our program will be eventually used for the "UGA Insectival!" targeting middle-school aged children in the Athens community. Our feedback included phrases such as "simplify," "explain in detail," and "visual aids" in regards as to how the program could be modified for "UGA Insectival!" Through our various outreach methods we believe that we can both inform the public effectively about a research project being actively conducted in the Entomology department at the University of Georgia and the importance of researching adelgids and their symbionts.

Effects of 25-Hydroxycholecalciferol on bone growth and development of pullets

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Avian osteoporosis leads to serious economic and welfare issues in the laying hen industry. Avian osteoporosis, which is very similar to osteoporosis in humans, is described as the reduced activity of osteoblasts with increased activity of osteoclasts. Osteoblasts build bone to be stronger and osteoclasts break down bone. As a result, this leads to a lack of bone density and increased fractures. In order to counteract these issues in laying hens, it is vital to promote proper bone health prior to onset of egg production. One method of fighting osteoporosis in laying hens is through the use of pro-osteogenic agents. 25-Hydroxycholecalciferol (25-OH VitD3), an intermediate of active VitD3, is hypothesized to be a more potent stimulating agent to increase bone density and prevent bone degradation in layers than normal VitD3. The main objective was to evaluate the effects of 25-OH VitD3 on pullets. This was done by introducing the 25-OH VitD3 (2,760IU,69μg/kg) on the top of VitD3(2,760IU) and double dose VitD3 (5520IU/kg) into the diets of two different groups of layers as well as a third control group (VitD3 at 2,760IU/kg). From here, femur samples were collected and analyzed using micro-CT and calcein injection technique. We hypothesized that the 25-OH VitD3 will be more effective than both the 2 x VitD3 and control groups in promoting bone growth and development. The overall goal was to introduce an effective strategy in allowing for optimal egg production by reducing osteoporosis in laying hens. The data that we analyzed through the taken measurement confirmed our observations. The 25-Hydroxycholecalciferol (25-OH VitD3) group was most effective, followed by the 2 x Vit D3 group, then by the normal Vit D3 group. Effectiveness was determined by the average growth that took place in among the 3 treatments. This demonstrates that there is a large amount of validity that this treatment can be one that is highly effective in promoting bone development. While the rest of the experiment needs to be entirely completed to fully determine how levels line up with the control and how development proceeds in the control, this is still a large step in a positive direction in producing a solution for bone health and development in the chickens.

Adaptation of a DNA Purification Protocol for Whole Genome Sequencing of an Eimeria Species

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Coccidiosis is an economically significant enteric disease in chicken that is caused by several Eimeria species parasites. Among the different species of Eimeria that infect chickens, the independence of the species' mitis and mivati is controversial. Previously, Eimeria have been speciated based on gorss morphology, pre-patent period, and region of the gut parasitized. More recently, molecular identification has been used to identify species. Full genomes of 7 Eimeria species have been published, but no molecular genome data is present for Eimeria mivati. The purpose of this study is to use genome sequencing of a pure strain of Eimeria mivati from a vaccine stock to determine similarities and/or differences between it and published Eimeria mitis genomic sequence. For this, a DNA purification protocol that can isolate large fragment genomic DNA will be established. The genomic DNA will then be sequenced using PacBio sequencing. The previously published genomes of other Eimeria markers will be used to allign the genomic sequences into a functional genome, and then specific genome markers will be compared. Understanding the similarities and differences in the genomic structure of this contested Eimeria will allow us to accurately determine its relatedness to other Eimeria and, ultimately, if it is truly a separate species.

The Evaluation of Soil Mixes for Vegetable Production

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In urban agriculture, compost is often applied to constructed raised beds to increase nutrients availability and improve soil structure. Compost is expensive and not always readily available. In addition, decomposition of compost results in the release of large amounts of carbon dioxide as a byproduct of mineralization. This research evaluated the yield of kale in raised beds filled with native soil and varying amount of compost. The goal was to determine the optimal yield of kale and/or the least amount of compost necessary to obtain the yield. The experiment was conducted over three growing seasons – fall, spring, and fall. Results show that kale yield increases slightly in beds with 25% to 75% compost, but decreases when grown in 100% compost. Based on the results of this experiment, 50% compost is optimum for yield and quantity compost incorporated.

The Arctic Council: A Review of its Strengths and Weaknesses

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Consisting of the eight northernmost countries of the globe, Canada, Russia, the United States, Denmark, Iceland, Sweden, Norway, and Finland, the Arctic Region faces circumpolar challenges such as climate change, environmental pollutants, shipping, safety and search-and-rescue, and biodiversity. As stated within each Arctic Nation's formal publications on their respective Artic policy, it is the Arctic Council that primarily serves as the forum to discuss and create unilateral recommendation-making on these aforementioned circumpolar matters. Since the Council's founding in 1996, two agreements, each invoking political force, have been ratified by the Arctic Council. Given the two decades of history of the Arctic Council, some environmental policy analysts have investigated whether the Arctic Council remains best method for policy-making in the Arctic region. To investigate this matter further, a policy review of each of the eight Arctic Council Nations was conducted to see what individual countries could achieve by themselves towards Arctic issues. Relevant official laws and documents from each country's government were analyzed. In addition, a scientific research expedition to the Canadian North revealed how climate science is collected, managed, and then used to inform intranational and international policy. Interviews with Andres Jato and Ojala Tuli, respectively, Finnish and Swedish diplomatic representatives to the Arctic Council revealed how each country approached their relationship with the Arctic Council, and each diplomat's identification and solutions to using the Arctic Council as an instrument to navigating the challenges within the Arctic region. Competing priorities and interests among the eight Arctic Nations offers some explanation for why the Arctic Council has produced two mandates in the past twenty years. Participating countries in the Arctic Region must navigate the complexities of advocating for their individual interests, while also considering the greater good for the entire region. In conclusion, climate change will impact Arctic Nations differently, bringing a potential economic opportunity to some and an economic threat to others. To achieve meaningful policy in the Arctic Region, a circumpolar council of these competing interests should not be expected to be the most effective policy-making forum. Instead, each country must work in partnership with like-minded partners or individually to propose what they deem to be sensible.

Effect of different concentration of 25-hydroxycholestrol on osteogenic differentiation of mesenchymal stem cells (MSC) from broiler compact bone

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MSC are multipotent progenitors that can differentiate into various tissue cells. The objectives of the study were to 1)isolate MSC from broiler compact bone and 2)study the effects of 25-hydroxycholestrol on osteogenic differentiation of MSC. This is important for the production and welfare facets of the poultry industry as chickens develop orthopedic problems such as lameness, tibial dyschondroplasia, and osteoporosis. MSC were isolated from the femurs and tibia of day-old chicks and left to confluent, with the media changed every 2-3 days. The cells were passaged until P4 and plated in 24 well plates at density of 20,000 cells/cm2. Upon confluency, cells were treated with the following treatment: control, osteogenic media (OM), and OM with 0.5, 1, and 2 uM 25-hydroxycholesterol. Cytochemistry conducted on day 7 and 14 to detect osteogenesis. Cells treated with OM, and 25-hydroxycholestrol induced higher proportion of Alizarin Red and Von Kossa stain (mineralization), and Alkaline Phosphatase (early osteogenic marker) compared to control cells. However, 2uM 25-hydroxycholesterol was toxic to cells, causing cell death. Results indicated that 25-hydroxycholesterol has a stimulatory effect on MSC ostegenesis. Current results provide rationale for further study on regulatory mechanisms of 25-hydroxycholesterol on MSC which can help to address skeletal problems in poultry. RNA extraction then RTPCR will be conducted at 7 and 14 days to analyze gene expression and obtain a broader understanding of the effects of 25-hydroxycholesterol on MSC. A positive result will show a significant expression of pathways activated by osteogenesis such as BMP and BGP.

Examining the Dynamics of Faculty Learning Community Meetings

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A growing emphasis on reform in U.S. higher education has led many college faculty to consider changing their teaching strategies. In particular, many faculty are now implementing active learning, which consists of teaching methods that encourage students to cognitively engage with the material during class. This research focuses on the dynamics of Faculty Learning Communities (FLCs) and their use as professional support for the implementation of active learning strategies in undergraduate science courses. The FLCs under investigation arose through a multi-institutional project known as Automated Analysis of Constructed Response (AACR). AACR provides data to faculty about their students' thinking. AACR FLCs support faculty in understanding the data-heavy AACR reports and how to modify teaching accordingly. Transcripts of FLC meetings from multiple institutions are analyzed by qualitative content analysis, which involves exploring the transcripts for thematic patterns. These data reveal the interests and perceptions of AACR FLC participants. This knowledge will lead to improved professional support for faculty groups and should and may improve the implementation of active learning strategies in the undergraduate classroom.

Effects of Form and Level of Vitamin E Supplementation on Kinematic and Physiological Measures of Muscle Damage Following Intense Exercise in Horses

Lauren Purvis, Animal Science Major, Department of Animal and Dairy Science; Presented in 2017

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Vitamin E is an essential dietary antioxidant thought to have a role in preventing delayed onset muscle soreness in exercising subjects. Previous research has shown that horses supplemented with natural α-tocopherol are able to achieve higher blood α-tocopherol levels as compared to those supplemented with the more commonly used synthetic acetate form. The purpose of this study was to determine if supplementation with natural α-tocopherol as compared to synthetic confers a physiological advantage to the exercising horse as measured by markers of muscle damage. Eighteen horses were placed on one of three diets for a seven week feeding trial: (1) Synthetic low (SynL), 1000 IU α-tocopherol acetate (2) Synthetic high (SynH), 4000 IU supplemental α-tocopherol acetate (3) Natural (NAT), 4000 IU natural RRR-α-tocopherol. Horses underwent a 6 week exercise program of increasing intensity following one full week of supplementation. A standard exercise test (SET) was performed immediately before and immediately after the 6 week program. Blood was drawn pre and 2 hours post SET and analyzed for creatine kinase and aspartate aminotranserase (measures of muscle damage). Additionally, horses were filmed trotting (4 m/s) in hand using high speed cameras. Filming was conducted immediately prior to each SET, and 24 hours post SET to assess kinematic changes to the gait that may be induced by muscle soreness. From the blood work we collected we can conclude there was a statistical difference in (post-pre) AST levels following the second SET ($P<0.05$). There was a noted high level of AST in both synthetic groups 24 hrs post SET 2 as opposed to the natural α-tocopherol group. It can be inferred from this data that there was an increase in muscle breakdown in the SynH and SynL horses as compared to NAT horses post SET 2. Physiological measures of muscle damage were indirectly assessed through changes in the equine gait. SynH and SynL horses showed significantly greater reduction in stride duration at 24 hrs post exercise as compared to NAT horses in both fore and hind limbs. A conclusion can be made that the supplementation of NAT α-tocopherol in exercising horses compared to the Syn L/H groups resulted in a reduction of measures of muscle damage in both blood and kinematic analysis.

Electrochemical Determination of Antioxidant Activity

Carter Reed, Food Science Major, Department of Food Science and Technology; Presented in 2017

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A major problem in food characterization is that there is no rapid, simple, and inexpensive method of characterization of antioxidant capacity. Our goal is to develop a quick method to determine the antioxidant capacity in foods using the electrochemical principles of cyclic and step voltammetry to characterize single antioxidants. Then using that information to test antioxidants in mixtures to determine the antioxidant potential of each compound, developing strategies to quantify the antioxidant activity of the mixture. For this experiment we prepared concentrations of antioxidants in an electrolyte solution, and the pH of the solutions were adjusted to match literature values. The oxidation and reduction potentials were measured using a 3-electrode potentiostat, model Reference 600 from Gamry Instruments. Platinum disks were used as working and counter electrodes and an Ag/AgCl 3.0 M KCl was the reference electrode. The antioxidant reaction occurs on the surface of the working electrode and the current correlates to the reducing power of the antioxidant in solution. Through this method of cyclic voltammetry we separately tested the reducing power of gallic acid and caffeic acid in .3 M KCl solution, as an electrolyte source. The reduction reaction occurring at the surface of the working electrode provided a current peak when the reduction potential was reached in the sweep. This peek represents a balance between the electron transfer rate of the reaction and the diffusion of oxygen towards the working electrode. Peaks were seen at 500 mV for caffeic acid and gallic acid. Since gallic acid is a reversible antioxidant and can be oxidized in the reverse sweep, the voltammogram shows an anodic peak at 250 mV. Caffeic acid is non-reversible and the oxygen continues to diffuse into the working electrode, coating the electrode, decreasing the current for subsequent sweeps. For antioxidants, BHT and glutathione, the results were inconclusive. BHT was not able to dissolve into a KCl solution to test, and glutathione required the presence of a metal in solution for the reduction reaction to occur. We have concluded that in a system preventing the working electrodes from becoming coated, the different reduction potentials and currents of the antioxidant reduction reactions in a mixture could be identified and the antioxidant potential of the mixture could be quantified. A prototype system that uses a sacrificial electrode will be used in future.

Use of Label vs. Extended Antibiotic Therapy for the Treatment of Bovine Mastitis

Gabrielle Resnick, Animal Science Major, Department of Animal and Dairy Science; Presented in 2017

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Mastitis is a bacterial infection of the cow's mammary gland caused by pathogenic bacteria such as staphylococci and streptococci. One method of controlling this disease is by infusing infected mammary quarters with antibiotics to eliminate infection. The purpose of my study was to determine the most effective antibiotic therapy regimen for treating mastitis in lactating dairy cows at the UGA Teaching Dairy. Mammary quarters of 30 cows that were diagnosed with mastitis were treated with one of the following antibiotic therapies by intramammary infusion: Spectramast LC, Hetacin-K, Pirsue, Amoxymast, and Today. Quarters were treated using 2 regimens: either per label instructions ("label") or extended therapy, which included a total of 6 days of antibiotic treatment ("extended"). Prior to treatment, quarter milk samples were collected to determine somatic cell counts (SCC) and establish the bacteriological status. After treatment, milk samples from treated quarters were monitored for bacteriology and SCC daily for 1 week and then weekly thereafter for 1 month. Differences among cure rates (% cure) and mean SCC prior to treatment for each regimen were separated using SAS 9.3 Proc GLM for Windows. Overall cure rate across treatments was 41.2%. Highest cure rate was observed with Today (80.0%) followed by Spectramast LC (44.4%), Pirsue (40.0%), Hetacin K (33.3%), and Amoximast (16.6%). No differences were observed among treatments between label (42.1%) and extended therapies (40.0%) ($P>0.05$). However, compared with label therapy, extended therapy resulted in numerically higher cure rates for streptococci (40.0 vs. 33.3%) and coagulase-negative staphylococci (CNS) (100 vs. 75.0%), but lower cure rates for Staphylococcus aureus (14.3 vs. 33.3%). Across treatments and therapies, cure rates were highest for CNS (85.7%), followed by the streptococci (36.4%), and S. aureus (25.0%). The average SCC prior to treatment in any infected quarter destined to cure after therapy was 587,000/ml, whereas the average SCC of quarters destined to fail was 2,994,000/ml ($P<0.05$). Results suggested that Today was the most effective product when used as an extended therapy, while Pirsue was the most effective product for label therapy across all organisms. Quarters with higher SCC at the time of treatment had a significantly lower cure rate overall than quarters with lower SCC; thus, the SCC may be used as a bench mark when deciding if an infected quarter should be treated.

Analysis of Different Methods for Quantitative Western Blot Analysis in the Avain Model System

Timothy L. Ruiz, Biological Science Major, Department of Poultry Science; Presented in 2017

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Western blotting is a commonly used laboratory practice that can be used to quantify protein levels in samples. One essential consideration for quantitative Western analysis is the amount of protein in each lane, which may vary due to inaccuracies with protein concentration determination, loading volume, or differences in transfer efficiency. To account for these potential differences, the amount of target protein is normalized to the amount of protein present in each lane by using a loading control. A good loading control is one that is co-expressed with target protein within the same sample and consistently expressed between samples. Tubulin,

Life History Trade Off in Male Milkweed Bug, Oncopeltus fasciatus

Zachary Sanchez, Cellular Biology; Minor in Entomolgy Major, ; Presented in 2017

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For a species to evolve it must first be able to survive and reproduce successfully. More specifically, a species must develop a strategy for the balance of resources between survival and reproduction to compensate for its environment. This specific practice can be analyzed as life history theory. It is already understood why an organism responds to altered conditions, but not much is known about how an organism is able to respond and alter its own fertility and lifespan. To understand this, a investigation into Oncopeltus fasciatus, large milkweed bug, was launched to analyze its known life history trade offs between an ancestral and adapted diet. On the adapted sunflower seed diet, the male Oncopeltus fasciatus displays a longer life span, but these males do not display high levels of fertility and mating. On the ancestral diet of milkweed seed, the males have a shorter life span but are more reproductively successful. This research analyzes the life history trade off effect with regards to fertility by determining if there is a difference with sperm quantity, sperm quality, or both between the two diets. Sperm was isolated from the seminal vesicles of adult males and then counted and assessed for viability. After testing the sperm it was discovered that the there is not a significant variance in sperm quality, but there is a significant variance in sperm quantity as determined by statistical analysis. There is a greater mean number of sperm in the seminal vesicle of the male on a milkweed seed diet. From these results, it can be determined that even though the diet may not play a role in sperm quality, it does produce a variance in sperm quantity which can be used to explain the difference in fertility levels of the two diets.

Do Protease and Lipase Affect the Growth Performance of Broiler Chicks?

Rebekah Scott, Animal Science Major, Department of Animal and Dairy Science; Presented in 2017

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Broilers in the United States have normally been fed corn/soybean meal based diets but with the increase in feed prices over the last decade, there has been greater use of byproduct feeds. Feed enzymes are a billion dollar business, which creates a high demand for enzyme studies. Enzymes such as protease are being evaluated in feed as means to lower diet cost and improve digestibility. Due to the ability to grow rapidly, broiler chicks provide a very sensitive model to study diet ingredients. A study was conducted to determine if the growth performance response of broiler chicks is improved by the addition of protease or lipase to the starter diets. 240 day- old broiler chicks were randomly allotted to 30 battery brooder pens (6 -8 birds/pen) with each pen being randomly assigned 1 of 8 treatment diets (6 pens/ diet). Diet 1, a positive control diet, is a corn/soybean meal based diet with 5% DDGS that is typical of that used in the poultry industry. Diet 2, the negative control (NC) diet, has reduced lysine, TSAA, and energy. Diets 3, 4 and 5 are the NC + 100, 200 and 400 g/ton of the EN Protease product. Body weight and feed intake were monitored and recorded twice a week for 2 weeks. Orthogonal contrast statements were used to determine linear and quadratic effects of the enzymes. Overall (0-11d), there was a quadratic effect on the level of enzymes on weight gain (257, 304, 294, and 270 g for chicks fed 0, 100, 200, and 400 g of EN respectively, $P < 0.05$). There was a negative relationship between weight gain and an increase of enzyme used which shows that there is an optimal amount of enzyme that should be used. These results suggest that the broiler chicks grow best when fed the NC diet with 100 g of EN.

Texture Evaluations of Southern Highbush and Rabbiteye Blueberry Varieties

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There are two types of blueberries commercially grown in Georgia: southern highbush (species complex between Vassinium corybosum L. and V. darrowii Camp) and rabbiteye (V. virgatum Aiton). One of the main comparisons between the two types for fruit quality is texture as it relates to skin toughness and fruit firmness. Often, rabbiteye varieties are considered of a lower quality than southern highbush varieties, however, there is very little evidence to support this. The objective of this study was to examine the skin toughness and the fruit firmness of the main commercial varieties within each type currently grown in Georgia. Fruit from early, mid, and late season southern highbush and rabbiteye varieties were harvested at approximately 50% ripe from April to July in 2014 and 2015 from the University of Georgia Research Farm near Alapaha, GA. Seven varieties from each type were examined for southern highbush: 'Camellia', 'Emerald', 'Farthing', 'Legacy', 'Meadowlark', 'Rebel', and 'Star'; and for rabbiteye: 'Alapaha', 'Brightwell', 'Ochlockonee', 'Powderblue', 'Premier', 'Tifblue', and 'Vernon'. An Instron universal testing machine measured skin strength (puncture test) and fruit firmness (Kramer shear press). Fiber content characteristics of NDF, ADF, lignin, cellulose, and hemicellulose were also measured. Varieties were significantly different for both texture traits within both years, and across years ($P<0.05$). For skin toughness, southern highbush were not different than rabbiteye for 2014 (0.985N vs. 1.002N), and southern highbush were 26% tougher than rabbiteye in 2015 (0.995N vs. .792N). For fruit firmness, rabbiteye were firmer than southern highbush for both years, by 65% in 2014 (578.3N vs. 350.4N) and by 42% in 2015 (518.6N vs. 365.1N). Fiber traits were not consistently correlated with either textural trait within a blueberry type across years, which suggest that fiber content is not a consistent indicator of fruit texture. Cultivar rank across years was weakly correlated ($r=.66$, $P<0.0001$) for fruit firmness. This suggests that skin toughness is more influenced by environmental factors, and that fruit firmness is more related to cultivar selection and is more consistent across environments. This information will be used as a starting point to understand consumer acceptability of fruit texture of the two blueberry types.

Effects of Condensed Tannins in Lespedeza cuneata on Oxidative Stress in Performance Horses

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Lespedeza cuneata, commonly known as sericea lespedeza, has garnered popularity in the small ruminant industry due to its anthelmintic effects. This increased popularity is allowing L. cuneata to become more common and readily available on the feed market. L. cuneata is a perennial, warm-season legume that grows well in poor conditions. Condensed tannins, which are found in high levels in sericea lespedeza, are what most research points to as the reason for its anthelmintic effects in ruminants. Another characteristic of condensed tannins is their antioxidant capabilities; however, these have not been extensively studied. Health benefits from L. cuneata, such as reduced oxidative stress and treatment of inflammatory conditions, have been noted in human research. Sericea lespedeza has a nutrient profile comparable to other high quality equine forages, and may prove to be advantageous as a feed source if it is able to reduce oxidative stress that performance horses are commonly subjected to. The purpose of this study was to determine if feeding L. cuneata hay improved antioxidant capacity and reduced oxidative stress in response to a bout of moderately intense exercise. Twelve horses were used in a 6 week feeding trial. The horses were placed in stalls for 6-7 hours each day and fed 1% of their body weight in either sericea lespedeza hay or Russell bermudagrass hay. At the conclusion of the feeding trial all twelve horses underwent an incremental standardized exercise test (SET). Blood was collected via jugular venipuncture pre and post SET. Blood was analyzed for antioxidant capacity via assaying total, reduced, and oxidized glutathione, as well as other markers of lipid and protein oxidation.

Effects of Drought Stress on Tomatio Fruit Growth

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Water availability can influence fruit growth processes such as cell division and expansion. The effects of limited water availability or drought stress on fruit growth in tomatoes may depend on the inherent fruit size potential. To test this hypothesis, four genotypes of tomatoes differing in fruit and plant size potential are being grown in a greenhouse under controlled drought conditions. The four genotypes selected for testing were 'Matina', 'Napa Grape Hybrid', 'Lizzano Hybrid', and 'Patio Princess'. Within each of these sets, a small fruit size and a large fruit size genotype have been included. The substrate water content is monitored using moisture sensors to ensure the correct amount is being applied and at the appropriate times. Treatments included in this study are 45% (control) and 15% volumetric water content (VWC). The treatments were initiated during early fruit development. A randomized complete block design with five replicates has been used in this study. The fruit will be measured during the growing cycle and compared with fruits grown under control conditions. This study will also be used to determine the amount of time to grow the fruit to maturation as compared to the fruit not grown under stress of drought. Fruit samples will be collected at regular interval during fruit development to determine cell-related parameters such as cell division and expansion using microscopy. Fruit quality will be determined at maturity. Comparisons between genotypes will be used to determine the relationship between potential fruit size and response to drought stress. If fruit can be grown with less water and still average the same size, the cost of production could decrease making production more profitable for growers.

Effects of gender and race on speed and accuracy of facial recognition

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Gender and race of both viewer and target have been explored in the context of facial recognition accuracy, but factors predicting individual variability have not been as well investigated. Overall, women perform better than men in face recognition in terms of both accuracy and reaction time; women also display an own-sex advantage for recognition of female faces. In terms of race, it has been shown repeatedly that both males and females are better able to recognize faces of their own race when living in an area with a strong racial majority. Our purpose is to investigate factors predicting individual variability in visual short term memory, measured by reaction time for faces, when gender and race vary. We created a standardized short-term memory task, which consisted of blocks of white female, white male, Asian female, and Asian male faces presented in a random order. Participants first completed a general reaction time task in which they pressed the space bar as soon as a randomly timed symbol appeared, followed by practice trials of the facial recognition task to gain an understanding of the task. The conditions were presented in a random order in sets of 30 trials. Sets of three faces were flashed for 100 ms, followed by a 900 ms gap. Immediately afterward, a second set of faces was presented. The participant indicated whether the two sets of faces matched ("same") or if one of the new faces had changed identity ("different"). The program measured their reaction time during each trial. Faces with neutral expressions were standardized to be grayscale with the same silhouette. Data indicates accuracy of both white male and female participants is lessened, and reaction time is slower, when analyzing Asian faces. Females showed greater accuracy in recognizing female faces only in the white race condition, and males did not exhibit an own-sex advantage. White males had slightly greater average accuracy than white females in white face conditions, though not significant. White females had faster condition-specific reaction times than white males. There was no significant correlation between condition-specific reaction time and accuracy for any participant group. Further experiments of this nature could be improved upon by having larger, balanced sample sizes and analyzing a less common racial minority. This research may have implications for understanding individual differences in factors underlying facial recognition and discrimination.

A Comparison Across Time of Grower Pigs

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Lameness is a major issue within the swine industry. Gait analysis has been used to study the changes that occur due to lameness, but no ideal value has been isolated. In this study, pigs were recorded every 50 lbs from 50 to 300 lbs in weight. 10 pigs were walked across the GAIT4Dog® mat (GAITRite®) until 5 replications were recorded for each weight measurement. Data were collected on GAITRite® computer program. Measurements for stride length, stride duration, and velocity were compared over time. Data were then analyzed using SAS 9.4 PROC Mixed model. From 50 to 250 lbs, there were significant increases in velocity, front and rear limb stride length, and stride duration. From 250 to 300 lbs, there were significant increases in velocity and stride length, but a significant decrease in stride duration. Overall, the observed changes over the time points can be consistently related back to the growth of the pigs.

Hydrophilic Top Coat on Nitric Oxide Releasing Surfaces for Enhanced Antibacterial and Antifouling Properties

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Healthcare-associated infections have resulted in rising numbers of deaths and medical costs in the United States. A majority of these infections stemmed from opportunities provided by medical implants and surgical wounds. Implanted medical devices provide surfaces for proteins from body fluids to bind, leading to bacteria aggregation and platelet activation. Biomedical grade polymers that involve the incorporation of nitric oxide (NO), an antimicrobial agent, are being investigated to reduce the risk of infection. While the results have been widely successful in reducing the incidence of infection it has been discovered that NO-releasing surfaces consequently increase protein absorption to these surfaces. This research worked to prevent protein absorption on these surfaces by incorporating hydrophilic polymers as a topcoat to NO-releasing surfaces. Four different polymers, three thermoplastic polyurethanes and a silicone elastomer, were evaluated for their surface characteristics, affinity towards protein and viable bacteria absorption. These traits were measured using methods such as spectroscopic ellipsometry, chemiluminescence NO analyzer and atomic force microscopy (AFM) to identify which polymer exhibited the most hydrophilic properties. Highly hydrophilic polymers, such as SP60D60, form hydration layers on their surface, protecting the surface from protein adhesion. The formation of a hydration layer can be attributed to low surface roughness, as identified with AFM scans. The antifouling property of SP60D60, top coated on a NO-releasing film provided a synergistic effect of reducing viable bacteria by 95.83% compared to the control and protein adhesion was minimal, as measured by change in thickness of the SP60D60 films (2.24 ±0.68 nm).

Effect of Micronization of Tart Cherry Puree on Structure, Particle Size Distribution, and Rheology of the Sample

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The tart cherry studied in these experiments has been found to contain antioxidants; compounds that are effective in decreasing disease risk for several chronic diseases such as cardiovascular disease and cancer that impact Americans today. The objective of this study was to determine the effect of micronization on structure, particle size distribution and rheology of tart cherry puree sample. In addition, the in-vitro digestion changes were studied to determine the effect of micronization on gastric and intestinal digestion. In our study, commercially frozen cherry puree was thawed and micronized using Megatron MT5000 (Kinematica AG) at 15000 rpm for three cycles (M1, M2, M3; 10 min each) followed by high pressure homogenizer (Stansted Fluid Power Ltd.) at 200 MPa. The particle size distribution was then measured using Malvern Laser Particle Size Analyzer, Mastersizer S with 300 mm lens. Tart cherry puree samples were dispersed in deionized water until an obscuration point (10–20%) was obtained in the diffractometer cell at a pump speed of 2020 rpm. The rheological properties were measured using a rotational Rheometer (HR-3 TA instruments) with rotor-vaned SST smart swap to minimize the slip. Photomicrographs were taken using a Nikon Eclipse E400 light microscope. The images were captured using OMAX A35100U3 camera and viewed using the TopViewX software. Statistical significance of treatment factors and its interactions were determined according to two-way factorial design with three replications of each treatment using SAS version 9.1 Results showed a significant reduction in apparent viscosities (2.599 Pa.s to 0.0144 Pa.s) with a reduction in particle size (800 μm to 100 μm) and this trend was consistent in different shear rate ranges. A comparison of samples of varying micronizations viewed under the light microscope revealed a direct trend between particle size, structure, and sample viscosity. Comparative analysis of the effect of shear rate (0 to 1000 s-1) on viscosity showed an inverse relationship, suggesting a shear thinning behavior of the fluid. This effect on viscosity was found to be more pronounced in the shear rate range of 0 to 10 s-1, as opposed to a relatively less reduction at higher shear rates of 20 to 100 s-1 and 20 to 1000 s-1. Results of this study provide relevant information about indicators of textural properties, mouth-feel and commercial acceptability of tart cherry puree.

Troubleshooting Vertical Hydroponic System Under Organic Conditions

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Urban and factory farm systems are interested in utilizing vertical space, but there is a surprising lack of evidence-based research supporting many of the claims made by companies selling products for vertical and indoor production systems. The initial goal of this experiment was to evaluate the benefit, if any, of artificial lighting in a vertical growing system in a greenhouse in Georgia. However, problems with the system setup created a new question- how to overcome complicating factors in an organic hydroponic system? Two separate experiments were run, one growing basil and cilantro, and the other using tomatoes and kale, both grown in a hydroponic vertical wall system under organic conditions. One of biggest problems encountered was orienting the system to allow the plants to receive sufficient natural light to reduce the amount of artificial light necessary. Fish emulsion, a common organic fertilizer, was circulated through the system, but plants immediately showed signs of deficiency. The fish emulsion also caused emitters to clog and created thick layers of biofilm in the fertilizer solution reservoir. Aphids were also seen to be a problem, especially on the cilantro, and organic insecticides proved inadequate in keeping populations at an acceptable level. Crop selection and timing of planting transplants into the system was another problem encountered. Based on this experiment, kale, tomatoes, and basil could be potential candidates for vertical farm systems using non-organic soluble fertilizers.

The Role of Chondrogenic Growth Factors in the Pathogenesis of Equine DSLD

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Equine Degenerative Suspensory Ligament Desmitis (DSLD) is a disease afflicting a wide range of horse breeds that often results in mortality. Little is known about the pathogenesis of the disease making diagnosis and treatment of the affected horses difficult. Our lab has shown that the key histopathological sign of DSLD is an abnormal buildup of proteoglycans within connective tissue throughout the body with Safranin O staining which indicates the proteoglycan's sulfation. Additionally, at least one of the tendon proteoglycans, decorin, is abnormal in horses with DSLD, with chondroitin sulfate replacing the normal dermatan sulfate. The purpose of our current research has been to explain the abnormal levels of the proteoglycans by investigating the levels of the chondrogenic growth factors Bone Morphogenetic Protein 2 (BMP-2) and Transforming Growth Factor β1 (TGFβ). These growth factors regulate the production of proteoglycans by binding to the dermatan sulfate in decorin to suppress further production of the proteoglycans. When the dermatan sulfate is replaced with the chondroitin sulfate we believe the growth factors are unable to bind to the decorin which stimulates further production of proteoglycans by the tendon cells. Through immunohistochemistry staining, abnormally high levels of BMP-2 were found to be correlated with the overproduction of the proteoglycans and cellular activity. Interestingly, the levels of TGFβ were found to be low. Finding higher levels of the BMP-2 correlated with abnormally high levels of proteoglycans supports our hypothesis that growth factors are unable to bind to the altered decorin and could be leading to the progression of DSLD.

Interaction of nanocellulose with mucosal membrane in gastrointestinal tract in vitro

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Nanocellulose refers to nano-structured cellulose, which has a diameter 5-20 nanometers and a length about several micrometers. Nanocellulose can possibly get into human gastrointestinal (GI) tract through consumption as a food ingredient and ingestion of food contaminated by nanomaterials. Little is known about how nanocellulose interacts with mucosal membrane in GI tract, which is important to understand its health implications. This experiment was designed to study the mucoadhesion behavior of nanocellulose. The two methods used were flow-through method and viscometric method. In the flow-through method, a glass channel was covered with a thin mucosa-mimetic layer. Fluorescently-labeled nanocellulose was evenly placed on this layer. A syringe pump was used to pump stimulated intestinal fluid (SIF) to wash over its surface for 20 minutes. Using fluorescence microscopy, the mucoadhesion effect was observed by the amount of nanocellulose remaining on the mimetic-mucosal tissue. Nanocellulose in the rinse was also quantified by fluorescence microplate reader at emission 620 nm. In the viscometric method, mucin and nanocellulose interaction was evaluated by comparing the viscosity of mucin, nanocellulose and their mixture. The viscosity enhancement due to bioadhension was calculated by the following equation: $\Delta ŋ = [ŋ_{mixture} - (ŋ_{nanocellulose} + ŋ_{mucin})]$. The results from the flow-through method indicated that SIF flowed through the gel had less fluorescence than that flowed through glass channel, which proved the mucoadhesive ability of nanocellulose. Moreover, SIF collected every 30 seconds hardly contained fluorescence, demonstrating that almost all of the nanocellulose were successfully adhered on mucosa-mimetic layer. Examination on the viscosity of mucin, nanocellulose and their mixture confirmed the bioadhesion between mucin and nanocellulose, and the viscosity enhancement of nanocellulose was close to 800mPa at the shear rate of 4.08 1/s. It was reported in the literature that pectin can enhance viscosity by 150-400 mPa at the similar shear rate. Therefore, we can conclude that mucin and nanocellulose had stronger adhesion than mucin and pectin.

Correlation between teat end scores and presence of mastitis in the UGA dairy herd

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Mastitis is an inflammation of the mammary gland caused by bacteria that affects 1 in every 3 cows and costs the producer an average of $180/cow/year. Penetration of bacteria into the teat canal causing mastitic infections may be enhanced by hyperkeratosis, a thickening of the teat canal keratin, which provides a breeding ground for bacteria. The goal of this research project was to determine if a correlation existed between elevated teat end scores (degree of hyperkeratosis) and presence of mastitis and elevated somatic cell counts (SCC). For this study, ~30 purebred Holstein cows in early lactation were sampled. Their teat ends were scored on a scale of 1 to 4 according to level of severity, and teat canal swabs as well as milk samples were collected aseptically from each quarter for microbiological examination. Additionally, milk samples were evaluated for SCC using a DeLaval Cell Counter. The association of teat end score, infection status, and SCC was analyzed using the CORR procedure of SAS. A strong correlation was seen between level of infection and SCC for each quarter ($p = 0.001$) and for teat end score and age of the cow ($p = 0.001$). However, there did not seem to be a correlation between presence of infection and teat end score ($p = 0.444$) or SCC and teat end score ($p = .439$). Uninfected quarters exhibited an average score of 2.00, whereas the overall average score for infected quarters was 2.42, When data for infected quarters was examined individually, it was found that teat scores were CNS – 1.9, streptococcus – 2.0, prototheca – 2.0, S. aureus – 2.6, mold 3.0, and E. coli – 3.0. While little to no correlation is seen for the presence of infection and teat end scores, the correlation between presence of specific mastitis causing bacteria and elevated teat end score suggest that teat end hyperkeratosis is associated with presence of mastitis, and that management practices should be in place to prevent this condition and to promote healthy teat ends.

The effects of soil moisture on cotton growth and yield: a multi-varietal investigation

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The main objective of this project was to quantify the effect of total water received and the corresponding soil moisture levels on final crop yield in a variety of production scenarios common to Georgia. The secondary objectives of this study were to determine the effect of total water received during critical growth stages on final seed cotton yield, and to determine the effect of sensor installation method on capacitance probe readings and accuracy. This information will be used to develop an optimization matrix to aid producers in deciding which variety is the best option for certain field and environmental conditions. Rainfall, irrigation, soil moisture, and maturity data were collected throughout the cotton production season approximately every two weeks in twenty cotton variety trials in the southern region of Georgia. Soil moisture data were collected using AquaCheck capacitance probes (AquaCheck Brackenfell , Cape Town, South Africa); rainfall and irrigation data were collected using Rain-O-Matic small tipping bucket rain gauges (Fjord Alle 8, DK-6950 Ringkobing) equipped with Decagon EM-50-R data loggers (Decagon Devices Hopkins Ct, Pullman, WA). One soil moisture probe was installed using a recommended method while the other was installed using an experimental method. The sensor installation comparison took place in ten locations during the growing season and was repeated in four other locations after the crop had been harvested. The additional data was collected to compare the types of installation in varying locations and soil conditions without the crop effect. Overall, it was noted that well-timed irrigation or rainfall during critical growth stages produced higher yields when compared to trials that did not receive these well-timed events. Showing that on cotton it is most critical to provide ample water during squaring through bloom.

Using biochars as a soil amendment in crop production

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With increasing need to grow more food on less land, farmers are finding that depleted soils cannot sustain the demand for crops. One soil amendment that may improve biodiversity, nutrient hold capacity, and water hold capacity is material known as biochar. Biochar is hypothesized to improve soil quality, which should improve crop growth and crop yield. Biochar is charcoal composed of either animal waste or plant residue. This experiment was designed to evaluate the effects of biochar on the growth of lettuce. For this experiment, trials were conducted in a greenhouse. Bibb lettuce was grown in containers filled with either field soil or conventional potting soil, amended with either 10% compost, 10% biochar, or no amendment. Yield weights were taken at maturity. Yield data showed no significant difference between any of the treatments in the field soil group, but there was a significant difference in the potting soil group between the 10% compost and the no amendment treatment. No significant differences were observed in the rest of the potting soil group. Based on the results of this experiment, biochar did not improve crop yield.

The effect of form and source on bioavailability of vitamin E supplementation in mature horses

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Vitamin E (α-tocopherol) is an essential nutrient for all horses and has an integral role in preventing excessive production of free radicals that can cause major damage to cell structures. Uncontrolled oxidative stress can inhibit the horse's ability to combat the imbalance between production and removal of free radicals, resulting in tissue damage, and most recently discovered, degenerative disease. Since α-tocopherol is not synthesized by the horse, it is a crucial nutrient for all types of equine diets. Vitamin E can be found in natural sources through green pastures, alfalfa, and other quality roughages, as well as in the synthetic form of α-tocopherol acetate, the most commonly included form of vitamin E in Equine commercial feeds. However, due to structural differences, absorption rates and effectiveness of α-tocopherol can vary. The objective of this study was to compare serum levels of α-tocopherol in response to natural and synthetic forms of supplementation. We utilized sixteen mature horses, previously housed on pasture. Horses were confined to stalls with minimal turnout to a dry lot (2-4 hrs/day) for a two-week washout period prior to the start of the trial. Horses were then randomly assigned to one of four treatment groups; each receiving 4000 IU/day (Group 1 = synthetic acetate powder, Group 2 = natural acetate powder, Group 3 = micellized α -tocopherol powder, Group 4 = micellized α -tocopherol liquid), and then placed on a two-week feeding trial. Serum was collected pre-feeding on days 1, 7, and 14 and 4 hours post-feeding on days 1 and 14 to measure α-tocopherol levels. Mean α-tocopherol pre-feeding serum levels were significantly higher on days 7 and 14 across all treatments as compared to day 0. Horses on the liquid form of micellized α -tocopherol showed greater absorption ($P<.05$) at day 0 as compared to other treatments. However, this effect was not seen at day 14. Pre-feeding serum values between days 7 and 14 showed no significant differences. Across exercise time points, horses receiving micellized α-tocopherol in either liquid or powder form exhibited higher serum α-tocopherol levels as compared to horses receiving either natural acetate or synthetic acetate treatments ($P<.05$). Results indicate that supplementation of micellized α-tocopherol showed potentially greater immediate absorption and resulted in higher serum levels when challenged with repeated bursts of exercise.

The Action of a Hemipteran-Active Bacillus thuringiensis Toxin in Tarnished Plant Bug, Lygus lineolaris

Darcie Bruce, Applied Biotechnology Major, Department of Entomology; Presented in 2016

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Tarnished Plant Bugs, Lygus lineolaris, have emerged as major global crop pests. This group of bugs in the Order Hemiptera has piercing – sucking mouth parts, stylets that puncture plant cells and remove cellular contents. These species are cosmopolitan pests of high value crops. During the early bud and bloom stage, feeding by these insects causes bud and flower loss reducing yield on stone fruits, and a number of agricultural crops including cotton. Recently, the structure of Cry51Aa was solved by a collaboration with the Adang laboratory. Furthermore, Bacillus thuringiensis Cry51Aa, was determined to have insecticidal activity against Lygus (Baum et al. 2012).The objectives of this study were to first create a novel bioassay method to feed Cry51Aa toxins to Lygus nymphs. This method was created using a modified sachet-feeding system developed during the Summer 2015 Semester. The second objective involve testing the Cry51Aa for toxicity in the nymphs and analysis of the exposed nymph's midgut. The Cry51Aa toxin was solubilized by a 20mM concentration of NaOH, which was dialyzed by 200mM Na_2CO_3 pH 9.6 for testing. The experiments did show toxicity in the third instar nymphs which was statistically relevant [0.002197], however the trials were plagued with high mortality [50%] in the control buffer, 200mM Na_2CO_3 pH 9.6. Further analysis of the Lygus midgut in ongoing studies will help to provide information on the activity of this toxin.

Creating an entomological Geodatabase to understand the effects of biophysical context on arthropod distributions

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The overall objective of this study is to create a geodatabase that links the spatial variability of invertebrate (i.e. insects, spiders, and nematode) populations to geospatial environment data in different crop contexts. By creating this database we can better understand the distribution of pest and beneficial arthropod populations in space and time in relation to field management practices. In order to create an accurate geodatabase, it is vital that both biological figures and GPS points be properly collected using quality equipment and software. I was part of a team that collected insect samples, GPS points, and soil samples during the summer of 2015. The study area for my project is three fields planted in either irrigated cotton, dry land cotton, and a biofuel feed stock, Miscanthus grass, surrounded by varying degrees of forests and waterfront. The first objective is to get all data into the program ArcMap. I will compile and evaluate all of the gathered information for errors and then use the data to form the basis of a geodatabase. The data sources include aerial photography, population data, and shapefiles of the separate biomasses/vegetation and bodies of water. The second objective is to work closely with my mentors to perform initial statistical analysis to explore correlations between the arthropod populations and geospatial environmental features present within and surrounding the fields. The results of this project will provide new information to help calibrate the use of remote sensing and soil measurements for understanding the geospatial context for promoting ecosystem services.

Spatial and temporal iron isotope fractionation in Hawaiian soils

Shannon Burns, Environmental Chemistry Major, Department of Crop and Soil Science; Presented in 2016

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In the future, iron isotope fractionation patterns can serve as tracers for redox conditions in past climates, particularly when coupled with fractionation patterns for other metal isotopes. Given that microbes play a role in iron reduction, these redox conditions might elucidate microbial composition in ancient soils. Hawaiian soils have undergone controlled soil formation, or pedogenesis, as a result of their formation from volcanic hot spot activity. We sought to determine differences in the iron (Fe) isotopic ratio of 56Fe/54Fe in soils of varying age and climate from Hawaii. Our sampling sites varied in mean annual precipitation. We hypothesize that elevated weathering from increased precipitation and/or age of soils will yield a greater 56Fe/54Fe ratio. Samples were digested for Fe isotope analysis. For Fe purification, a double-spike of 58Fe-54Fe was added to each purified sample to account for mass bias in Inductively Coupled Plasma Mass Spectrometry (ICP-MS) measurements of 56Fe and 54Fe. Isotopic compositions will be compared across soils with temporal and spatial climate variation to elucidate redox patterns in the soils.

Management Influences of Nitrogen Losses in Runoff from Beef Cattle Pastures

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Eutrophication is a serious concern both environmentally and economically that may be prevented through better management of the nutrient load released from animal feeding operations. Practices preventing and reducing nutrients from entering surface waters will be far more cost effective than repairing ecosystems that suffer from eutrophication. The objectives of this study are to determine efficient and safe methods to measure nitrate and dissolved organic carbon (DOC) in runoff water and the influence cattle camping areas have on nitrate and DOC. Cattle camping areas are areas of intense cattle activity within the pasture. Runoff water samples (n=350) were collected from 10 pastures over a 1 year period following rainfall events. Samples were collected, filtered, and frozen within 24-h of the conclusion of a runoff producing event (rainfall greater than 1.3 cm). Samples were analyzed for nitrate and DOC and two methods were compared for each determination. For nitrate concentrations, the nitrate reductase (NR) method and the Rapid Flow Analysis (RFA) method were compared. The NR method was run on the Tecan Infinite M200PRO microplate reader at 540 nm with excellent sensitivity for nitrate concentrations between 0.01 and 1 ppm; concentrations above 1 ppm were diluted. The NR method uses NADH as the electron acceptor for the enzyme NaR to reduce nitrate to nitrite, which results in reliable and environmentally benign nitrate measurements. In contrast, the RFA method was run on an ALPKEM RFA-300 using a cadmium coil to reduce nitrate to nitrite, which has potentially negative environmental consequences. The sensitivity range for the RFA method was from 0.5 to 30 ppm. For DOC, the Shimadzu TOC method uses combustion compared to the much faster UV method that runs samples on the Tecan Infinite M200PRO microplate reader at 230 nm. Results showed that the nitrate concentration in runoff water was affected by cattle camping area. However, there was no consistent relationship between nitrate and dissolved organic carbon in runoff water.

Georgia beef cattle budgeting advancements by systematic reconstruction and current input cost evaluation

Dylan Chandler, Agribusiness Major, Department of Agricultural and Applied Economics; Presented in 2016

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The University of Georgia's latest beef cattle budget was released in 2013, but the beef cattle industry saw record setting prices in 2014 across the United States and throughout Georgia. With regard to the larger returns cattle producers are seeing today and change in input prices, a moor current budget is sought after. The overall objective of this study is to analyze the current beef practices of Georgia cattle producers, construct an untroublesome tool that may help farmers make informed decision concerning their beef cattle operations, and to forecast these prices into the future. This study involved contacting cattle farmers, forage producers, feed distributors, fertilizer distributors, and cattle genetics companies to obtain current input prices and operating practices of beef producers. Survey pricing data concerning each type of input was averaged and then entered into a spreadsheet that formulates an average variable cost when consumption values are entered by producers in the spreadsheet. Current nearby futures contracts for feeder cattle are used to provide an output price and for forecasting procedures. Results of the study suggest considerable change to both input and output prices affecting profitability of Georgia beef operations. In addition to the changes of input and output prices, this study will also forecast these prices to provide a glimpse of what the future holds for Georgia cattle producers.

Response of experimental zoysiagrass genotypes to a soil moisture gradient

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Four water table depth gradient tanks were utilized at the Crop and Soil Sciences greenhouse complex at the University of Georgia in 2015/2016 to evaluate the response of experimental zoysiagrass genotypes to soil moisture. Each tank was steeply sloped and had a volume of nearly 0.9 m3. Tanks measured 2.4 m long, 1.2 m wide, and were 0.3 m high at one end and 1.8 m high at the other end. Tanks were lined with 3 mm plastic and had a 10 cm base of pea gravel that provided a uniform substrate for water movement. Tanks were filled with a 2:1 mixture of a Pacolet sandy clay loam (fine, kaolinitic, thermic Typic Kanhapludults) and course sand. A valve at the high end of the tank regulated water inflow, while a standpipe at the low end regulated water table height. Tank surfaces were divided into 9 levels ranging in depth to the water table (DWT) of 27 cm (level 1) to 151 cm (level 9). Soil moisture measurements were taken at each level and averaged across tanks to determine capillary fringe. One year old '09-TZ-53-20', '09-TZ-54-9', '10-TZ-35', and 'Zeon' zoysiagrass sod (0.3 m wide) were established on the soil surface of all four tanks and allowed to grow-in for two months prior to soil moisture treatment initiation. Normalized difference vegetation index (NDVI) was recorded weekly to determine plant health/turfgrass quality. Lowest order curves giving high R2 values were fit to data for comparison of zoysiagrass genotypes at different soil moisture levels. Two months after trial initiation, all zoysiagrass genotypes declined with respect to NDVI measurement as DWT increased from level 1 to level 9. All zoysiagrass genotypes exhibited similar NDVI readings at level 1 (0.76 to 0.78) and level 2 (0.73 to 0.77). At level 3 and 4, 09-TZ-53-20 exhibited the lowest NDVI when compared to the other genotypes. At level 5, NDVI readings for all genotypes were ≤ 0.22, with 09-TZ-54-9 and 10-TZ-35 resulting in the highest readings (0.19 and 0.22, respectively). At level 6, 10-TZ-35 resulted in the highest NDVI reading (0.16), while all other genotypes exhibited NDVI readings ≤ 0.07. At levels 7 through 9, all experimental zoysiagrass genotypes were still alive, while Zeon exhibited an NDVI of 0.02 at level 7 and was completely desiccated at levels 8 and 9 (NDVI = 0.0). Higher NDVI readings and plant survival exhibited by experimental genotypes grown at the drier levels of the gradient tanks compared to Zeon (industry standard) indicates improved drought stress tolerance.

Maternal effects and their role in personality variation of laying hens

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Brown and white laying hens exhibit different personality types, which correspond to different stress responses when exposed to acute stress. White hens typically have a “reactive” personality: they behave less aggressively, display more fear, and have higher corticosterone (CORT) responses to stress. Brown hens have a “proactive” personality: they are more aggressive, display less fear, and have lower CORT levels in response to stress. Previous research in our lab has shown that these personality differences correspond to differences in measures of stress and reaction to immune challenges. The objective of this study was to examine the effects of stress on immune function in brown and white laying hens. To induce stress, hens were subjected to a rotating feeding schedule for 10 days. Control hens were fed within the same hour every morning. Blood samples were collected on day 0 and day 7 to measure plasma CORT levels. Eggs were collected for the duration of the experiment to monitor egg production and egg mass. During the 10-day experiment, two immune challenges were conducted: a Phytohemagglutinin (PHA) challenge on day 3 of treatment and a lipopolysaccharide (LPS) challenge on day 7 of treatment. For the PHA challenge a pressure sensitive micrometer was used to measure the thickness of the toe web before and 24 hours after injection of PHA (100 ug/100 ul). We then calculated the difference between the measurements and used that to compare the treatment groups. For the LPS challenge, internal temperature was measured using a basal thermometer 0, 6, 12, and 24 hours after an intraperitoneal injection of 1ml/kg LPS (treated) or 1 ml/kg saline (control). After PHA injection, white hens had significantly greater swelling than Brown hens ($p = 0.01$). Stressed white hens had significantly greater swelling than control white hens ($p = 0.03$), while stressed brown hens swelling was not significantly different than control brown hens swelling ($p = 0.73$). Six and twelve hours after injection, stressed white hens injected with LPS had a significantly higher temperature than stressed white hens injected with saline ($p = 0.002$, $p=0.03$ respectively) and a significantly higher temperature than stressed brown hens injected with LPS ($p = 0.003$ and $p<0.0001$ respectively). The results of this study suggest that white hens are more reactive to immune challenges than brown hens and these reactions are intensified by stress.

Comparing kinematic methods across technologies

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With the amount of pork production in the United States, it is essential that the welfare of the animal be maintained. Hence, a standard stride length for swine needs to be put forth for the use of lameness differentiation. The objective of this study was to see the difference in stride length for three different weights: 2.27 kilograms, 22.68 kilograms, and 68.04 kilograms. In the study, 5 piglets were used over time to track the change in stride length. The pigs were walked down a straight track across a pressure mat, in conjunction with cameras recording perpendicular to the track. The individual stride length data of each pig was obtained using two high speed cameras and were analyzed in the kinematic program, Kinovea. Once all the measurements were taken for each group, data were analyzed using a PROC MIX model in SAS 9.4. Significance was set at $P < 0.05$. The front and rear limb stride length was compared amongst the three weight groups, looking at the average and difference of the limb pairs. The stride length for the front and rear limbs had a significant increase in length from the 2.27 kg to the 68.04 kg ($P < 0.0001$; front: 46.74, 56.66, 70.72 cm; rear: 47.33, 56.72, 70.44 cm, respectively). The difference between the front and rear limbs were notably smaller from 2.27 kg to 68.04 and 70.72 kg ($P < 0.001$; front: 5.30, 1.88 and 1.47 cm; rear: 5.53, 2.03 and 1.90 cm, respectively). From this study, the difference in stride length over the life of the pig is established. This illustrates the differences that can be expected to be seen in an average animal over time. Further analysis of the data will look into different locomotion parameters that will help to establish a normal stride pattern to identify abnormal pigs from the herd.

Soybean mosaic virus resistance via Tasi-RNA

Andrew Disharoon, Biological Science Major, Department of Poultry Science; Presented in 2016

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Soybeans, as one of the largest crops in cultivation, are constantly under attack by diseases. One of the most common diseases affecting soybeans internationally is the soybean mosaic virus. Food supply safety is a growing concern that must be addressed through new solutions as old techniques falter in the face of evolving diseases and increasing demand. Gene silencing is a powerful tool that many plants use to regulate their own gene expression. In this case, if genesilencing could turn off the genes of the invading virus, the plant would be resistant. Even before the causal mechanism was known, genetic engineers have used gene silencing to combat viral disease. With a greater understanding of these silencing mechanisms, genetic engineers can create more efficient ways to induce gene silencing. One such method is using a specific type of miRNA pathway known as tasiRNA, which is found within crop plants and using it to induce the desired silencing. By placing a tasiRNA 22 DNA recognition site in front part of the viral DNA, resistance to soybean mosaic virus should be achievable. Accordingly, vectors for silencing the positive sense, negative sense, and a combination of the two strands of the virus were constructed. These events were introduced into Jack soybean tissue to generate transgenic lines for each vector. Events will be phenotyped for disease resistance upon reaching 20 cm in height. It is expected that not only can this approach impart viral resistance to soybean mosaic virus, but also to all other related viruses.

Holy basil production for increased yield

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Holy basil (Ocimum tenuiflorum) is an important medicinal plant that has been associated with decrease in stress, regulation of metabolism, and reduction of inflammation. In many cultures it is used as a tea. The study evaluated yield and essential oil content of O. tenuiflorum varieties to determine the best for commercial production. Plants from 14 holy basil varieties were selected from commercial catalogs and the USDA Germplasm systems. Plants were grown in the field, harvested and biomass recorded before and after drying. Eessential oils were extracted from each sample by hydrodistillation. Varieties were ranked using an index score that was a combination of yield and essential oil content per plant. The top five yielders included both USDA and commercial varieites, including PI288779, Amrita, PI652059, PI652057, and Kapoor. Results indicate an inverse relationship between biomass yield and essential oil content, suggesting that growers should not use biomass as the sole characteristic for variety selection.

Evolutionary of mating-type genes in Stagonosporopsis species causing gummy stem blight of cucurbits

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Gummy stem blight of cucurbits has recently been discovered to be caused by three genetically distinct but morphologically indistinguishable fungal species: Stagonosporopsis cucurbitacearum, Stagonosporopsis citrulli, and Stagonosporopsis caricae. A key biological difference among these species may be their mating systems, and specifically the presence and structure of the MAT1-1-1 and MAT1-2-1 genes, which together compose the MAT1 locus. Genes associated with reproduction tend to diverge rapidly, so our objectives were to identify the genes and determine if the genes are rapidly evolving. This would include analyses for both positive and purifying selection. Genomes of the three species were searched for homologs, and tests for positive and purifying selection were conducted primarily in the form of dn/ds analyses. The results of these analyses show that the dn/ds ratio for the three species varies greatly, with several ratios being less than one. However, the evolutionary constraints within the three species were significantly different than those between the species, suggesting that positive selection is occurring. Concrete evidence of positive selection in mating-type genes may provide evidence that distinct speciation among S. caricae, S. citrulli, and S. cucurbitacearum is occurring. Because the MAT1-1-1 and MAT1-2-1 genes contained in the mating-type locus are associated with several functions ranging from host recognition to the formation of reproductive structures, understanding the evolutionary factors acting on the MAT1 locus could be critical in understanding the emergence of new fungal species.

Assessment of iNSC treatment on learning, memory and behavior in a piglet traumatic brain injury model

Kayla Hargrove, Animal Science Major, Department of Animal and Dairy Science; Presented in 2016

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With the demographic shift in age set to progress in the 21st century and triple by 2050, dementia will become one of the most important health issues worldwide. Vascular changes resulting in decreased cerebral blood flow (CBF), and white matter damage have prompted a shift in focus from Alzheimer's to a newly recognized form of dementia known as vascular cognitive impairment (VCI). Recent failures of therapies tested in rodents to support safety and efficacy in human clinical trials has led to the development of a novel porcine VCI model with more comparable brain anatomy and physiology. The objective of this study was to create chronic hypoperfusion in a porcine model of vascular cognitive impairment. We hypothesized permanent bilateral and unilateral occlusion of the common carotid artery (CCA) would lead to decreased cerebral blood flow (CBF) and white matter damage and would elicit significant alterations in cognitive function. Three barrows were randomly assigned to sham, unilateral, or bilateral treatment groups. VCI was induced by permanent unilateral and bilateral ligation of the CCA, and pigs were evaluated at 24 hours, 4 and 12 weeks post-VCI via MRI analysis. T2, PWI, and DTI scans revealed sustained decreases in CBF as well as progressive white matter damages. Collectively, these results demonstrate a porcine model of VCI led to comparable white matter lesions and decreased CBF with minimal structural changes, and could be used in the future to assess the efficacy of potential treatment options.

In-Vitro and In-Vivo Assessment of a Yeast By-Product on the Inhibition of Histomonas meleagridis

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Histomonas meleagridis is an anaerobic protozoan and the causative agent of Blackhead disease. This disease can cause up to 100% mortality in turkeys because the innate immune is not able to identify the parasite as foreign. The objective was to determine if a yeast by-product known to upregulate the innate immune system could inhibit H. meleagridis in-vitro and in-vivo. For the in-vitro trial, H. meleagridis cells were incubated in Dwyer's media for 24h at 42oC then flasks containing fresh media were inoculated with 100,000 cells per flask. Cells were treated with several concentrations of yeast by-product and counts were performed after 8 and 48 h. For the direct and indirect in-vivo trials, 1 day old poults were obtained and had ad libitum access to treatment diets and water. Treatments consisted of varying yeast by-product concetrations. At 18 days old, poults were challenged with H. meleagridis cells. For the direct trial, all poults were challenged and for the indirect trial, 5 out of the 30 poults per treatment were challenged. Mortalities were necropsied for liver and cecal lesions. The direct trial was terminated at 10 days post-infection and the indirect trial was terminated when 80% of the inoculated control birds exhibited Blackhead signs. The results of the in-vitro trial determined that the treatments did not inhibit H. meleagridis cell growth ($P<0.05$). There were also no significant differences between treatments for the direct trial ($P<0.05$). Lastly, the indirect trial determined that the treatments did not inhibit lateral transmission of Blackhead ($P<0.05$).

Immune response to subcutaneous and intranasal vaccination in young beef calves

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Vaccination is utilized in an attempt to prevent bovine respiratory disease in cattle; however, maternally derived antibodies have been shown to interfere with the immune response to vaccination in young calves. The objective was to compare the serum neutralizing antibody titers (SNA) to BHV1 and BRSV, and nasal mucosal BHV1-specific IgA (BHV1-IgA) following intranasal (IN) or subcutaneous (SC) booster vaccination 60 days after IN priming of young calves using a modified-live virus (MLV) vaccine. Twenty-four beef calves (3-25 days old) were prime vaccinated against BHV1, BRSV, and PI3V IN (Inforce-3®, Zoetis Animal Health), and 60 days later were randomly assigned to receive a booster of the same vaccine either IN (n= 12) or SC (n= 12). Blood and nasal secretion samples were collected on days -60 (priming vaccine day), -14, 0 (booster vaccine day), 14, 21, 28, and 60 for determination of total serum IgG (only at d-60), SNA to BHV1 and BRSV, total mucosal IgA, and mucosal BHV1-IgA concentrations. On d-60, total serum IgG concentrations between groups did not show any statistically significant difference. Calves had high SNA to BRSV and BHV1 at d-60, which decreased on d-14 and d0. Intranasal, but not SC, booster vaccination significantly increased the SNA to BSRV on d14, 21 and 28 compared to d0 ($P < 0.05$). Both groups had a sustained increase in nasal BHV1-IgA concentration after priming and booster vaccinations. By comparing the fold change of nasal BHV1-IgA on d21, two patterns of response were observed in IN group; calves with high concentrations of nasal BHV1-IgA at the time of booster did not show clear recall response to IN booster vaccination, but those with lower concentrations of nasal BHV1-IgA at the time of booster vaccination showed a strong (≥ 8 fold increase) recall titer at d21 and d28. In contrast, a significant nasal BHV1-IgA response was observed in the SC booster group regardless of the concentration of BHV1-IgA in nasal secretions at d0. In conclusion, IN booster significantly induced SNA to BSRV in young calves IN primed with MLV vaccine, and both IN and SC boosters increased the BHV1-IgA titers in nasal secretions. The amount of IgA present at the time of the IN booster vaccination affected the BHV1-specific nasal antibody recall response.

Development of a low-cost automated irrigation controller

Jesse Lafian, Horticulture Major, Department of Horticulture; Presented in 2016

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Water conservation is becoming increasingly important. As global temperatures reach record highs, severe drought limits water supply to farms, cities, industries, and ecosystems. Over-irrigation can contribute to water shortages and suppress biodiversity by leaching nutrients that cause eutrophication. Improving irrigation accuracy could provide significant environmental and economic benefits worldwide. The objective of this project was to develop a prototype for a low-cost tensiometer in order to measure soil water tension (SWT)—the force necessary for plant roots to extract water from the soil. As soil loses water, SWT increases. Irrigation becomes necessary when a plant's root zone reaches a certain degree of tension, which varies by plant type. Thus the ability to measure SWT is a key to improving irrigation accuracy. The novel aspect of my design is that it mimics the response of plant roots to soil moisture; pressure accumulates in the device relative to the volume of water it extracts from the soil. This pressure signal is correlated with—and thus can be converted to—SWT. These results confirm that this tensiometer design could help improve irrigation accuracy; however, additional research is needed to increase the device's precision. Once fully developed, the tensiometer could connect to an inexpensive automated irrigation control system for use in lawns, gardens, nurseries, greenhouses, farms, and research (e.g., in agriculture, horticulture, ecology, geology, and hydrology). By optimizing the volume of water used for irrigation, this device may minimize the risk of overwatering, which can kill plants and therefore profits. Finally, this tensiometer may reduce government expenditures on water quality/accessibility and prevent costs related to a lack of ecosystem services such as fisheries production and CO_2 sequestration.

The effect of supplemental vitamin E form on blood oxidative stress parameters measured in exercising horses

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Vitamin E is a component of the antioxidant system of the horse and is commonly included in commercial horse feeds in the form of synthetic α-tocopherol acetate. The purpose of the research was to test the effect of supplemental vitamin E form on blood oxidative parameters in exercising horses. The project utilized 16 horses previously housed on pasture. Horses were kept in stall confinement for the duration of the study with 2-4 hours of dry-lot turnout per day. The horses underwent a two week "wash-out" period in which horses were fed a low vitamin E diet with no supplemental vitamin E. Following the wash out period, horses began a two week feeding trial where they were fed the same diet plus 4,000 IU/day of supplemental α-tocopherol. Horses were randomly assigned to one of the following supplementation groups: synthetic acetate powder, natural acetate powder, micellized d-α-tocopherol (liquid), and micellized d-α-tocopherol (powder). At the completion of the feeding trial, horses began a two day standard exercise regime. Whole blood and serum were collected four hours post supplementation prior to exercise on the first day, four hours following completion of the standardized exercise test (SET) on the last day and 24 hours following the completion of the last SET. SET protocol was conducted by free lunging in an enclosed round pen at controlled and incrementally increasing speeds. Pre and post exercise serum was analyzed for α-tocopherol. Whole blood was analyzed for reduced, total, and oxidized glutathione to assess exercise induced oxidative stress. Results indicate that average serum α-tocopherol levels were higher in the horses supplemented with micellized liquid and micellized powder forms of α-tocopherol as compared to horses supplemented with synthetic and natural acetate powder over the three exercise time point sampled ($P<0.05$). Immediately pre-exercise and post-exercise, horses receiving synthetic acetate powder showed lower serum α-tocopherol levels as compared to either micellized liquid (pre-exercise) or micellized powder (post-exercise) ($P<0.5$). At 24 hours post-exercise, horses receiving natural acetate exhibited significantly lower α-tocopherol levels as compared to horses supplemented with micellized liquid ($P<0.05$). Findings of this study indicate that micellized forms of α-tocopherol are better able to maintain serum α-tocopherol levels when horses are challenged with repeated exercise as compared to acetate-bound forms of α-tocopherol.

Controlling flowering of short-day plants with far-red LEDs

Mary Lewis, Horticulture Major, Department of Horticulture; Presented in 2016

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Better control over the growth and development of greenhouse crops can help growers increase profits. Control over when plants flower is especially important. Far-red light is known to be important in triggering flowering responses of many plants. Our objective was to determine whether far-red light from LEDs can make marigolds flower faster. Marigolds (Tagetes erecta) typically flower fastest when exposed to long nights. We also wanted to determine whether far-red light affects plant morphology, including height and leaf size. Each day, marigolds were exposed to 16 hours of light and 8 hours of dark, simulating summer time. At the start of the dark period, plants received 0, 15, 30, or 60 minutes of far red light. All other growing conditions were kept as similar as possible. Plants that did not receive far-red light flowered later (after 104 days) than those in any of the other treatments (~76 days). Plants that did not receive far-red light were 30 cm tall compared to a height of 87 cm for those exposed to far-red light. Plants grown without far-red also had smaller leaves than those in far-red treatments. Our results show that growers can speed up flowering of marigolds with far-red LEDs, while also producing larger plants. The amount of far-red light required is very low, which makes practical applications easy and cheap.

PCR-Restriction Fragment Length Polymorphism Method for De? (cut off on sheet)

Paola Lopez, Mircobiology, Biological Science Major, Arts/Sciences; Presented in 2016

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Cyclospora cayetanensis is a food and waterborne coccidian parasite responsible for gastrointestinal illness in humans. In the past three years, more than 1,500 cases of Cyclospora infections have been reported in the U.S. Clusters of infection were epidemiologically associated with imported salad greens and imported cilantro. Tracking the implicated food items and source of contamination associated with cases of cyclosporiasis has been one of the significant challenges in the past years. Previously, the use of the 18S rRNA, HSP70, and ITS genes have been useful in the detection of Cyclospora cayetanensis. The nested-PCR-restriction fragment length polymorphism (RFLP) protocol was used to specifically detect C. cayetanensis oocysts in environmental samples. In this project we evaluated various PCR assays used to detect Cyclospora and included primers for MLST analysis. Cyclospora oocysts from various endemic locations were compared in this study. Samples were examined using four PCR assays targeting four different alleles. Amplified products have been sequenced to determine if these could differentiate isolates from different geographic and endemic locations.

An investigation into the complex viral interactions between Microplitis demolitor bracovirus and TnAV-2a, an Ascovirus

Johnathan Mayfield, Entomology Major, Department of Entomology; Presented in 2016

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Parasitoid wasps are a diverse and abundant group of organisms that spend part of their development either within or on their host. One group of parasitoid wasps, the superfamily Ichneumonoidea, has evolved an obligate, beneficial symbiosis with the doublestranded DNA Polydnaviruses. Microplitis demolitor bracovirus, or MdBV, is a polydnavirus found within the ovaries of the wasp host M. demolitor and has been shown to alter the immune system of the host to promote parasitism. Our project aimed to determine if MdBV interacts with other viruses within the host, specifically the ascovirus TnAV-2a. TnAV-2a is a pathogenic, double-stranded DNA virus that infects early stages of Lepidopteran hosts and is only transmitted on the ovipositor of parasitoid wasps like M. demolitor. Based on quantitative PCR analysis of parasitized and unparastized ascovirus infected hosts, we have determined a species specific interaction between these two viruses. In parasitized hosts, TnAV-2a replication was lower at 24, 48, and 168 hours post infection within Pseudoplusia includens. In the hosts Trichoplusia ni, Spodoptera frugiperda, Helicoverpa zea, and Heliothis virescens we did not see any significant difference between parasitized hosts and unparasitized hosts in terms of TnAV-2a replication at 48 hours post infection. Within P. includens, we infected the host with both MdBV and TnAV-2a and determined that MdBV is the cause for lower TnAV-2a replication. Lastly, we unsuccessfully attempted to generalize the effect we saw in P. includens to a cell line derived from the same host suggesting that this interaction is more complex and involves many factors within the host.

The effects of using ice as irrigation on orchid root physiology

Sierra McDonald, Horticulture Major, Department of Horticulture; Presented in 2016

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The use of ice to irrigate plants has been an accepted practice for over 25 years. Recently, a company that recommends this practice for orchids was challenged by an orchid society to prove that ice was not detrimental to orchids. To address this question, we conducted two different studies using chlorophyll fluorescence measurements to determine if this procedure causes root damage: 1) The internal temperature of Phalaenopsis orchid roots was monitored using a micro-thermocouple placed deep inside the stele of the root as an ice cube was placed directly on the root and 2) the quantum efficiency of the photosynthetic spongy parenchyma of the orchid root was assessed in a time study where roots were immersed in a bath filled with anti-freeze. The temperature of the anti-freeze solution was gradually lowered until the roots showed signs of freezing. Freezing was evident when the exothermic reaction of ice crystal formation expressed itself as a jump in the tissue temperature. Freeze damage was also assessed by determining the quantum efficiency of photosystem. Our results showed that when ice cubes were placed directly onto the root surface, internal root temperatures dropped quickly, but never below 2 °C. In the second study, roots did not show freeze-induced damage until the temperature of the water bath reached -7 °C, at which time the internal temperature of the roots reached -2 °C. The quantum efficiency of photosystem II dropped from about 0.75 in healthy roots to 0.17 in freeze-damaged roots. This drop in quantum efficiency is likely due to because the cell membranes in the roots was compromised by ice crystal formation. The below 0 degree C freezing point may be due to sugars and other solutes in the root tissue. In summary, the internal temperature of roots with an ice cube placed on top did not drop below 2 °C (38.6 F), while freeze-induced damage in the roots was seen only at root temperatures below -2 °C. There is no evidence of root damage based on the quantum efficiency of photosystem II when ice is placed directly on the root. Long-term studies with the use of ice cubes or water are being conducted to look at how ice cubes may affect longer term plant health and flower longevity.

Optimizing traumatic brain injury quantification in Piglet model of TBI

Mary Mehegan, Animal Science Major, Department of Animal and Dairy Science; Presented in 2016

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In the United States alone, approximately 50,000 deaths result from traumatic brain injury (TBI) annually. At this time, there is no adequate TBI treatment. Neural stem cells may serve as a regenerative cell replacement therapy, as they are capable of differentiating into neurons, astrocytes, and oligodendrocytes and produce regenerative factors such as VEGF. These cells have been shown to lead to structural and functional improvement in rodent models that have suffered similar neural injuries. However, treatments that have been developed in rodent models regularly fail in clinical trials, thus more predictive large animal models are needed. With a large gyrencephalic brain and gray-white matter composition similar to humans, the pig is an effective large animal model. The objective of this study is to longitudinally assess changes in brain cellular composition in a piglet model of TBI. Piglets underwent surgery to generate a concussive TBI. To assess the time course of TBI pathology, piglets were sacrificed and brain tissues were collected 1 day, 1 week, and 4 weeks post-TBI. At the site of neural injury, we assessed cellular level changes in TBI pathology using the neuron marker NeuN, astrocyte marker GFAP and the oligodendrocyte marker Olig2. At 1 week post-TBI, NeuN staining demonstrated a significant decrease in neurons. In addtion, the upregulation of GFAP expression indicated increased astrogliosis at both 1 week and 4 weeks post-TBI. No significant changes in Olig2+ oligodendrocytes were noted. Standardization of this novel model opens the door for the evaluation of new cell therapies, pharmaceuticals and therapeutic approaches thus providing the field with a critically needed assessment tool.

Expression analysis of immune genes in the liver and ceca of Blackhead infected turkeys

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Histomoniasis, commonly referred to as Blackhead disease, is a threat currently faced by the poultry industry. Blackhead is caused by infection of the parasitic protozoa Histomonas meleagridis in the ceca (and eventually liver). In turkeys this disease is highly fatal; symptoms include drooping head, pale neck, and yellow bile around the cloaca. There are no approved drugs on the market today that combat the disease and immunization attempts have only been partially successful. We hypothesize that feed additives such as fermentation products may be effective in prevention of colonization of Histomonas meleagridis and may improve bird performance under a challenged situation. To test this, a yeast product was fed to turkeys and the immune response of control infected birds compared to birds fed a control diet .The weight of poults was taken prior to cloacal infection at day 18. Samples of liver and cecal tissue were collected from euthanized birds 5 and 10 days post-infection. Initial data suggests that there is no statistical difference in treatment regarding infection percentage or in the liver and ceca lesion scores of infected birds on the control and treatment diets. Poult weight gain also remained statistically similar between control and yeast product diets.RNA from samples has been isolated and gene expression of CXCLi2, IFN-y, IL-10, IL-1B, IL-4, and IL-13 genes will be analyzed using rtPCR to examine immune response. Future research will be conducted to determine the yeast product's capability as a Histomoniasis prevention method and its effects on the immune response of turkeys.

Investigation of how Lysinibacillus sphaericus Bin toxin kills a cell line derived from the malarial mosquito Anopheles gambiae

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Binary toxin (Bin) produced by the bacterium Lysinibacillus sphaericus is toxic to Culex and Anopheles mosquito larvae. It has been used world-wide for the control of mosquitoes that vector human diseases, including West Nile virus, lymphatic filiariasis and malaria. The Bin toxin interacts with a receptor in the gut of Anopheles mosquitoes. However, the exact mechanism of its mode of action is not clearly understood. The Adang laboratory developed an Anopheles gambiae Ag55 cultured cell line as a model for investigating the molecular action of Bin toxin. The Bin toxin, composed of BinA and BinB proteins, internalizes and kills the Ag55 cells via a process that is consistent with autophagy. The goal of this project was to determine whether BinA or BinB alone is sufficient to kill A. gambiae larvae and Ag55 cells or whether the BinA/B pair is required for toxicity. Our approach was to individually produce BinA and BinB in recombinant Eschericia coli and test the toxicity of each separately and together against A. gambiae larvae; followed by testing the cytoxicity of BinA and BinB against Ag55 cells. Preliminary results with purified BinA alone show toxicity to Ag55 cells and now we are beginning to analyze uptake of BinA by the cells. This information will contribute to the understanding of how Bin toxin kills mosquito larvae, and could provide insights into approaches to prevent mosquitoes from acquiring Bin resistance.

Effects of historic cotton farming on depth to argillic layer

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Up until the last hundred years, most of the land in the Southeast region of the United States was heavily farmed for cotton. The popularity of single-cropping of cotton and little to no use of Best Management Practices (BMPs) during this period led to high rates of runoff and soil erosion. Understanding how much of the top soil (A Horizon) eroded during and after cotton farming in relation to slope is essential to understanding erosion severity. Particle size analysis was conducted on soil samples of varied ranges of depths from different augured locations from Watersheds 3 and 4 of the Calhoun Critical Zone Observatory. From there, the depth to the argillic horizon (Clayey B) or simply the top soil was quantified. In relation, the samples were also scanned with a VNIR (Visible and Near-Infrared) to test the effectiveness of using VNIR soil reflectance to predict clay content in situ instead of the long process of ex situ particle analysis. Overall, the data showed that as slope increased, the depth to the argillic decreased showing greater erosion of the top soil in the upland position. With a wavelength of 2203, the soil reflectance data gave a .61219 R squared value concluding that the VNIR data and the clay content of the soil samples gave an above average correlation.

Effect of different concentrations of 25-hydroxycholestrol on osteogenic differentiation of mesenchymal stem cells (MSC) from broiler compact bone

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MSC are multipotent progenitors that can differentiate into various tissue cells. The objectives of the study were to 1) isolate MSC from broiler compact bone and 2)study the effects of 25-hydroxycholestrol on osteogenic differentiation of MSC. This is important for the production and welfare facets of the poultry industry as chickens develop orthopedic problems such as lameness, tibial dyschondroplasia, and osteoporosis. MSC were isolated from the femurs and tibia of day-old chicks. The compact bones were flushed with PBS, chopped to small pieces, and digested with a digestion buffer containing 0.25% collagenase and 20% Fetal Bovine Serum (FBS). Digested cells were filtered, centrifuged, and cultured in a growth medium DMEM containing 10% FBS. MSC were successfully isolated and left to confluent, with the media changed every 2-3 days. The cells were passaged until P4 and plated in 24 well plates at density of 20,000 cells/cm2. Upon confluency, cells were treated with the following treatment: control, osteogenic media (OM), and OM with 0.5, 1, and 2 uM 25-hydroxycholesterol. Cytochemistry was conducted on day 7 and 14 to detect osteogenesis. Cells treated with OM, and 25-hydroxycholestrol induced higher proportion of Alizarin Red and Von Kossa stain (mineralization), and Alkaline Phosphatase (early osteogenic marker) compared to control cells. However, 2uM 25-hydroxycholesterol was toxic to cells, causing cell death. Results indicated that 25-hydroxycholesterol has a stimulatory effect on MSC ostegenesis. Current results provide rationale for further study on regulatory mechanisms of 25-hydroxycholesterol on MSC which can help to address skeletal problems in poultry.

Developing natural and shelf stable preserved red pepper sauce

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The purpose of this research was to develop a red pepper sauce that is made of all natural ingredients, feasible for mass production and shelf stable. The current red pepper sauce made by a small company has a pH 4.9 which makes it a low-acid food, and thus has to be distributed under refrigeration. In order to achieve the purpose, three methods were examined to acidify the red pepper sauce product below pH 4.6: 1) addition of commercial cultures with 6 hours fermentation, 2) addition of commercial cultures with 1 week fermentation, and 3) a combination of acidification and hot fill-hold. Commercial cultures containing Lactobacillus with 0.05 g/kg and 0.1 g/kg were added into the fresh red pepper products with garlic and without garlic. They were fermented for 6 hours at room temperature (21 °C). The products with garlic resulted in 0.21% to 0.23% lactic acid with pH 4.86 to 4.96, soluble solids 16.00 to 16.07 ºBrix, and microbial count of 1.4 x 10-4 CFU/g and 1.5 x 10-4 CFU/g for 0.05 g/kg and 0.1 g/kg, respectively. On the other hand, production of CO_2 and black mold were observed in the products without garlic. Based on previous research, commercial cultures containing Lactobacillus with 0.1 g/kg and 0.2g/kg were added to the fresh red pepper sauce products with and without garlic. They were fermented for 1 week at room temperature (21 °C). The products with garlic resulted in 0.29 % to 0.40 % lactic acid with pH 4.60 to 4.62, soluble solids 14.70 to 15.40 ºBrix, and microbial count of 8.1 x 10-3 CFU/g and 2.2 x 10-4 CFU/g for 0.1 g/kg and 0.2 g/kg, respectively. On the other hand, production of CO_2 and black mold were still observed in the products without garlic. A combination of acidification and hot fill-hold method was applied to the fresh red pepper sauce products with garlic. In order to acidify the products with garlic, 15 mL of lemon juice were added to 100 grams of the products with garlic. The sauce was cooked to 190 F (87.7 °C) to prevent the growth of microorganisms, and then filled in the jars. The jars were inverted for 3 minutes. The acidified products with garlic had pH 3.75. This research indicated that garlic prevents the growth of undesirable microorganisms in the red pepper sauce products. Furthermore, this research confirmed that a combination of acidification and hot fill-hold method is more effective way to acidify the current red pepper sauce products with garlic than addition of commercial cultures containing Lactobacillus.

Local Adaptation through symbiosis

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The pea aphid, Acyrthosiphon pisum, has emerged as an important model for the study of defensive symbiosis. All pea aphids carry an obligate, nutritional symbiont, and individual aphids many have one or more of seven facultative symbionts, which play roles in defending the aphids from natural enemies. The best studied bacterial defensive symbiont is Hamiltonella defensa, which requires infection with temperate bacteriophages called APSEs for protection against parasitic wasps. However, little is known about the strain diversity of H. defensa/APSE and whether strains consistently vary among collections locations, which may be a signature of local adaptation in response to particular natural enemy genotypes. The null hypothesis is that strains will be the same among populations, but given that strains vary in levels of protection conferred to particular enemies, and that enemies themselves vary among populations, the alternative hypothesis is to find consistent variation among populations. To test our hypothesis, we compared symbiont strain variation between pea aphids collected in North Dakota versus Wisconsin by conducting PCR and Sanger sequencing of H. defensa and APSE 'typing' loci from. Sequences were aligned and compared using Geneious software and binned into 'strains' and used to produce phylogenetic trees. Initial findings considering 27 samples find three distinct strains of APSE3-H. defensa that differ between North Dakota and Wisconsin populations of pea aphids. Although greater sampling effort is needed to confirm this finding, our preliminary results support our alternative hypothesis that distinct H. defensa/APSE strains are present in both populations. This may be due to local adaptation of particular strains to the natural enemies present in those regions, but additional work is needed to show this.

Investigating the effects of blood-borne eprinomectin on the malaria mosquito, Anopheles quadrimaculatus

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According to the World Health Organization, nearly half of the world's population is affected by malaria. Some believe that malaria is a problem only for the developing countries of the world, but that is not the case. Malaria is present in the United States, but incidence is lower than in other parts of the world. The mosquito Anopheles quadrimaculatus is responsible for malaria transmission in eastern North America. This insect is very prevalent in the United States and therefore there is still a risk of malaria being reintroduced into the United States as a larger threat. The current methods used to reduce risk of malaria transmission in more affected countries are mosquito nets, pesticides, and prophylactic drugs. While these methods have been successful, they are expensive and require upkeep that is not always available in the developing countries where malaria is so prevalent. This study was conducted to determine whether blood-borne eprinomectin consumed by A. quadrimaculatus is an option for controlling malaria-transmitting mosquitoes. A. quadrimaculatus were artificially fed using 2 mL of blood per group of female mosquitoes via a Rutledge feeder. The control group of twenty-five female mosquitoes was blood fed for 45 minutes using untreated blood from Black Angus cattle. After 45 minutes, the test group's twenty-five female mosquitoes were fed using blood in which a calculated level of eprinomectin had been added. Each group was monitored closely following the end of their feeding to determine death and survival rates. Surviving mosquitoes continued to be monitored throughout their lifecycle for sublethal effects, including egg laying, to determine whether eprinomectin affects oviposition and hatch rates. The results indicated that eprinomectin does kill A. quadrimaculatus. In the test group that consumed blood treated with 0.7 microliters (350 ppm) of eprinomectin, all of the mosquitoes were dead within 48 hours following feeding, while blood-fed control mosquitoes had high survival rates. This in-lab experiment provides a good foundation for future field studies. The hope for this study is that the mosquitoes will blood-feed on pastured cattle and die before they are able to transmit disease. Ultimately, the findings in this study add to research of methods to control malaria transmission worldwide.

Knockdown of evelopmental mediators of DNA Methylation in the fire ant

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In eusocial insects, genetically identical individuals can exhibit a fascinating variation of quantitative traits that determine caste differentiation such as size and behavior. Environmental factors, such as temperature, nutrition, and pheromones, induce individuals to differentiate into morphologically distinct groups at certain developmental stages. Epigenetic modifications such as DNA methylation have been recognized as regulators of gene expression and may represent a major mechanism by which many organisms develop phenotypes appropriate to their environment. Recently, a complete, functional DNA methylation system was identified in the eusocial bee Apis mellifera. Fascinatingly, via RNA interference, the down-regulation of a DNA methyltransferase (DNMT) enzyme that is key for developing female honey bees caused larvae to develop into queens instead of workers. Discoveries such as this one have led to the formation of many hypotheses concerning insect caste differentiation and the systems that regulate them. In this study, we targeted two DNMTs in the fire ant, Solenopsis invicta. DNMT1 is responsible for maintaining previously established methylation patterns across cells whereas DNMT3 is classified as a de novo methyltransferase in that it establishes new methylation patterns. We designed PCR primers for DNMT1 and DNMT3, transformed the amplicons and our promoter into the plasmids of competent bacteria which were then cloned, and streaked on selective media. We then synthesized double-stranded RNA. Developing larvae in most social insect colonies are totipotent and retain the ability to develop into queens or workers. Therefore, we will treat S. invicta larvae with the dsRNA in the hopes of degrading DNMT1 and DNMT3 transcripts, consequently, reducing DNA methylation in the ants. We will examine the molecular effects of this experiment using quantitative real time PCR. This study will validate the utility of RNA interference (RNAi) in S. invicta, providing the framework to explore the role of DNA methylation in S. invicta caste determination.

The evaluation of chios mastiha essential oil on sow performance

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The objective of this project was to determine how the essential oil from the Chios Mastiha tree affected sow performance during lactation. Previous research shows that the essential oil increases sow feed intake and decreases fecal dry matter, which decreases constipation issues. Two groups of sows were brought used. The first group had 8 sows in it; however, one of the sows had to be taken off of the study. The second group had 10 sows in it with one taken off of the study. The sows were housed in farrowing crates at the Large Animal Research Unit. The sows were chosen at random for one of the two treatments. The control group was feed normally while the treated sows were given ten milliliters of Chios Mastiha essential oil along with feed. The treatment was given starting at day 110 of gestation and continued until weaning. Feed intake was monitored daily. Fecal samples were collected at day 110 and 114 of gestation as well as day 4, 8, 12, 16, and 20 of lactation for dry matter determination. The fecal samples were weighed and placed into a drying oven. After five days, the fecals were weighed again and placed back into the drying oven. This procedure was repeated on day seven and eight. On day eight, the fecal samples were completely dry. Calculations were then done to determine the percent dry matter. After collecting all of the data, the dry matter decreased in both the control sows and the treated sows over time. The control sows' fecal dry matter decreased by 6.3198%, and the treated sows' fecal dry matter decreased by 8.3591%. The treatment did decrease the dry matter percent in the sows. Sow daily feed intake was not different between treatments (6.3 kg/d for control sows, 5.7 kg/d for treated sows).

Hatchability of Sanitized Eggs Using Peragonn and Cecure

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In this study, the hatchability of eggs sanitized with Peragonn or Cecure was tested. The objective of the research was to determine if fertilized eggs could remain viable when sanitized. Approximately ninty eggs, collected on the day they were laid, were placed in each treatment group. The eggs were weighed and sanitized before being placed in the incubator. The sanitizers used were 750 ppm Peragonn, 1500 ppm Peragonn, 1000 ppm Cecure, 5000 ppm Cecure. There were six treatment groups, a control, one for each sanitizer, and one group that was washed. The control group was placed in the incubator without any washing. The sanitizers were applied as an electrostatic spray for two seconds. The eggs were then placed in an incubator at 99.5° F and 53% humidity. They were candled at eight days of incubation to determine the viability of the embryos. At seventeen days of incubation, the eggs will be transferred and moisture loss will be determined based on the weight loss from when they were laid. At twenty-one days of incubation chick quality will be assessed by external observation. The chicks will be counted and the cull and abnormal chicks will be assessed. The candled eggs showed a 98.9% fertility rate for the control group, 94.4% for the 750 ppm Peragonn, 96.5% for the 1500 ppm Peragonn, 96.6% for the 1000 ppm Cecure, 96.7% for the 5000 ppm Cecure, and 98.8% for the washed eggs. There is not a large deviation in fertility rates at this stage of development. There was also not a large difference between treatments in early dead percentages. The control group had 4.4%, the 750ppm Peragonn had 5.6%, the 1500 ppm Peragonn had 2.4%, the 1000 ppm Cecure had 1.1%, the 5000 ppm Cecure had 2.2%, and the washing group had 2.4% early dead percentages. This research will help determine if sanitizing hatching eggs would be a useful practice in the broiler industry.

Tracking Giardia spp. And Cryptosporidium spp. In canines and felines at Spalding County Animal Shelter

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Giardia and cryptosporidium are protozoan parasites that can cause gastrointestinal illness in humans and animals. Transmission can be food and waterborne in addition to direct transmission. Animal shelters can house large number of animals for various periods of time as they wait for adoption. The objective of this study was to determine the prevalence of parasites in animals housed in a local shelter and to track the transmission of Giardia and Cryptosporidium in these animals. Fecal samples from dogs and cats from a local animal shelter were collected the first week of August, September, October, and November of 2015. These were initially examined for the presence of parasites by direct wet smear and ethyl acetate sedimentation method. Immunofluorescence Assays (IFA) was used subsequently to further confirm the presence of Cryptosporidium and Giardia in the fecal samples. A survey was filled out by the personnel of the animal shelter to better understand the handling of the shelter animals, the sanitary practices, and to identify any potential for Cryptosporidium and Giardia transmission among the animals. A map of the kennels was recorded during the November collection for such purposes as well. Examination of the fecal samples over the four-month period demonstrated an increase in the prevalence of Cryptosporidium and Giardia in the animals. Analysis of the data, positive animal clustering in November, and the results of the survey demonstrated that the most likely cause to the increase and transmission of Cryptosporidium and Giardia among the shelter animals was due to the insanitary practices of the shelter personnel.

Identifying the cell-surface receptor proteins on avian spermatozoa that are involved in Sperm-Zona Pellucida Binding.

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A significant advancement in the understanding of the molecular mechanisms of sperm-egg interaction in mammalian species was achieved only over the last few decades. One key mechanism is the initial interaction between sperm and the ovulated egg's glycoprotein barrier, the zona pellucida. The sperm carry a number of cell-surface proteins that are in with their interaction with the egg; an example of one of these proteins is the SED1 protein. SED1 is known to have a significant role in initiating the binding of sperm to the zona pellucida in several mammalian species. Due to the paucity of information concerning the molecular mechanisms of fertilization in avian species, we investigated the presences of SED1 and its potential role in fertilization using the economically important Gallus gallus domesticus as the avian model. Western blot analysis was performed on rooster sperm lysate to test for the presence of SED1 using a polyclonal SED1 antibody. Western blotting revealed a band at the predicted molecular weight of avian SED1 at 57 kDa. To determine potential binding partners of SED1, a Far-Western blot analysis was preformed with an overlay of sperm lysate, containing native SED1, with a blot of freshly ovulated avian zona pellucida proteins. Far-Western analysis with the SED1 antibody revealed that SED1 interacts with both a 97 kDa band and a 37 kDa band, which correspond to two known sperm receptors in the chicken, ZPB1 and ZPC. Finally, in vivo and in vitro sperm penetration assays were completed to determine if the antibody to SED1 blocks sperm binding to the zona pellucida. The collated results indicate that SED1 may also play a key role in the initiation of sperm binding to the ovulated ovum during fertilization in the domestic chicken. A better understanding of fertilization in chickens by identifying key proteins, like SED1, can provide selection criteria for improving fertility in broiler breeders, an identified problem in poultry production.

Reactive Microglia as a Biomarker in a Piglet Model of Traumatic Brain Injury

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Traumatic brain injury (TBI) is a major cause of hospitalization and death in the United States, and patients with TBI often struggle with physical and cognitive impairments for months to years. The development of treatments for TBI have been performed on predominantly in rodent models, but because the brain composition of mice is very different compared to humans, treatments often fail to translate to human medicine. Pig brains are more similar to human brains, making them an appealing alternative for treatment development. However, a reproducible piglet TBI model with measurable deficits at the cellular level must be optimized before beginning the testing of treatments. The objective of this study is to longitudinally assess changes in microglia in a piglet model of TBI. Piglets underwent surgery to receive a controlled cortical impact (CCI). Piglets were sacrificed one day, one week, and four weeks post-TBI and brain samples were collected for analysis. Microglia, which secrete inflammatory cytokines in response to injury, were quantified by immunohistochemistry utilizing Iba1 antibody. The microglial activation occurred as early as one day post-TBI and exhibited a threshold value of 639.5 ± 111.69 which can be compared to the threshold value of normal piglet models which was 458.3 ± 87.99. We saw microglia peak at one week post-TBI with a threshold value of 1206.95 ± 266.15, although statistical significance was not reached. After four weeks, there was slightly less activated microglia presence as they begin to return to a resting state but the threshold value was still relatively elevated at 951.2 ± 40.465. Statistical significance between the normal pigs and the pigs sacrificed after four weeks. These research findings will be used to determine a normal pattern of TBI pathophysiology to serve as a platform for the development of effective treatments for TBI.

Comparison of the cleanability of metallic strain relief cable gland model Skintop ® MS-M ATex with model Skintop® Inox Stainless Steel manufactured by the Lapp Group

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Sanitary design is required to maintain a sanitary food processing environment and to reduce the risk of bacterial contamination from environmental sources. Food contact and non-food contact surfaces are designed with smooth materials and rounded corners to aid in the complete cleaning and sanitation of the equipment. The Lapp Group has created a new type of gland (a device for preventing leakage of fluid past a joint in machinery) with smooth edges that lacks the exposed threads and corners found on older models. The objective of this study was to determine if the new generation of gland is more easily cleaned than their predecessors. Liquid egg, peptone broth, and a meat slurry were applied in different trials to the surface of new and old glands. The preparations dried for 40 min before they were washed under running water. Wash water was collected to determine the volume used. Some trials involved inoculating the broth and food slurries with Salmonella. These trials included a swabbing step to determine the concentration of Salmonella attached to the glands before and after washing. The results were inconclusive. Recovery of Salmonella from both types of glands and the amount of washing done to produce visibly clean glands was similar for both types of glands. The new design has fewer irregular surfaces to trap food debris, so further comparative analysis of the glands is warranted.

Spike roosters; a study in boiler breeder fertility

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Spiking, i.e. adding roosters to a flock, is a common practice in the broiler breeder industry to mitigate the decrease in fertility of an aging flock. This experiment was conducted to study the influence of roosters of different ages and mating experience on the fertility of a 55 week old flock of broiler breeder chickens. The birds were housed in six rooms, each with two rows of three pens along on each side of a central aisle. The pens contained 38 to 42 hens and 3 roosters. The three spiking treatments were; replace the largest rooster in a pen with a sexually inexperienced male of the same age, replace the smallest rooster with a young rooster 27 weeks old, and exchange the largest sexually experienced males between two random pens. For behavioral observations, three students independently recorded behaviors in two rooms by watching three adjacent pens on one side of a room and then the other for ten minutes. This procedure was then repeated in the second room so that all six rooms were observed in one session. Six observation sessions were made from 51 to 52 weeks of age before the spiking treatments were applied. Six more observation sessions were made at 55 to 56 weeks, beginning two days after the treatments were introduced. The final set of four observation sessions was recorded four weeks post-spike when the flock was 59 weeks old. Behaviors recorded were attempted mating, completed mating, interrupted mating, and aggression between roosters. Up to 90 eggs were collected from each pen both pre and post-treatment. After candling, fertile eggs were incubated to acquire hatchability data. Pre-treatment percent fertility and hatchability were high, greater than 96% and 92% respectively, with no statistically significant difference between pens. Post-treatment hatchability data recorded at 55 and 56 weeks of age was significantly lower in pens spiked with older experienced males compared to pens spiked with young roosters (89.7% vs. 93.0%; $P<0.05$). Pens treated with mature roosters were intermediate. Pens spiked with young roosters showed a small numeric increase in fertility, from 96.2% to 96.8%. The other two treatments had small numeric decreases in fertility. The behavioral data recorded during observation sessions as well as fertility of the final egg collection is currently being analyzed. It is expected that these data will shed light on how social dynamics of pens spiked with young roosters may have contributed to improved hatchability.

Assessment of Natural Shade and its Impact in Cattle Grazing Behavior

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Natural Shade is an important factor in any pasture based grazing system. It allows cattle the ability to escape heat stress and its detrimental effects. These effects include increased weight loss as well as increased food and water intake, and can be observed during the hot summer months. The focus of this project is assessing the influence of natural shade and its distribution in a pasture on cattle grazing patterns. Cattle movement was observed through the use of GPS collars in two separate locations, John Phil Campbell Research Farm in Watkinsville and the Animal and Dairy Science Research Pastures in Eatonton, Ga. GPS collars were placed at random on three cattle in each field and rotated every month. The data is then taken and analyzed using GIS technology to show movements patterns and locations. For shade simulation, tree heights for each of the pastures were provided through the use of LIDAR (Light-Radar) maps. LIDAR maps are taken using lasers in order to record the elevation in a field. In order to ground truth the data provided, two separate measurements were taken for the height of each tree using a clinometer. GPS points were also taken around the perimeter of each tree or patch of trees in order to provide an outline, or dripline, which was then used for ground-proofing the data provided by the LIDAR maps. Results from the assessment showed that trees possessing a spherical shape provided more shade area than trees which were cylindrical in shape. Taller trees also provided more shade volume than trees which were shorter. Patches of trees together resulted in larger shaded areas than single large trees. When water, hay, and shaded areas were located within close proximity of one another, the cattle density tended to be high. In contrast to this, areas which provided little to no shade did not have a high cattle density, particularly in the hotter summer months. The data provided could also be used in order to decide on where to plant new shade trees or place artificial shade in order to reduce the chance of heat stress in a cattle population during the hotter summer months, while taking into account other factors such as nutrient distribution and soil health. An example of this would be planting a patch of shade trees, or placing an artificial shade, on an uphill area to allow for better nutrient distribution in an area where cattle spend a large portion of their time.

Forensically Important Beetles in Georgia in the Spring

Garrison West, Entomology Major, Department of Entomology; Presented in 2016

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Forensic entomology plays a crucial role in solving urban and criminal cases. Insects can unlock the hidden truths of a story that investigators may not uncover otherwise. There has been little research in the field of forensic entomology in the Southeastern United States. The objective of this experiment was to examine and document beetles that colonize carrion from February to May. The method for the experiment starts by obtaining an approximately 80 pound euthanized pig. The pig was then placed under a cage to protect it from scavengers. Pitfall traps were then stationed around the pig, and the beetles from the traps were collected and examined. On site beetle collecting was included in the data as well. The results showed that beetles were among the first colonizers of the pig. Appearing at the two-week mark in mid-February, the family Silphidae (carrion beetles) was the first found on and around the pig. During the third week only Silphids and flies were collected. On the fourth week Staphylinidae (rove beetles) beetles were found in the pitfall traps. Amidst the sixth week of the experiment Histeridae (clown beetles) were present in the traps. Other incidental beetles were present to prey on other larvae of flies and beetles. These incidentals are of no forensic importance. Forensic data that has not been documented in the state of Georgia was recorded. In conclusion, the research demonstrated there are beetles in Georgia that appear at decomposition sites in a successional rate between February and May. The beetles found in the spring do differ from ones documented to be present in the fall, and vary in their abundance. The research is continuing and further collections will be preformed.

The effects of colored mulches on tomato and corn growth

Emily Wheeler, Agricultural Education Major, Department of Agricultural Leadership, Education, & Communication; Presented in 2016

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Plastic film mulch is used among farmers to promote plant growth and increase yield and quality. Mulch color has been shown to influence plant growth through “absorption, reflectance, and transmittance” of sunlight, increasing the plant’s photosynthetic ability (Ibarra-Jimenez et al 2008). Black mulch is the most common and inexpensive of plastic mulches. During the fall season, black mulch results in reduced plant growth and yield due to the high root-zone temperatures. In south Georgia, black mulch provides benefits to crops during the spring season. Finding ways to successfully use plastic mulch for several seasons, including the use of black much during the fall season, would increase the sustainability of the farm by reducing the amount of plastic waste and reducing production costs. The objective for study is testing use of white mulch and wheat straw applications on black mulch to evaluate whether black mulch could be used successfully in tomato and sweet corn crops during the fall season. The experiment was conducted at Horticulture Farm, UGA Tifton Campus. Tomato and sweet corn will be planted on August 24, 2015. The design was a randomized complete block with four treatments: a) black mulch; b) black mulch painted with white paint; c) black mulch covered with wheat-straw; and d) white plastic mulch. Both the black mulch and the white plastic mulch served as the control variables for the experiment. Tomato and sweet corn were managed as two independent trials. Both crops were measured for plant growth, yield, and root-zone temperature.

The Effects of the Essential Oil from Chios Mastiha on Lactating Sows

Mary Wright, Animal Science Major, Department of Animal and Dairy Science; Presented in 2016

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The objective of this project is to determine the effect of the essential oil from the Chios Mastiha tree on litter performance throughout lactation. It was indicated in preliminary studies that the essential oil from Chios Mastiha would improve litter performance and increase litter weaning weight. Throughout the study, 15 sows were housed in standard farrowing crates in the LARU. The sows were randomly assigned to one of two treatments. Control sows were fed as normal and treated sows had their ration topped with 10 mL of the essential oil from Chios Mastiha during the morning feeding, starting on day 110 of gestation until weaning. Piglet weights were taken at birth (within 24 hours), day 7, and 14. Cross fostering did occur in cases where the sows were unable to care for all of her pigs. Milk samples were collected on day 2, 6, and 14 to determine nutrient content (Crude protein and fat). Milk dry matters were also assessed to determine the amount of milk components during that time of lactation. Milk dry matter data showed that dry matter was increased in the sows fed the essential oil. The percent crude protein (percent nitrogen) was also increased in the sows fed the dietary essential oil. In conclusion, the essential oil from Chios Mastiha increased the quantity of milk nutrients and could be a useful additive to feed rations to improve the nutrient composition in milk in lactating sows, which hopefully would increase litter performance and litter weights.

Alternative Prechill Treatments of Poultry Carcasses to Reduce Bacterial Contamination

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Bacterial counts are frequently higher in ground poultry compared to whole parts. Some theorize this may be due to release of entrapped bacteria within feather pores in the tissue during grinding. Therefore, entrapped bacteria may not be exposed to antimicrobial treatments used on whole carcasses. If pores were opened during pre-chilling at certain pHs, deeper tissue penetration of antimicrobials may yield greater inactivation of entrapped bacteria. Peracetic acid (PAA) with NaOH is used in some poultry processing plants as an antimicrobial treatment during pre-chill. This combination may also increase water-holding capacity (WHC) of chicken carcasses. The study's objective was to determine if using PAA with NaOH (pH 9.0) in the pre-chill step of processing would lower the odds of bacterial cross-contamination. The effect of treatments on WHC was also studied. Treatments contained either PAA (30 ppm; pH 4.3) or PAA (final conc. 30 ppm) with NaOH (pH 9.0). Chicken carcasses obtained post-evisceration were pre-chilled in either PAA (pH 4.3), PAA+NaOH (pH 9.0), or water followed by immersion chilling with ice water. Thirty-six carcasses were sampled to enumerate mesophilic aerobic bacteria (APC), coliforms, and E. coli, and isolate Salmonella spp. at the following processing stages (4 carcasses sampled/stage/rep): before treatment, post pre-chill treatment, post chill, and post cut-up. Carcass temperatures, weights , and breast pHs were also recorded at each processing stage. Carcass weights were used to calculate percent WHC. There were no statistical differences ($p>0.05$) in APC values during processing or between different treatments. However, there were significant reductions ($p<0.05$) in both coliform and E. coli counts between the beginning and final processing points (post chill and cut-up) for the PAA+NaOH treatment. While there were no statistical differences ($p>0.05$) in the WHC between the treatments, the WHC of both treatments were in the acceptable range. No insightful Salmonella reduction trends were observed. Peracetic acid in combination with NaOH may be an effective antimicrobial in poultry chiller applications. While the APC counts did not vary between treatments, significant reduction in numbers of coliforms and E. coli on alkaline treated samples provides possible evidence that entrapped bacteria may be inactivated to a greater degree due to greater penetration of the antimicrobial. The alternative treatment does not adversely affect WHC.

Arbuscular mycorrhizae may decrease plant growth in organically produced basil, lettuce, and nasturtium crops.

Maya Baumeister, Horticulture Major, Department of Horticulture; Presented in 2015

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Mycorrhizae are fungi that symbiotically associate with many plant roots. Arbuscular mycorrhizal fungi have been shown to aid certain plant species in nutrient uptake by extending the plant root zone, allowing exploitation of nutrients beyond the typical depletion zone. PRO-MIX® PUR™ Mycorrhizae Powder is a product that claims to aid plant growth by utilizing this relationship. The purpose of this study is to determine if mycorrhizal associations occur and aid plant growth in the following vegetables using the PRO-MIX® PUR™. Basil (Ocimum basilicum), lettuce (Lactuca sativa), and nasturtiums (Tropaeolum majus) were grown in the presence of the mycorrhizae inoculant mixed into the soil media in 6 inch pots at a ratio of 8 gallons of soil to 16 teaspoons of inoculant, and compared to control plants grown without this product. The experimental design was a replicated with randomized treatments in a greenhouse setting. Plants were watered and observed twice a week. Plant height was measured in millimeters with a standard ruler at three stages of growth. Plant specimens were dried and shoot dry weight was measured at the Campbell Research Station. Mycorrhizal colonization was assessed via Trypan Blue root staining procedure followed by compound microscopy. Colonization was measured to assess the efficacy of this product in the Wurzburger Lab. Trends from a preliminary experiment indicated that plants grown with PRO-MIX® PUR™ had decreased shoot biomass and shorter plant height than those grown without the product. Plant tissue analysis indicated that all treatments were macronutrient deficient. A second trial was performed to assess the effect of fertilization on mycorrhizal association and plant growth. A biweekly fertilization schedule was performed at a rate of 2 tablespoons of 2-4-1 fish emulsion fertilizer to one gallon of water. The main factor remained an assessment of plant growth and mycorrhizal colonization with and without PRO-MIX® PUR™, but this experiment also included a sub-factor of with or without fertilization. The second trial is still in progress and anticipated to end on April 10th. Conclusions will be presented on April 15th.

Outcome Analysis in Ekbom Syndome Clients

Gillian Caudill, Entomology, Psychology Major, Department of Animal and Dairy Science; Presented in 2015

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The objective of this project was to follow up with individuals suffering from Ekbom Syndrome (delusory parasitosis) to determine the long-term outcome of their condition. The test population consisted of clients who had submitted samples of potential arthropods to Georgia Cooperative Extension within the past five years. We previously determined that they were not infested with any problematic or parasitic arthropods upon receiving original samples. Of fifty people contacted, 19 were eligible for analysis. Criteria for inclusion were to be a previous client and to be available for a phone interview. During the interview, clients were asked several follow-up questions concerning management of their problems that included if they used pesticides, pest control companies, or other methods to “get rid of the bugs”. Other questions that we were also interested in were how much clients were spending, on average, on these methods; whether they did any investigation on which pesticides to use, and what keywords were they using to search. The results differed from what we were expecting at the beginning of the experiment. Of those sampled, 12 (63%) reported that their symptoms improved and 6 (31%) reported full recovery from symptoms. Only two (10%) reported specific amounts of pesticides they used themselves. However 11 (57%) of the clients reported consulting pest control companies as their primary method of addressing their problems. Of the 19 clients, 16 (84%) reported using methods other than pesticides to ease symptoms, and four reported that they spent an average of $433.75 per week and $441.89 per month on all methods used. Thirteen (68%) sought information about their problems; however they focused primarily on the symptoms themselves and possible causes of symptoms, rather than specific pesticides. We can conclude that clients presented with infestations do not necessarily resort to pesticides, but rather they use other methods, such as cleaning or using other substances, relying on pest control companies to eliminate pests, and do their own research on the problem.

Can wheat gluten be substituted for corn and soybean meal in nursery pig and poultry diets?

Carson De Mille, Animal Science, Animal Biology Major, Department of Animal and Dairy Science; Presented in 2015

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Protein sources are more costly than energy sources, so evaluating alternative cost-effective protein sources can reduce the overall cost of the diet. Wheat gluten (WG) is a high-protein ingredient that is commonly used in pet food and milk replacers, but not commonly used in swine or poultry diets. Two studies were conducted to determine the effect of WG on growth performance in weaned pigs and broiler chicks. The first study utilized 48 pigs that were weaned at approximately 21 days and blocked according to weight and gender (16 pens, 3 pigs/pen). There were 4 dietary treatments: a positive control diet (a typical commercial diet, P1), 0% WG (P2), 5% WG (P3), and 10% WG (P4). WG was added at the expense of corn and soybean meal. Dietary treatments were randomly assigned to pens. Test diets were fed for 14 days post weaning, followed by common diet for an additional 13 days. Bodyweight gain and feed disappearance were measured weekly. The second study used 120 day-old broiler chicks that were randomly allotted to pens (20 pens, 6 birds/pen). Birds were assigned to one of 4 dietary treatments: a positive control diet (typical commercial diet, B1), 0% WG (B2), 5% WG (B3), 10% WG (B4). WG was added at the expense of corn and soybean meal. The birds were weighed and feed disappearance was measured twice weekly for 2 weeks. Overall, the pigs fed test diets with 5% WG grew significantly faster than the pigs on other dietary treatments (11.44 P1, 10.88 P2, 11.80 P3, 10.39 P4, kg, $P<0.05$). There were treatment effects on average daily gain (ADG) during days 0-14 of the pig study (370 P1, 331 P2, 398 P3, 380 P4, g/day, $P<0.05$). There was an overall effect on ADG (506 P1, 492 P2, 553 P3, 460 P4, g/day, $P<0.05$). There were treatment effects on feed efficiency during days 0-14 of the pig study (0.91 P1, 0.89 P2, 1.02 P3, 0.94 P4, $P<0.05$). There was an overall effect on feed efficiency (0.79 P1, 0.80 P2, 0.87 P3, 0.80 P4, $P<0.05$). Broilers fed diets with 5% WG grew significantly faster than broilers on other dietary treatments (418.0 B2, 422.5 B2, 508.7 B3, 431.5 B4, g, $P<0.05$). There were treatment effects on ADG in the broiler study (26.1 B1, 26.3 B2, 32.6 B3, 27.1 B4, g/day, $P<0.05$). These results suggest that the addition of 5% WG to nursery pig or poultry diets results in a stimulation of growth.

Determination of phytate Forms in Tree Nuts by HPLC-ESI-MS/MS

Ashley Dolphus, Food Science Major, Department of Food Science and Technology; Presented in 2015

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Phytic acid, or myo-inositol hexakisphosphate (IP6), is a strong chelator/complexing agent of important divalent mineral ions such as calcium, magnesium, iron, and zinc; therefore, it is often referred to as an anti-nutrient. On the other hand, phytic acid and its isomers have a number of health benefits due to their marked antioxidant activities, protective effects against kidney stones, and possible reduction in the risk of colon cancer. Typical levels of phytic acid found in almonds are quite variable from 0.4 to 9.4%. This stems largely from the fact that phytic acid quantities are assessed by a total phosphorus content determination, rather than by the contribution of each of its six isomers via chromatography. The objective of this study was to employ high-performance anion-exchange liquid chromatography/mass spectrometry with electrospray ionization for the separation of myo-inositol and myo-inositol phosphates (i.e., the different phytate forms) in almonds. Using a BioBasic AX anion-exchange column (2.1 mm ID x 150 mm, 5-µm particle size) and a gradient mobile phase connected to an Agilent 1100 HPLC, the six isomers of phytates were separated from extracts of blanched almond meal and almond skin. These were detected by a Waters® Q-Tof (time-of-flight) micro™ Mass Spectrometer equipped with an ESI interface operating in the negative-ion mode using a capillary voltage of -3.5 kV and a desolvation temperature of 300 oC. Detection was carried out across a mass range of 178 to 800 m/z. Comparison of parent molecular ions, $[M – H]^{-}$ in almond samples were made against those of a hydrolyzed phytic acid commercial standard, in which all six isomers were separated. As expected, almond skins possessed greater concentrations of myo-inositol phosphates (IPs) than the blanched almond meal did. In almond skin, IP6 was determined to be the most abundant isomer, followed by myo-inositol pentakisphosphate (IP5) and then myo-inositol tetrakisphosphate (IP4). IP6 was also the dominant isomer in almond meal; albeit, it at a much lower level, while IP5, myo-inositol triphosphate (IP3), and myo-inositol biphosphate (IP2) were also present at detectable concentrations. Sharp but close elution of peaks suggests that further fine tuning of the method would be beneficial, but also highlights the potential of accurately quantifying all IPs by the inclusion of an internal standard.

Characterization of Leigh's Syndrome Patient Human Induced Pluripotent Stem Cells for Clinical Research

Christina Ethridge, Applied Biotechnology Major, Department of Entomology; Presented in 2015

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Leigh’s Syndrome is an inherited disorder of mitochondrial energy metabolism that affects the central nervous system. Symptoms include muscular and neurological degradation leading to death within the first few years of life. No curative treat-ments are currently available. The reprogramming of mitochondrial diseased fibro-blasts into induced pluripotent stem cells will allow for their differentiation into multiple cell types and tissues. If reprogramming is possible, this will function as an invaluable tool for studying disease pathophysiology in vitro with the intention of designing future gene therapies and pharmacological treatments for affected pa-tients. Our goal in this study was to generate and characterize induced pluripotent stem cells (iPSCs) derived from skin fibroblasts of Leigh’s Syndrome patients. To do this, we first generated LS-iPSCs using a non-viral, non-integrating mRNA and mi-croRNA system. We then characterized the iPSCs using immunofluorescence staining for pluripotency markers (Oct4, Sox2, Nanog, Tra-181, Tra-160, and SSEA4). The iPSCs were then differentiated and stained for endoderm (VIM, AFP), ectoderm (MAP2, TUBB3), and mesoderm (ACTA2, Desmin) germ layer markers. The generated LS-iPSCs expressed markers of pluripotency as seen by immunofluorescence staining. Staining the differentiated iPSCs showed expression of tissue markers from all three germ layers. Characterization of the iPSCs derived from Leigh’s Syndrome patient fibroblasts demonstrated that the LS-iPSCs possess qualities of true stem cells.

Differences in immunological responsiveness between white and brown laying hens

Sean Evans, Biological Science Major, Department of Poultry Science; Presented in 2015

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Understanding how laying hens respond to stress and disease has extremely important welfare implications for the poultry industry. It has been shown that most animals studied tend to fall into one of two “personality” categories: Reactive individuals are fearful, slow to explore, and respond highly to stress while proactive individuals are bolder, quick to explore, and show low physiological stress responses. Brown and white laying hens exhibit exactly this pattern; white hens are reactive while brown hens are proactive. We hypothesized that the suites of physiological and behavioral traits exhibited by these two groups would also extend to the immune system. We exposed White Leghorn and Hy-line Brown hens to two antigen treatments to induce immune response: To test T-lymphocyte responses, 1 mL of PHA (phytohemagglutinin, a known T-cell stimulant) was injected into the toe webbing between the 3rd and 4th digits of the right foot of each hen. The degree of swelling was measured before injection and 18 hours later using pressure-sensitive digital calipers. Strain differences in swelling responses were analyzed using an analysis of variance (ANOVA). One week later, each hen was randomly selected to receive either an injection of LPS (lipopolysaccharide, a known fever-inducer), or saline as a control. Baseline temperatures were recorded rectally prior to the injections and then 12, 24, and 48h after injection using an ovulatory thermometer. Febrile patterns were analyzed between strains using a repeated measures ANOVA. As predicted, white and brown hens responded differently to the two immune challenges; White hens experienced a significantly greater degree of swelling in the toe web than the brown hens ($p < 0.0001$) in response to PHA. In the LPS challenge, the white hens exhibited a fever 12h prior to injection while brown hens never had a febrile response ($p < 0.03$). Thus, in both challenges, the white hens experienced a greater degree of immune response than the brown hens. This work indicates that, not only do reactive and proactive animals respond differently to stress, but that they also may be differentially susceptible to disease, which indicates that optimal rearing and housing conditions may differ for hens that are reactive versus proactive “personality” types.

Attitude and Self--□Competence as Predictors of Camp Outcomes for Children with Tourette Syndrome

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Camps for children with Tourette Syndrome (TS) are a unique experience for campers to socialize with other children living with the same disorder. However, individual differences may contribute to children having different camp experiences. The aim of this study was to determine which child characteristics predicted positive camp experiences for children with TS. Pre--□camp attitudes towards having TS and self--□ competence were evaluated as predictors of post--□camp outcomes for children who attended Camp Twitch and Shout. Thirty--□one children (M age = 12.32 years) with TS participated. Prior to attending camp, children reported on their attitudes towards having TS and perceived social and general self--□ competence. After camp, children completed the Pediatric Camp Outcome Measure. A hierarchical regression analysis was conducted to identify predictors of post--□camp outcomes, with attitude towards having TS entered in Step 1 and social and general self--□competence entered in Step 2. The overall model accounted for 47.8% of the variance in children's camp experience. Attitude towards having TS was found to be a significant predictor of camp outcome, and the addition of social and general self--□ competence in Step 2 accounted for additional significant variance in predicting camp experiences. However, social self--□competence was the only significant predictor at Step 2. These results indicate that children's attitudes towards TS and their perceived social--□self competence are predictive of overall camp experience. Conversely, our conclusion indicates that children with lower social self--□competence may benefit from extra attention at camp. Finally, additional factors associated with positive camp outcomes should be examined in future research.

Comparative genomics of mating-type in Stagonosporopsis species causing gummy stem blight of cucurbits

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Gummy stem blight of cucurbits, an important disease in Georgia, is caused by three closely-related fungal species: Stagonosporopsis cucurbitacearum, S. citrulli, and S. caricae. These species are morphologically identical but genetically distinct and may have important biological differences. One difference may be in their mating system, such as whether they are self-compatible or self-incompatible. A critical aspect to understanding mating systems is an investigation of the mating-type locus, MAT1. The MAT1 locus is conserved among species within the phylum Ascomycota, and commonly flanked by the genes APN2 and PPO, with differences in gene content for self-compatible and self-incompatible species. Within the locus, there are two potential genes responsible for mating type, MAT1-1-1 and MAT1-2-1. The presence of both genes in a single isolate would suggest self-compatibility; the presence of only one of the genes would indicate self-incompatibility. The objectives to this study were to: (i) identify the MAT1 locus in all three species, (ii) identify the mating-type genes at each locus, and (iii) compare the inferred mating systems of the three species. Currently, there are draft genomes for three isolates from each of the three species causing gummy stem blight. In this project, the MAT1 locus of the closely related self-compatible fungus, S. chrysanthemi, was used as a reference to identify the MAT1 locus. This MAT1 locus was identified in each of the three species using the blastn algorithm. The blastn results identified the genes MAT1-1-1, MAT1-2-1, APN2, and PPO in all three species. The genes were in the same order and dircetion in all three species. The MAT1 genes were compared to each other using the blastn algorithm and had approximately 97% identities. These results suggest that S. cucurbitacearum, S. citrulli, and S. caricae are all self-compatible, meaning that isolates from any of the species are able to mate with themselves in the wild. In addition to having the same mating systems, the three species are genetically similar at the MAT1 locus.

Utilizing stride velocity, swing, stance, and break-over time to assess motor function and efficacy of iNSCs in a porcine ischemic stroke model

Kayla Hargrove, Animal Science Major, Department of Animal and Dairy Science; Presented in 2015

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A cerebrovascular accident, also known as a stroke, is one of the current leading causes of death and long term disability in the United States. Stroke survivors are forced to undergo long-term rehabilitation in an attempt to regain lost motility and motor function, but are often unsuccessful. Although effective treatment options are limited, induced pluripotent stem cell-derived neural stem cells (iNSCs) have shown promise as a potential regenerative therapy. While previously conducted studies have utilized rodent models, the white/gray matter composition, size, and gyrencephalicism of the porcine brain offer a more translational model to humans. Yucatan pigs were utilized in this study to establish a baseline for normal gait characteristics, assess the deficits in motor function following middle cerebral artery (MCA) occlusion, and test the efficacy of iNSCs by assessing changes in motor function after administration. Pigs were trained to navigate a semicircular track and then recorded at 3 time points prior to stroke, 1, 3, and 5 days post infarction, as well as 1 day, 3 days, 1 week, 2 weeks, 4 weeks, 6 weeks, 9 weeks, and 12 weeks after iNSC or vehicle only (PBS) injection. MRI diffusion weighted imaging (DWI) and apparent diffusion coefficient (ADC) maps confirmed ischemia in each occluded pig. Evaluation of the velocity, hind limb swing, stance, and break-over time revealed marked differences in symmetry after occlusion. Shorter swing time and longer stance time were noted in the paretic limb contralateral to stroked side.

In-vitro assessment of heavy metal toxicity on Histomonas meleagridis

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Histomonas meleagridis is an anaerobic protozoa and the causative agent of Blackhead disease. The only preventative used commercially for Blackhead disease is Histostat which contains Nitarsone, a chemical containing arsenic and is poisonous to humans. Therefore, it is paramount to find another preventative method for Blackhead disease. The objective was to determine if other compounds, specifically heavy metals, could be used to reduce H. meleagridis cell counts in-vitro. For this experiment, 84 flasks containing 10 mL of Dwyer's media were inoculated with 100,000 H. meleagridis cells per flask. Each flask represented a replication. Three replications were used per treatment and after 24 hours of incubation (42°C), treatments were added to each flask. Four metals were chosen for the in-vitro screen: $CdSO_4$ (20, 10, 5, 2.5, 1.25, and 0.625 ppm), $NiSO_4$ (500, 250, 125, 62.5, 31.5, and 15.2 ppm), $ZnSO_4$ (4000, 2000, 1000, 500, 250, and 125 ppm), and $CuSO_4$ (676, 338, 169, 84.5, 42.25, and 21.1 ppm). Flasks without treatment served as the control. Once the metal solutions were made, 4-Nitrophenylboronic acid (200 ppm) was added to each metal concentration to make the complete treatments. After 8 and 48 h of incubation (42°C) each flask was counted using a Neubauer hemocytometer. For the Cd treatment at 8 h, all metal concentrations had cell counts lower than the control and at 48 h the 1.25, 5 and 20 ppm had lower counts than the control. For the Ni treatment, all concentrations had lower counts compared to the control at 8 h and at 48 h counts were lower than the control for every concentration except for 31.25 ppm. For the Zn treatment, all concentrations had higher cell counts compared to the control at 8 h, but all metal concentrations had lower cell counts compared to the control at 48 h. For the Cu treatment, all the concentrations had higher cell counts than the control at 8 h and at 48 h the 84.5, 338, and 676 ppm concentration cell counts were lower than the control. Cu treatment at 338 ppm at 8 and 48 h and Zn treatment at 2,000 and 4,000 ppm at 48 h had the best reduction in cell counts compared to the other treatments ($P<0.05$). From this experiment, it was determined that the heavy metal treatments could be used to decrease cell counts of H. meleagridis in-vitro at varying concentrations. Further research will include testing other metal combinations and performing experiments in-vivo using turkeys.

Effectiveness in curing existing intramammary infections and preventing new cases in bred Holstein heifers

Courtney Haviland, Animal & Dairy Science Major, Department of Animal and Dairy Science; Presented in 2015

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Bacterial infections in the cow's udder result in mastitis, the chronic inflammation of developing milk-producing tissues. Protecting these tissues during the greatest development of the mammary gland (1st gestation) from pathogenic bacteria will guarantee maximum milk production. Nonlactating cow antibiotics are effective in curing infected mammary quarters and preventing new cases of mastitis in uninfected quarters. In addition, teat sealant products have proven effective in preventing new infections and in reducing the chances of contracting clinical mastitis at the time of calving. For this study, mammary secretions were collected from bred heifers prior to treatment and processed for bacteriology, differential leukocyte counts, and total white blood cell counts (WBC) to determine initial infection status. Four treatments (untreated control, nonlactating cow antibiotic, teat seal, and nonlactating cow antibiotic + teat seal) were administered to each of 23 heifers 30-60 days prior to expected calving date. Responses to treatment were monitored at 3 and 10 days postpartum. Significant treatment differences for cure rate, new intramammary infection rate, and WBC were determined with PROC GLM (SAS 9.3). Compared to the control, use of antibiotic and antibiotic + teat seal resulted in higher cure rates ($P<0.05$); no differences were observed among treatments for new intramammary infection rate. Compared to the control, use of antibiotics, teat seal, and antibiotic + teat seal resulted in lower WBC on day 3 postpartum ($P<0.05$). Results demonstrated that treatment with antibiotic, teat seal, or antibiotic + teat seal resulted in less mastitis and lower WBC after calving.

Feeding/Hiding Behavior in Cockroaches

Kendra Hogan, Biological Science, Entomology Major, Department of Poultry Science; Presented in 2015

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Insects have evolved anatomically, physiologically, and behaviorally to prolong their survival to an ever-changing world. The Madagascar hissing cockroach, Gromphadorhina portentosa, is one of the largest species of cockroaches. This cockroach, similar to most insects, has distinct adaptations. One of these adaptations is their ability to turn off their backs. This study evaluates this roach's ability to turn over when placed on its dorsal side on a smooth, temperate surface. Thirty Madagascar hissing cockroaches were placed individually on their backs and separated into groups based on their ability to flip from their backs onto their feet. The cockroaches were observed throughout 10 trials over the course of six months. Except for a small percentage of roaches, their ability to flip over or not was consistent. The ability to turn over is imperative to a cockroach's survival, but for the cockroaches that lack this ability, the cause is unknown. Future research may connect genetics, illnesses, and differing species with survival rates among cockroaches that can turn over.

Measuring Willingness to Pay for Sea Level Rise in Coastal Communities of Georgia

Kirstie Hostetter, Environmental Economics & Management Major, Department of Agricultural and Applied Economics; Presented in 2015

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Forces associated with climate change have caused sea levels to rise at an unprecedented rate with much uncertainty about what the exact magnitude of the rising oceans will be. This makes low-lying coastal areas increasingly vulnerable to flooding and infrastructure damages that put both property and people at risk. Currently, FEMA has a program in place called the Community Rating System that offers reductions on flood insurance premiums in proportion to the amount of mitigation and resiliency measures a community enacts to protect themselves against rising sea levels. Our research uses a survey distributed throughout different coastal counties in Georgia to determine whether or not people are more willing to pay for sea level rise adaptation measures if they receive a message of empowerment as opposed to simply facts about how sea level rise affects coastal communities. We will do this by sending people to one of two websites with the same formatting but different uses of rhetoric, and then asking similar questions about their willingness to pay for various levels of adaptation measures. This research question comes from psychology literature that indicates people are more likely to take action against a large threat if they believe that their efforts will actually influence the outcome. We hope that our results will contribute to the effort to enroll more communities in the Community Rating System and encourage a larger demand for sea level rise adaptation measures.

Clinging Strength in Madagascar Hissing Cockroaches

Allison Johnson, Entomology Major, Department of Entomology; Presented in 2015

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The Madagascar Hissing Cockroach (MHC), Gromphadorhina portentosa, reaches up to 4 inches in length and lives for 2 years or more. A critical part of survival is strength, but unpublished research suggests that clinging strength in MHC declines over time. They have specialized padded tarsi to enhance the ability to cling and climb surfaces, making them excellent candidates for strength testing. An observational study was conducted with 10 male and 10 female MHC, defining strength by measuring how many mL of water a cockroach can hold with a harness while scaling a cement surface. While the roach clung to the cement brick, water was slowly added in a graduated cylinder until the roach fell, giving a quantitative measure of strength versus body size. Some of the cockroaches could hold 17 times their body weight, but clinging strength decreased over time. These results can benefit researchers looking to use these insects as “robo--□roaches” or mechanically controlled insects, possibly to be used to investigate places that are difficult for humans to enter.

The Effects of TnAV-2a on the Complex Interactions between the Parasitoid Microplitis demolitor and Various Species of Lepidopteran

Johnathan Mayfield, Entomology, Biology Major, Department of Entomology; Presented in 2015

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Ridding a crop of devastating agricultural pests requires comprehensive approaches to find an effective solution. One alternative solution to harmful insecticides involves parasitoids, which are insects that parasitize another insect ultimately killing them, all the while completing some of their development within the host. Moreover, many parasitoids are more successful in parasitizing because of mutualistic viruses that have evolved from previously pathogenic ones. Thus, studying viruses and their role in the complex interactions between insect parasitoid and host proves beneficial economically and environmentally. The purpose of this study was to explore the complex interactions between the parasitoid wasp Microplitis demolitor, the lepidopteran hosts it parasitizes, and TnAV-2a, an ascovirus. TnAV-2a is a pathogenic ascovirus, but there exists another ascovirus that is mutualistic with a species of parasitoid wasps supporting the idea that TnAV-2a could evolve to become mutualistic with M. demolitor. Five lepidopteran species were used as potential lepidopteran hosts for Microplitis demolitor, the parasitoid wasp, and include Pseudoplusia includens, Heliothis viriscens, Spodoptera frugiperda, Trichoplusia ni, and Helicoverpa zea. These same five species were used as hosts for TnAV-2a. M. demolitor attempted oviposition in all five species, but Spodoptera frugiperda and Trichoplusia ni showed low levels of successful parasitism, 0% and 20% respectively, whereas Pseudoplusia includens, Heliothis viriscens, and Helicoverpa zea showed high levels of successful parasitism, 90%, 95%, and 95% respectively. Furthermore, all species were inoculated with various levels of TnAV-2a, ranging from 1-10,000 genome copies per microliter, and showed characteristics of TnAV-2a infection which include arrested development and growth, white hemolymph, and premature death. Moreover, the levels of TnAV-2a required to cause a significant negative effect on the growth of the caterpillars differed among the species based on multiple factors such as weight and developmental stage at injection and range from 10-1,000 genome copies per microliter. Preliminary trials of TnAV-2a injections on parasitized Pseudoplusia includens show 100% mortality of the wasp larvae within the host as compared with parasitism rates without TnAV-2a infection. Further research is necessary to fully understand the elaborate interactions between TnAV-2a, parasitoid wasps, and lepidopteran hosts.

Development and Characterization of a Novel Landrace Piglet Cortical Impact Traumatic Brain Injury Model

Mary Katherine Mehegan, Animal Science Major, Department of Animal and Dairy Science; Presented in 2015

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In the year 2010, 2.5 million people suffered from a traumatic brain injury (TBI). In the United States alone, approximately 50,000 deaths result from TBIs annually. At this time, there is no adequate TBI treatment available. Recently, the West Laboratory developed induced pluripotent stem cell-derived neural stem cells (iPSC-NSCs). These iPSC-NSCs may potentially serve as a regenerative cell replacement therapy as they are capable of differentiating into neurons, astrocytes and oligodendrocytes while also producing regenerative factors such as VEGF. Although these cells have been shown to lead to significant structural and functional improvement in rodent models, treatments that have been developed in rodent models have regularly failed in clinical trials. Thus, more predictive large animal models are needed. The pig serves as an excellent large animal model with a large gyrencephalic brain that has gray-white matter composition similar to humans, unlike rodent models. We have developed a model with four treatment groups; 2 m/s and 4 m/s at 6 mm impact velocity, as well as 4 m/s at 12 mm and 15 mm depth. This study serves as a model for future iPSC-NSC therapy studies. We hypothesize piglets receiving a cortical impact will develop brain lesions, show changes in inflammatory response, macrophage infiltration, glial scaring and changes in motor function deficits ranging from mild to severe based on impact speed. Development of this model will allow for the testing of efficacy and safety of novel stem cell therapies as well as traditional pharmacological and device approaches.

Mapping Total Leaf Flavonoid Content to the Sunflower Genome

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Two factors limiting plant survival and reproduction are herbivory and disease. To combat these threats, plants produce numerous secondary metabolites. While these compounds have no direct role in photosynthesis, growth, or reproduction, many classes of secondary metabolites have been shown to deter insect herbivores and infection by pathogens. The cultivated sunflower (Helianthus annuus) is an important agricultural and horticultural crop, and is known to produce many secondary metabolites. This study seeks to identify the genetic basis of one key class of secondary metabolites, the flavonoids, using an association mapping panel of 288 lines of cultivated sunflower. Total leaf flavonoid content was assessed on extracted leaf tissue using the aluminum complexation assay and subsequent spectrophotometry. Two key hypotheses tested are (1) that flavonoid content will be negatively correlated with physical defenses like leaf toughness, and (2) that regions linked to flavonoid production will cluster with regions linked to total phenolic content due to shared biosynthetic pathways.

Improvements in the Detection of Coccidian Parasites in Fresh Produce

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The molecular methods for detecting the coccidian parasites Cryptosporidium parvum, Cyclospora cayetanensis, and Toxoplasma gondii need significant development in order to detect and prevent future outbreaks. This two-part study sought to improve fresh produce detection methods of the coccidian parasites, and to determine if C. parvum and C. cayetanensis could be isolated from fresh produce purchased from markets in the United States. To achieve these goals, we tested the sensitivity of three commercially available DNA extraction kits, Fast DNA TM SPIN Kit for Soil, DNeasy Plant Mini Kit, and Wizard® Genomic DNA Purification Kit, to detect Cryptosporidium and Cyclospora oocysts which had been previously purified using discontinuous sucrose gradients and stored in potassium dichromate. The second part of this study tested 25 gram samples of vegetables purchased from various markets. These samples were rinsed with elution buffer, followed by DNA extraction and nested PCR to determine the presence of Cryptosporidium, Cyclospora, and Toxoplasma. The Fast DNA TM SPIN Kit for Soil had the most consistent and reliable results for extracting coccidian parasite DNA. The 56 vegetables tested by PCR yielded positive results for Cryptosporidium (n=2), Eimeria (n=1), and Toxoplasma (n=2)

The Spatial and Temporal Preferences of Gromphadorhina portentosa and Blaberus craniifer for Food and Shelter

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Gromphadorhina portentosa (Madagascar hissing cockroach) and Blaberus craniifer (Death's head cockroach) eat a variety of foods including, bananas, oranges, and onions. The purpose of this research was to use these different types of food to determine their preferences for hiding with or without their food. They were selected, identified as male or female, and weighed. They were randomly placed into ten different groups and were placed in containers that had two different areas to hide. One area was with food and the other was without food. The location of the roaches were recorded daily. The roaches highly preferred to hide away from the food source. The G. portentosa preference data across all food groups had a P value of <. 001. The B. craniifer preference data across all food groups had a P value of <.001. The data show the roaches do not mix their shelter spaces with their feeding spaces. This could be because they do not want to lure their predators to find them. It could also be due to the fact that they do not want to lure other insects to follow them to their food.

Ryanodine Channel Protein in Insects: A Novel Pesticide Target

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Ryanodine receptor (RyR) proteins are large-sized calcium channel proteins located in the sarcoplasmic/endoplasmic reticulum that regulate calcium signaling between muscle and neural cells in animals. Ryanodine is a compound in a neotropical bush that is a natural insecticide which locks the calcium channel causing irreversible muscle contraction and insect death. Diamides are synthetic forms of ryanodine with high specificity for caterpillars. Diamides have a critical role in managing caterpillar pests in cotton, soybean and other crops. However, resistance in the diamondback moth has stimulated interest in RyR proteins of field insects that differ in susceptibility to diamides. My thesis is that by cloning a soybean looper (Chrysodeixis includes) RyR, we can model RyR structure and conduct analyses of RyR-diamide interactions. In our present study, the full length cDNA of Chrysodeixis includens RyR (CiRyR) was cloned from adult looper thorax mRNA. The general approach to this project included using PCR to clone and amplify CiRyR cDNA fragments, sequencing of PCR fragments and E. coli cloned PCR-products, and then computational reassembly of the full-length CiRyR cDNA. Analyses of our reconstructed CiRyR cDNA showed that it contains a 15273-bp ORF encoding 5090 amino acids with a predicted molecular weight of 574.9 kDa. All common conserved structures are present in CiRyR, including six transmembrane domains at C-terminal and a consensus calcium-binding site. Other conserved domains such as MIR (Mannosyltransferase, IP3R and RyR) domains, RIH (RyR and IP3R Homology) domains, SPRY (splA and RyR) domains, and RyR domains (RyR repeated domain) were identified in CiRyR. Significantly, three alternative splice sites were identified in the CiRyR gene. Also, a phylogenetic tree that compared the evolutionary relationships between CiRyR and other RyR sequences showed a close relationship between insects' RyRs and a distinct relationship with vertebrates' RyRs. These results show that CiRyR is highly homologous to other insects' RyRs. They also provide the foundation to analyze and understand the relationship between structure and function of RyR in C. includens. This information can be used to create molecular tools to detect changes in RyR proteins in field insects that correlate with resistance to diamide insecticides.

Dietary levels of Methionine affect Growth, Feed Intake, and Gene Expression in Meat-Type Chickens

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L-Methionine is an essential amino acid required for protein synthesis and normal growth of animals. It is the first limiting amino acid in poultry diets. Utilization of amino acids is affected when deficient or excess levels of a limiting amino acid are supplied. Amino acids transporters maintain coordination of metabolic events. Since methionine is the first limiting amino acid in poultry diet, deficiency or excess has the potential to affect nutrient availability and molecular transport. Our objective was to investigate the effect of dietary methionine levels on performance, digestibility and ileal molecular expression of acid transporters in meat-type chickens. Thirty-six broiler chicks at 22 days were assigned to either a methionine deficient diet (DEF: 75% of requirement), normal (CONT: 100%) or excess (EXC: 125%). Body weight gain (BWG) and feed intake (FI) were measured over 18 day period. Birds were sacrificed and the ileal contents were taken at day 41. We calculated feed conversion ratio (FCR) and body weight gain (BWG). We extracted RNA from ileal tissue and using RT-PCR, the expressions of solute carrier (SLC) 38A1 and SLC7A1, methionine and lysine carriers, respectively were determined. The BWG were 1.52, 1.77 and 1.64 kg in the DEF, CONT and EXC groups, respectively suggesting that dietary methionine deficiency reduces growth and excess methionine can also impair growth. The DEF group consumed more feed to compensate for the deficiency of methionine. FCR was best in the CONT group and worse in the DEF group. Digestibility of methionine was 92.50, 93.95 and 95.04% for DEF, CONT and EXC groups, respectively. The mRNA expression levels for SCL38A1 were 0.80, 1.00 and 1.30 for DEF, CONT and EXC groups, respectively. The methionine carrier in the DEF group was activated to transport more methionine to the portal blood. The digestibility of lysine was 91.97, 90.34 and 89.19%, respectively for the DEF, CONT and EXC groups. The mRNA expression for the lysine transporter, SLC7A1 was 2.23, 1.00 and 0.41 for the DEF, CONT and EXC groups, respectively. We concluded that poultry diets deficient or excess in methionine impairs growth and feed efficiency. The deficiency in methionine led to slightly reduced methionine digestibility and the activation of the methionine transporter as a compensatory mechanism.

Tea Polyphenols Inhibit Activity of Pancreatic Lipase

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The purpose of this research was to investigate the effect of tea polyphenols, found in green tea, on pancreatic lipase activity under in vitro conditions. Porcine Type II pancreatic lipase was dissolved in ultra-pure water to make 0.5 mg/mL solution. The lipase solution (100 µL) was mixed with 450 µL of 0.02% (w/v) pNP laurate substrate, 350 µL of pH 7.2 Tris buffer, and 100 µL tea polyphenol solution with concentration ranging from 0.1 to 1.0 mg/mL. The control was prepared by using the same amount of lipase and substrate but with 450 µL buffer. The control and sample mixtures were incubated in the water bath at 37°C for 2 hours, and the mixtures were then analyzed with a spectrophotometer at a wavelength of 400 nm. Furthermore, changing the order of putting solutions showed the difference between drinking green tea before a meal and drinking green tea after a meal. To simulate drinking green tea before a meal, the lipase was added after 30 minutes of incubation under the same in vitro conditions with the previous procedures. For drinking green tea after a meal, the substrate was added after 30 minutes of incubation under the same in vitro conditions with the previous procedures. The result showed that tea polyphenols inhibited the lipase activity. The inhibition rate increased with tea polyphenol concentration, and reached its maximum at concentration 0.5 mg/mL, where pancreatic lipase activity was reduced by 47.8%. The inhibition rate was 2.4%, 15.2%, and 37.8% for tea polyphenol concentration of 0.1 mg/mL, 0.25 mg/mL, and 1.0 mg/mL respectively. For changing the order of putting solutions, comparing these two result indicated that drinking green tea before a meal has an average of 45.9% of lipase inhibition effect, and drinking green tea after a meal has no lipase inhibition effect under the same in vitro conditions. In addition, our research indicated that tea polyphenols also reacted with the substrate. However, in order to find the mechanism and why they react together, further research is required. It has been known that drinking green tea helps reduce risk of obesity and cardiovascular disease. This result indicated that the enzyme inhibition may be part of the mechanism. The results also demonstrated that green tea could be used as natural medicine to reduce the risk of these diseases.

Influence of Monostearin on the Survival of Salmonella in a Low-water Activity Peanut Protein Model Food System at 37°C and 70°C

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The purpose of this study was to investigate the role of monostearin and survival of Salmonella in a peanut flour model food system at a water activity (aw) of 0.46 at 70°C and 37°C. Water activity is the vapor pressure of the system and the vapor pressure of pure water under identical conditions. Salmonella is unable to grow but can survive in low aw model food system. Many multi-state outbreaks of Salmonella in low aw foods have raised concerns over its survival in peanut-based products. The influence of an emulsifier on the survival of Salmonella in low aw peanut-based products have not been previously determined. Peanut butters may be formulated with emulsifiers containing monoglycerides, some of which are reported to have antimicrobial effects. Emulsifiers encourage the creation and stabilization of emulsions, allowing immiscible droplets to remain dispersed indefinitely to prevent the separation of phases. Monoglycerides have been shown to have varying degrees of inhibitory properties against microorganisms, depending upon their structure in foods and the type of microorganism examined. Monostearin was homogenized with 50% (w/w) defatted peanut flour and 55% (w/w) peanut oil to obtain 0% and 1.625% (w/w) emulsifier concentrations and was equilibrated to aw = 0.46 (± 0.04). A dried cocktail of S. Agona, S. Montevideo, S. Tennessee, and S. Typhimurium was inoculated and the samples were treated at 70°C for 48 h and 37°C for 28 d. Surviving Salmonella were recovered at various time points using supplemented tryptic soy agar. Log CFU values were compared for each time point at 0% and 1.625% emulsifier concentrations using two-way ANOVA. At 70°C, survival of Salmonella was not affected by monostearin ($p = 0.28$, $\alpha = 0.05$). The average log reduction was 3.02 with monostearin and 3.59 without monostearin after 48 h. The D-value plots showed linear activation for monostearin (R2 = 0.97) and no monostearin (R2 = 0.98). At 37°C, survival was not affected by monostearin ($p = 0.80$, $\alpha = 0.05$). The average log reduction was 1.94 with monostearin and 1.78 without monostearin after 28 d. The D-value plots showed nonlinear inactivation for monostearin (R2 = 0.78) and no monostearin (R2 = 0.77). This data indicates that monostearin does not affect the survival of Salmonella in peanut-based products at aw = 0.46 at 70°C after 48 h and at 37°C after 28 d. These results will be useful for predictive modeling of Salmonella survival in a low aw (aw = 0.46) model food system.

Effect of Music on People with Developmental Disabilities During Phyiscal Activity

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People with developmental disabilities are typically less involved in regular physical activity and unhealthier than people without disabilities. The aim of this study was to investigate the effect of music on the exercise intensity selected by participants with developmental disabilities. The hypothesis was that participant-requested music would result in higher heart rates during exercise compared to non-specific or no music while walking on a treadmill or while cycling. Six participants with developmental disabilities enrolled in a wellness program course were recruited and permission of their guardians were gained. Three musical situations were carried out: a control situation with no music, a second general "gym music" situation, and a situation with requested music. Heart rate was recorded while on a treadmill or a stationary bike for each situation in separate trials. Questions were asked after each session regarding enjoyment of the workout. Starting at the same speed each session, participants walked or biked for ten minutes during each trial and were encouraged to control their speed. During the first semester of research, the study proved to be a feasible way for measuring the comparison between exercise intensity and different music conditions. It was determined that 80% of participants were not reaching their individual cardiovascular training zones during physical activity; however, more measurements are needed to complete the study. There appears to be a positive effect of self-selected music on exercise intensity. We feel self-selected music could be an important tool to allow fitness programs to provide health benefits to people with developmental disabilities.

Monitoring Northern Fowl Mite Population Dynamics in Wild Blue Bird Nests

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The northern fowl mite, Ornithonyssus sylviarum, is a hematophagous, avian-specific ectoparasitic arachnid that is gaining fame for its role in reducing egg production and lowering profit in commercial poultry. While research has been conducted in agricultural settings, little is known of the behavioral patterns of these mites in wild birds. Bird nestlings can suffer attack by large numbers of mites, causing stress, anemia, and in extreme numbers nestling fatality. The focus of this survey is on a common wild bird's nest - the eastern bluebird. Bluebird nest collection was conducted over the 2014 nesting season, beginning in May and extending until August. Twice weekly assessments of the numbers in collected nests began with collection and ended in October. Nest boxes were observed biweekly, and nests were bagged as soon as nestlings fledged, sealed in clear zip-locks, and stored in the lab. The adult mites emerged within one to two weeks after nest collection, and numbers of adults ranged from 2 to 1,000 mites per nest. Thirteen nests had nymphs and larvae emerge at various lengths of time, up to five months post collection. The number of nymphs and larvae that emerged from the thirteen bags ranged from 10 to 10,000. While emerged adult mites all followed a similar pattern of emergence and then gradual dying off, newly-hatched larvae and newly-emerged protonymphs emerged sporadically and repeatedly from a given nest. This suggests that while adult mites emerge once to find a food source, then die off, mite eggs inside the nest hatch over a long period of time, allowing the larvae and nymphs time to wait for the next host brood to hatch and provide food for adult and protonymphal mites. Upon conclusion of the study, each nest was checked and all nests that did not show living mites during the course of observation were found to contain deceased mites, indicating that 100% of bluebird nests in this study were infested with O. sylviarum.

Organic Lettuce Variety Trial

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Lettuce ranks among the top three vegetable crops in the U.S. both in terms of production weight and value (8.5 billion pounds and $1.9 billion USD in 2013). The majority of the U.S. lettuce industry is comprised of conventionally-grown iceberg and romaine lettuce types produced in California and Arizona. Several cultivars of leaf and butterhead lettuces have been bred to produce single serving size heads ("mini-heads"), which may be useful for marketing purposes. Nine such cultivars are being trialed in a replicated randomized block design at the organic UGArden facility on campus. Yield data (i.e., quality and quantity) will be collected and analyzed after lettuce heads mature in late April to early May. Information gained from this project will help growers select cultivars that perform well in the Piedmont region during the spring season and are appropriate for a USDA Certified Organic operation.

Profiling the Spatiotemporal Regulation of DNA Methylation in a Social Insect

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DNA methylation plays a role in development through the regulation of gene function in a diverse number of eukaryotes. The methylation is also affected by environmental input and may thus represent a fundamentally important mechanism by which development is influenced by the environment. Indeed, evidence suggests that DNA methylation responds to nutritional differences and helps to determine whether a larva develops into a queen or worker in the honey bee. The red imported fire ant Solenopsis invicta represents an ideal complement to the honey bee for investigations of epigenetic effects on development and behavior because appropriate genomic resources have been developed, marked natural variation in social behavior has been documented, and fire ants are easily collected and manipulated in the lab. Moreover, the red imported fire ant exhibits a profound economic impact, with the costs of control, medical treatment, and damage to property estimated at greater than $6 billion annually in the United States. DNA methylation is accomplished by several evolutionarily conserved enzymes known as DNA methyltransferases (DNMTs). DNMTs are divided into classes based upon the nature of their activity. The two foremost categories separate DNMTs into de novo and maintenance methyltransferases. De novo methyltransferases are responsible for establishing new methylation patterns within an organism's genome and are represented by the DNMT3 family of proteins in mammals. In contrast, maintenance methyltransferases, represented by the DNMT1 family of proteins, maintain previously established methylation patterns across cell generations through mitotic divisions by preferentially methylating hemimethylated DNA substrates. However, the function and regulation of insect DNMTs is poorly understood, partially because the model insect Drosophila melanogaster exhibits virtually no DNA methylation in its genome. In this study we have identified orthologs of DNMT1 and DNMT3 in the genome of Solenopsis invicta as well as designed and validated qPCR primers for these genes. We will be profiling patterns of gene expression across seven developmental stages (egg, first through fourth-instar, pupae, and callow adult), two castes, and multiple tissues. The ants will be collected from two nests of the monogyne (single reproductive queen per nest) social form of S. invicta. This profiling will be done in order to provide fundamental insight into the timing and levels of activity of the molecular mediators of DNA methylation in this social insect.

Improving Production Protocol of Rare Native Species of Clematis

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Clematis is a vigorous flowering woody vine in the family Ranunculales. There are over 300 different species in the genus with a couple native to the southern region of the U.S. Some of these native species are in high demand and U.S. growers cannot meet the demand due to the slow germination and inconsistent survivability of seeds. This research seeks to find the best approach for seed germination of two rare native species of Clematis; Clematis texensis and Clematis sp. nov. aff. viorna. Different propagation techniques were performed on C. texensis and C. viorna over a time period of 7 months. Treatments used to induce germination included; scarification followed by hot water soaking, cold vernalization, soaking in gibberellic acid for 24 hours, a hot then cold water treatment, and de-tailing seed followed by a hot water treatment. Scarification was completed by scratching the seed with sandpaper and was followed by a cold-water soak. Cold stratification of C. viorna was performed in order to break down seed coat and/or endogenous inhibitors so that the seed would be able to germinate. Some C. viorna seeds were exposed to freeze thaw cycles. This is known as vernalization and gives the seed the ability to flower or germinate by reducing endogenous inhibitors. C. texensis ripe seed, C. texensis unripe seed, and C. viorna were also soaked in gibberellic acid (GA3) 0.015g/ml (100 ppm) for 24 hours. Some seeds were placed in plastic, clear storage containers filled with the soilless media Mycorrhizae Promix Professional Growing Medium. Plastic tops were attached to each other and held together by a binder clip in order to retain 100% humidity. The seeds of other treatments were placed in 15.24 cm pots. No germination was seen in any treatment group. After a couple of months of no observed germination, the seeds were uncovered to determine viability. No rotting or molding of the seed was found. Possible reasons why the treated seeds may not have germinated include secondary level dormancy issues, seed immaturity, lack of development time, genetic inviability, or unknown environmental issues. The next important step would be to give the experiments more time in hopes of eventually breaking dormancy. Additional treatments might include soaking for 24 hours, peeling back the pericarp, and then placing seed on blotter paper or perhaps using a different form of Gibberellin.

The effects of interval verses continuous conditioning on physiological and kinematic parameters of equine fitness

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Interval conditioning is a method of exercise frequently used to train elite human athletes. This type of conditioning alternates between varying degrees of effort and incorporates a period of recovery between efforts thus allowing the athlete to become more efficient at switching from anaerobic to aerobic pathways. Conditioning in this manner also delays the onset of fatigue and allows the athlete to recover more quickly, potentially allowing for greater gains in fitness with less stress on the body. The objective of this study was to determine kinematic and physiological changes in response to either interval or continuous conditioning. Nine unconditioned horses were randomly divided into either a continuous conditioning (CC) or an interval conditioning (IC) group. Both groups underwent a conditioning program consisting of free lunging in a 92-m2 round pen at increasing workloads 3 times a week for 8 weeks. Horses were filmed in hand at the trot using a high-speed camera before beginning and at the end of the 8-week training program. An incremental standardized exercise test (SET) was conducted in the aforementioned round pen before and after training to establish fitness levels for comparison. Blood lactate and hematocrit levels as well as kinematic variables were analyzed using SAS version 9.4 proc GLM using a repeated measures design. Both CC and IC groups showed improved fitness following 8 weeks of training as measured by a decrease in peak blood lactate post SET. The IC group however, showed less of an increase as compared with the CC group ($P < 0.05$), suggesting that the IC group expended less energy at the same workload. Resting hematocrit levels increased for both groups following 8 weeks of conditioning; however, IC horses showed less of an increase post SET as compared with CC horses ($P < 0.05$). Kinematic analysis of horses at the trot showed shorter hind stance times post training for both groups ($P < 0.05$). The IC group had no significant change in swing time for either the front or hind limbs, indicating that propulsive forces were able to be generated with less ground contact time. IC horses also had a longer period of suspension at the trot post training as compared with CC horses ($P < 0.05$). By comparison, CC horses had significantly longer front limb stance times coupled with shorter swing times and shorter time in suspension following training ($P < 0.05$). Results from this study suggest that interval conditioning may be more effective as compared with continuous conditioning, indicated by improved physiological response to exercise as well as improved muscular propulsion.

Effect of Dietary Methionine On Immune Competence in Meat-Type Chickens

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L-Methionine (L-MET) is an essential amino acid required for protein synthesis and also plays an essential role in nutrient utilization, feed efficiency and immune function. Methionine is primarily the sole methyl donor to a variety of acceptors including nucleic acids, proteins, CpG islands in DNA and biological amines. Methionine is also the first limiting amino acid in poultry diets. There are indirect reports suggesting that methionine may be involved in immune competence. However, information on the direct relationship between dietary methionine levels and immunity is scant. Our objective was to the relationship between levels of dietary methionine and inflammation.
Twenty-four broiler chicks at 22 days were assigned to either a methionine deficient diet (DEF: 75% of requirement) or normal (CONT: 100%). Body weight gain (BWG) and feed intake (FI) were measured over 18 day period. Birds were sacrificed and peripheral blood was taken from the wing at day 41. We calculated feed conversion ratio (FCR) and body weight gain (BWG). We also measured the T cell receptor (TCR), interleukin (IL)-1β, IL-10, CD4 and IgM levels. We extracted RNA from liver tissue and used RT-PCR to measure the expressions of inflammation gene. The BWG were 1.52 and 1.77 kg in the DEF and CONT groups, respectively suggesting that dietary methionine deficiency reduces growth. The DEF group consumed more feed to compensate for the deficiency of methionine. FCR was better in the CONT group compared to the DEF group. There were no differences in the IL-1β levels. The DEF group had significantly lower IL-10 (33.88 vs 49.30 pg/ml) compared to the CON group. The percent TCR:CD4 ratio was 15.31 in DEF compared to 19.76 in CONT. The percent IgM was 7.3 and 5.1%, respectively in the DEF and CONT groups. Even though there were no changes in the pro-inflammatory cytokine, IL-1β, there levels of the inflammation suppressor, IL-10 was significantly higher in the CONT group compared to the DEF group. IgM is the largest antibody in circulation in response to an antigen. The significantly high IgM levels in the DEF group could be in response to inflammation. We concluded that adequate dietary methionine is required to suppress inflammation. Deficient dietary methionine level reduces growth, and may also cause cellular stress that may elicit inflammation.

Antioxidant potential of anthocyanins in micronized tart cherry puree

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Antioxidants are defined as substances that prevent destructive chemical reactions involving the combination of oxygen and other materials in many processed foods. These substances help reduce free radicals, or by-products, that can lead to heart disease, diabetes and cancer. Fruits and vegetables are known to have a high content of antioxidant potential and when they are processed their phytochemical and nutrient content is generally improved (Ou, 2012). Tart cherries are known to possess different chemical compounds that aid in increasing the overall biotic activities they preform. As far as concerns cherry anthocyanins, studies have demonstrated that they are able to reduce proliferation of human colon cancer cells in culture (Ferretti, 2010). Tart Cherries products also possess in vitro anti-inflammatory activity and antioxidant capacity against diverse forms of oxidative and nitrosative stress (Ou, 2012). Based on theories such as this, the purpose of this study is to understand the different antioxidant potentials associated with Tart Cherry Puree in relation to particle size. The overall experimental nature of this study was to evaluate the overall color, viscosity and total phenolic content. While comparatively testing the original sample in relation to the micronized sample to determine overall Antioxidant potential changes. This information was recorded and analyzed to determine the following applicable results.

Investigating Interest in Ingesting Insects

Audrey Wright, Agricultural Education Major, Department of Agricultural Leadership, Education, & Communication; Presented in 2015

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With a human population projected to reach nearly 10 billion people by 2050, current food production will need to double in order to sustain our species. Because expansion of existing agricultural land is neither likely nor realistically feasible, current farming practices must be reevaluated. Increasing livestock production, though seemingly necessary to supply enough edible protein to the world's population, will also exponentially increase already-high greenhouse gas emissions and exacerbate climate change. A more sustainable solution exists. Since invertebrates make up a majority of the biomass on the Earth, insects—the largest subgroup of invertebrates—provide the most encouraging and sustainable solution for providing protein to a growing population. While some cultures have been eating insects for ages, a popular taboo exists in the Westernized world that condemns this practice. This study examined the effects of education and exposure on the attitudes towards insects and willingness to consume them as food. We surveyed 50 college students before and after five weeks of entomology and entomophagy education and consistent exposure to live insect specimens. Our study supports the notion that increased education and exposure to insects not only increases positivity towards arthropods, but also the inclination to consume insects as food.

Analysis of cortex and pith size contribution to fruit size in different apple cultivars

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Apple fruit consists of the economically important fleshy cortex and a generally less edible core (pith), which can constitute a significant volume of the fruit. The relationship between pith and cortex size between different cultivars is unknown. The objective of this study was to determine the variation in pith size across apple cultivars. Such knowledge could be eventually useful in developing cultivars with a higher proportion of edible flesh. The twenty cultivars used in this study were sourced from the Mountain Research and Education Center (Blairsville, GA), Ellijay county orchards (GA), Michigan orchards and several local grocery stores. Fruit weight, length and diameter were measured using about 16 fruit from each cultivar. Half of the fruit from each cultivar were sliced vertically (radial plane) and half horizontally (transverse plane) to obtain sections of the pith and cortex areas. These sections were then scanned using an Epson V600 high-resolution flatbed scanner. ImageJ software was used to measure the pith area and the overall fruit area from the scanned images. Although the exterior area of the fruit section could be easily determined, inversing the image using the software was required to better visualize vascular tissues that form the pith boundary. These measurements were used to determine the overall pith area to fruit area ratio for each cultivar. Fruit diameter and fruit length were good predictors of overall fruit weight indicating that metrics along these axes are useful indicators of overall fruit size. Image analysis data indicated that the pith area to fruit area ratio varied across different apple cultivars by more than a factor of two, especially when assessed along the transverse plane. The pith area constituted up to 30% of the fruit area. Pith area in the radial plane was only partially related to fruit area (R2 = 0.46), the relationship was much weaker in data from the transverse plane. As the pith size was not strongly related to the fruit size, it may be concluded that the growth of the pith and the cortex tissues of the fruit are independently regulated. This information could be used in future breeding efforts to increase the size of the cortex region of the fruit, resulting in a higher proportion of the edible part of the fruit.

A dietary phytochemical blend prevents liver damage associated with adipose mobilization in ovariectomized rats

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The dramatic reduction in endogenous estradiol observed during menopause causes increases in total body adipose accumulation. The increase in adiposity, in addition to increased risk of cardiometabolic diseases, may lead many women to seek out dietary supplements to prevent and treat such adverse body composition changes and disease risk. Some dietary supplements have shown to increase the risk of non-alcoholic fatty liver disease (NAFLD) and hepatic damage due to the enhanced adipose mobilization caused by treatment. Compounds that are both anti-adipogenic and cytoprotective may prevent the hepatic lipotoxicity associated with mobilization. For this study, a phytochemical blend with the above properties was added to the diet of aged, ovariectomized rats. Rats were given the AIN-93M basal diet or a diet containing varying doses of phytochemicals with vitamin D (diet 1: 1000 mg/kg Genistein (G); diet 2: 500 mg/kg G, 200 mg/kg Resveratrol (R), and 1000 mg/kg Quercetin (Q); diet 3: 1000 mg/kg (G), 400 mg/kg (R), and 2000 mg/kg (Q)). As expected serum free fatty acids were elevated in diets 2 and 3, indicating adipose mobilization ($p<0.05$). Hepatic triglycerides and Oil Red O staining of sectioned liver samples indicated increased lipid deposition within the liver of the rats given diets 2 and 3. Expression of genes related to lipogenesis, apoptosis, and cell remodeling were measured. Dietary phytochemical treatment had no effect on lipogenic gene expression; however apoptotic genes including MADH1 and caspase 2 failed to increase with the increased lipid deposition observed with treatment. Furthermore, the highest phytochemical dose (diet 3) prevented increases in serum ALT ($p<0.05$), the clinical marker of liver damage. In summary, the phytochemical blend used in the study which is both anti-obesity and cellular protective did not cause adverse effects in the liver. The use of such compounds may not only help with weight management and disease risk in menopausal women, but may also prevent the downstream lipotoxic effects of NAFLD.

Thermal Inactivation of Non-Pathogenic Strains of Escherichia Coli in Non-Intact Beef Steaks Using a Radio Frequency Oven

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Beef served the United States today has likely been mechanically tenderized. The tenderizing blades often push surface bacteria into the tissue of the meat. Currently, adequate cooking is the best way to eliminate Escherichia coli and other pathogens in beef. However, internalized E. coli and other pathogens may still survive, especially if undercooked. In the beef industry, additional intervention systems to control E. coli are needed. Radio Frequency (RF) uses electromagnetic waves to heat foods with rapid heat distribution, large penetration depth, and low energy consumption. RF is also capable to cook products in heat resistant plastic. Thus, RF cooking has application for packaged meat products, while reducing the risk of cross contamination after cooking as well as reduced costs for repacking, relabeling and overall yield losses. Many non-pathogenic strains of E. coli have shown similar thermal resistance characteristics to pathogenic strains of E. coli such as E. coli O157:H7; therefore, the objective of this research is to measure the extent of thermal inactivation of non-pathogenic E. coli strains in non-intact beefsteaks cooked in an RF oven to different internal temperatures. Short loin was previously tenderized, frozen, thawed and cut to form 1.9 cm thick steaks. Four non-pathogenic E. coli strains were mixed in equal quantities to form a cocktail that was spot inoculated on the surface of steaks to obtain a high inoculation level (10^6). It was found that few colonies survived above the detection level after treatment at 60C. For steaks treated at 65C there was a significant reduction (5 log) and no colonies survived above the detection level even after enrichment. Thus showing that should RF technology be implemented in the beef industry, this would likely be the temperature range to produce safe, E. coli free beef products. Possible further research might include identifying a thermal inactivation range for other known pathogens on beef or on beef tenderized differently such as with needle injection where bacteria could possibly be recycled in the marinade. Radio frequency technology, with its multiple advantages, proves to be very promising for the beef industry in general and across the realm of pre-packaged, value-added products.

Influences of Chronic Stress on Gonadotropin Inhibitory Hormone (GnIH) Expression in White Leghorns

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In the poultry industry, chickens may be exposed to stressful situations including overcrowding, environment concerns, behavioral issues with other birds, and issues with access to food and water. Stressed animals are less likely to perform at their optimal level causing issues in production. Stress activates the HPA axis resulting in increased levels of glucocorticoids (GCs) such as corticosterone. GCs redirect energy away from nonessential bodily functions, like reproduction, towards essential bodily functions. Persistent exposure to stressors can produce negative effects on reproductive physiology and behavior through prolonged exposure to corticosterone that inhibits gonadotropin secretion. However, we do not fully understand the mechanism for stress-related inhibition. The hypothalamic neuropeptide, gonadotropin inhibitory hormone (GnIH) has been shown to inhibit reproductive physiology and behavior in birds. But, it is still unclear if GnIH inhibits reproductive behavior when a bird is stressed. The objective of this study is to test the influence of stress on GnIH expression in the hypothalamus of white leghorns. We hypothesize that stress may take advantage of the natural regulation of reproduction by GnIH to inhibit reproduction. To induce chronic stress, hens were administered corticosterone in water. We predicted that the birds administered corticosterone in their water would have higher GnIH expression when compared to controls. Data was analyzed using one-way ANOVA for complete randomized design with significance at $p < 0.05$. Hens in the corticosterone group had higher GnIH expression levels, but the result was not significant ($p = 0.14$). Further research is necessary to determine whether GnIH plays a role in stress-induced reproductive inhibition.

Establishing Antibody Staining Methods in Three Species of Drosphila

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Germline stem cells and the mechanisms controlling their behavior are an important area in science, given the essential role of the germline in forming the next generation. Germline stem cells and the production of gametes are important in shaping mating and reproductive strategies in an organism, but the mechanisms by which mating effect turnover of the germline stem cells are largely unknown. In the model species Drosophila melanogaster established methods can determine which cells are germline stem cells and at what stage of the cell cycle these cells are. The simplest method is antibody staining for germline stem cell markers and also for cell cycle markers. Anti-fascilin III marks the "hub" or germline stem cell niche, anti-vasa antibodies label the germline cells, and anti-phosphohistone 3 labels cells in the mitotic phase. We can also use BRdU staining to label cells in the S-phase of mitosis. These antibodies and methods of staining have been established in D. melanogaster, but we are interested in two other Drosophila species, the newly invasive agricultural pest D. suzukii and D. pseudoobscura, a species with distinct anatomy, which utilizes two types of sperm during reproduction. The purpose of these experiments therefore was to determine a staining method that worked for the three different species, which will allow for comparisons to be made in further reproductive studies. Two different staining methods were used, one experiment without blocking and the second with. Blocking is a method employed to reduce non-specific binding of the antibody stains. The decision to use blocking came after several failed attempts with the non-blocking method. In this poster I describe my work in developing staining protocols to examine germline stem cell turnover rates in D. suzukii and D. pseudoobscura. Using this protocol, I plan to undertake future projects include comparing the rates of cell division in the unmated males as opposed to those who mated frequently among the 3 species to ask about how mating rates affect germline stem cell behavior in species with very different ecologies.

Effect of Drying on Orange Pulp Characteristics

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Incorporation of more nutraceuticals such as phytosterols into the average US diet can have a positive impact in the overall health of our country. One of the main issues in incorporating phytosterols into foods is that they are water insoluble and poorly to moderately soluble in vegetable oils. The microstructure and hydrophobic nature of citrus pulp (juice vesicles) allows for absorption of compounds that are water insoluble. In addition, citrus pulp is one of the by-products of the citrus juice industry with greatest market increase as it can be used to impart to beverages a mouth-feel and flavor that is perceived by consumers as "natural" and "fresh". Processing citrus pulp requires separation from the pulpy juice, pasteurization and usually storage frozen. Pulp can also be dried. However, drying affects the microstructure of the pulp. We hypothesize that the method of drying impacts the oil holding capacity of dried citrus pulp. The overall objective of this study was to maximize the amount of oil that can be absorbed by citrus pulp, thus maximizing the amount of oil-soluble nutraceuticals that can be incorporated into a pulpy fruit beverage. Three drying methods were examined: drum drying, tray drying, and freeze drying. Tray-dried pulp absorbed the by far least amount of any oil. Drum-dried pulp absorbed 24.5 % soybean oil (grams oil/gram pulp) and the freeze dried pulp absorbed on average 19.7 % of oil. Taking into account equipment and processing costs, this research suggests that drum drying is the most suitable process to produce dry pulp with high oil absorption capacity.

Intron Loss In the ABCB1 Gene

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The ABCB1 gene encodes an auxin transporter protein, knockouts of which cause an economically important dwarfing phenotype. The gene shows remarkable intron number variance, particularly among the Poaceae, from the ancestral state of nine introns, found in dicots, to as few as two, found in rice and millet. The mechanism by which intron loss occurs is not well understood, so we sought to identify patterns of loss and characteristics of this particular gene that may explain the frequency of the intron loss. Previously, we acquired and aligned sequences for ABCB1 homologs in plant species for which sequence data were available. For non-sequenced species, we designed primers near intron/exon boundaries to amplify across introns and determine, based on fragment size, intron presence. Based on this data, introns 1, 2, 5, and 6 were lost independently in various lineages, and introns 1, 3, 4, 8, and 9 were lost together after the divergence of grasses. To validate the results of our PCR analyses, the entire ABCB1 gene from representative species has been cloned into E. coli for sequencing. In addition to tracking intron loss events, we are investigating whether the most widely conserved intron, 7, was retained for functional reasons. We are transforming an ABCB1/ABCB19 Arabidopsis mutant which lacks both ABCB1 and its functionally redundant homolog ABCB19 with a copy of ABCB1 from which intron 7 has been removed to see whether and how phenotype restoration is affected. Finally, we compare ABCB1 to other genes showing high frequencies of recurrent intron loss.

Do X-Type symbionts protect aphids from parasitism?

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Insects are commonly infected with inherited bacterial symbionts capable of mediating important ecological interactions. The pea aphid (Acyrthosiphon pisum), an important pest of herbaceous legumes has emerged as a model system for studying the effects of infection with symbionts. All pea aphids are infected with an obligate (required for host survival) nutritional symbiont called Buchnera aphidicola, which provides nutrients lacking in their plant-sap diet, and most are also infected with one or more facultative symbionts (not required for host survival), which influence diverse interactions including protection against natural enemies. One of these facultative symbionts, Hamiltonella defensa, confers partial to complete protection against the parasitic wasp, Aphidius ervi, with the help of a toxin-encoding bacteriophage called APSE. This protection, however, has been reported to fail under heat-stress, rendering the aphids susceptible to parasitism. A more recent study found that another facultative symbiont (provisionally named X-type) which is often found co-infecting aphids with H. defensa, can rescue the loss of H. defensa-conferred protection under heat stress. This earlier X-type study, however, did not use genetically controlled backgrounds, so it is possible that aphid genotype, not the symbiont, rescued loss of protection. To test whether X-type indeed rescues protection of H. defensa at higher temperatures, or provides protection against parasitoids on its own, we created experimental lines sharing the same aphid genotype, but differing in infection status: uninfected (no H. defensa or X-type), X-type only, and both symbionts. We next performed two sets of parasitism assays, one at the 'normal' temperature of 19°C and another at a 'high' temperature of 30 C during the day and 24°C at night. Using ANOVA and Tukey-Kramer HSD tests, we found that X-type alone did not confer significant protection against parasitism relative to the uninfected control at either temperature, and aphids with both X-type and H. defensa symbionts were protected at normal, but not higher temperatures. These results indicate, at least for this interaction, that X-type does not confer protection against parasitism by itself and does not rescue protection-loss due to higher temperatures as was previously reported. We find no clear benefits to X-type infection in the presence of parasitism, but expect that this heritable symbiont confers some benefit to its aphid host given that it is found at high frequencies in natural populations.

mRNA Reprogramming of Leigh's Syndrome Patient Human Fibroblasts into Induced Pluripotent Stem Cells for Clinical Research

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Background: Leigh’s Syndrome is an inherited disorder of mitochondrial energy metabolism that attacks the central nervous system with symptoms including muscular and mental degradation. This disease affects 1 in 40,000 newborns every year and is invariably fatal, often within the first few years of life. No curative treatments are currently available. The reprogramming of mitochondrial diseased fibroblasts into induced pluripotent stem cells (iPSCs) will allow for later differentiation into multiple cell types and tissues. This functions as an invaluable tool for studying disease pathophysiology in vitro with the intention of designing future gene therapy and pharmacological treatments for affected patients. Objective: Our goal in this study was to use mRNA reprogramming to create clinical grade human induced pluripotent stem cells from fibroblasts of Leigh’s Syndrome patients. Methods: FB1 and FB3 cell lines obtained from patients were grown on NuFF feeder layers. Cell lines were reprogrammed using Stegment mRNA Reprogramming System. Cell cultures were transfected with mRNA daily and observed to record changes in morphology and expression of a nuclear tagged green fluorescent protein (nGFP) transfection marker. Results: After 24hrs, both FB1 and FB3 cells expressed nGFP demonstrating that mRNA successfully entered the cell and was translated into protein. Both FB1 and FB3 cultures showed the presence of putative colonies that were indicative of reprogramming into an iPSC state. Reprogrammed cells showed iPSC morphology with a high nucleus to cytoplasmic ratio, large nucleoli and were highly rounded and refractive. However, colonies showed high levels of cell death and after 28 days colonies could no longer be identified. Conclusion: In this study we were unable to implement mRNA reprogramming to create human iPSCs from Leigh’s Syndrome patient fibroblasts. Results may be improved in the future with strategies for optimizing mRNA reprogramming protocols for highly sensitive mitochondrial diseased cells.

Incubation temperature to optimize hatachability of modern meat-type chickens

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Objective: The point of this experiment was to determine optimal incubation temperature for chicken eggs by counting the number that hatch and using external characteristic and yolk utilization as a means of measuring chick quality. Chicken eggs are typically incubated at temperatures ranging from 99-100 F, with overheating being more of a concern than under heating. Either extreme can result in deformities during development and lower hatchability. Methodology: The experiment (1739 eggs total) had 3 incubation temperatures: 98.9, 99.2, and 99.5 F from 1-18 days with a common hatcher temperature of 98.5 F. In order to determine moisture loss and yolk utilization during incubation, 111 eggs were broken and components (albumin wet and dry, yolk wet and dry, and shell wet and dry) weighed. During the last 3 days of incubation (in hatcher at 98.5 F), we counted how many chicks hatched from each of the treatment groups at 6 hour intervals. At termination of hatching, all trays were grade for external features such as healing of the navel. Two trays (70-80 chicks per tray) of hatched chicks per treatment were gases, and body and residual yolk sac weighed. Results: The hatch percentage (number of chicks from total number of incubated eggs per treatment) was 81.9%, 85.9%, and 84.9% for 99.5, 99.2, and 98.9 F, respectively. In addition, the percent of Grade A chicks for each treatment group was 97%, 95%, and 94% for 99.5, 99.2, and 98.9 F, respectively. In terms of percent residual yolk after hatching, we found that the 99.5 F chicks had 9.52%, the 99.2 F chicks had 9.98%, and the 98.9 F chicks had 9.16%. Conclusion: By analyzing these results, we conclude that the optimal incubation temperature for maximum hatchability and chick quality is between 98.9 and 99.2 F. Further research is needed to determine if changes in incubator relative humidity or hatcher temperature are needed.

Solubilization of Phytosterols in Orange Oil and Soybean Oil

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There is a high demand for high quality, nutritious, and convenient foods that is critical to consumers' health. This research is part of a project with the main goal of designing processes to produce nutraceutical-enriched beverages based on fundamental understanding of structure, physicochemical, and biological properties of fruit pulps and selected nutraceuticals. The objective of this research was to determine the solubility of β-sitosterol in blends of orange and soybean oils. Selected concentrations of β-sitosterol were added to 10 mL of 100% orange oil, 100% soybean oil, and a 50/50 blend of the two oils. The mixtures were all heated to dissolve the phytosterol, then brought down to room temperature, vortexing throughout the process. A turbidity meter was used to measure the solubility. The turbidity meter was blanked with the respective oil or oil blend without any added phytosterol. Solubility was determined as the concentration immediately below the concentration that produced at least 3 NTU. β-sitosterol was approximately 3 times more soluble in orange oil (56 mg/mL) than in soybean oil (20 mg/mL). However, the behavior was different. In soybean oil, excess β-sitosterol clumped up and sank to the bottom of the test tube rapidly. In orange oil, over saturation produced a cloudy gel. In the 50/50 blend of oil, a concentration of 54 mg/mL was the highest concentration before gelling occurred and turbidity increased. β-sitosterol solubility increased linearly with orange oil concentration. Solubility of β-sitosterol is greater in orange oil that in any other previously reported solvents, increasing the potential incorporation of β-sitosterol into foods.

Genetic Analysis of Flowering Time Canidate Genes in Watermelon

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Flowering time has emerged as an important trait in plant breeding to escape biotic and abiotic stresses. In the United States watermelon industry, it has an added importance due to the need for synchronized flowering of triploid watermelon and diploid pollenizers that are responsible for approximately 85% of watermelon production in the U.S. Previous research identified a quantitative trait locus (QTL) on chromosome 3 associated with flowering time in watermelon cultivars. The aim of the current research was to identify candidate genes in the region of interest and to compare the sequence of the candidate genes between early flowering and late flowering cultivars. Information from the watermelon draft genome sequence was used to compare the 172 genes in the region of interest with genes known to be associated with flowering time in other crops. Two candidate genes flowering locus T (Cla00904) and tempranillo 1 (Cla000855) were identified and chosen for sequencing. The Polymerase Chain Reaction (PCR) was used to amplify these genes from 'Klondike Black Seeded' (late flowering) and 'New Hampshire Midget' (early flowering) and results were sequenced. These DNA sequences were then compared to each other and the watermelon draft genome sequence in search of mutations that may result in differences in flowering time. Results showed that no mutations were found in the exons (genetic region that codes for proteins) of the genes, but several mutations were observed in the intron regions (genetic region that does not code for proteins) of flowering locus T. Further studies must be done to address possible mutations in the promoter and to investigate gene expression of the two genes. Sequencing of the candidate genes was a key step towards the further understanding of genetic control of flowering time in watermelon, and guiding the direction of further work associated with this important trait.

Establishment of Conditions for a Small Molecule Screen in Histomonas meleagridis

Rachel Harrison, Poultry Science Major, Department of Poultry Science; Presented in 2014

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Histomonas meleagridis, a protozoan parasite that causes blackhead disease, is of particular interest to the poultry industry because it causes high mortality in turkeys and morbidity in chickens. Currently, nitarsone, an arsenical compound banned in the European Union, is the only approved product available for preventative use against this disease. Fear that a similar ban may occur in the United States has lead to increased research looking for alternative methods to treat this disease. Traditionally, H. meleagridis is cultured in the laboratory under anaerobic conditions in modified Dwyer's medium in 25 ml flasks. Although this is an effective method for growing H. meleagridis, a large amount of reagents are required to test its growth using statistically significant replications. Realizing these limiting factors, we developed a new method to culture H. meleagridis using a 96 well plate format. To do this 600 cells were placed in 300 ul of media in each well. The plate was sealed with a MicroAmp cover to inhibit evaporation and grown in BD GasPack EZ anaerobic bag. Growth was measured at 24 hours using a Neubauer hemocytometer. Under these conditions H. meleagridis grew at a similar rate compared to the 25ml flask conditions. Having developed this methodology, we wanted to test the hypothesis that zinc and copper inhibit the growth of H. meleagridis. We measured the growth of H. meleagridis in the presence of $ZnSO_4$ and $CuSO_4$ at concentrations of 50, 100, 500, and 1000 ppm. Growth was measured at 8-hour intervals for 32 hours. No significant differences were seen in cultures treated with water or 50ppm $CuSO_4$, while cultures treated with 100 ppm $CuSO_4$ and higher showed decreased growth compared to the control at 8 hours ($P<0.05$). In addition, no live cells were observed in cultures treated with 100ppm $CuSO_4$ or higher after 16 hours. Cultures treated with $ZnSO_4$ at 50ppm and 100ppm did not differ significantly from the control. Growth in the cultures treated with 500ppm $ZnSO_4$ and higher was notably decreased at all times tested. Based on this in vitro data, $ZnSO_4$ and $CuSO_4$ may inhibit growth of H. meleagridis in poultry. Our results also suggest that a 96 well plate system could be used to successfully screen for drugs that inhibit H. meleagridis growth.

Examining brown fat: where is it located and how can it help combat the obesity epidemic?

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In rodents, brown adipose tissue (BAT) is a highly metabolic organ that can produce heat in response to cold by using lipids as an energy source. BAT is regarded as a potential tissue to tackle obesity due to its great capacity to increase energy expenditure and thereby stimulate weight loss. With obesity reaching epidemic levels, studying the location and functionality of BAT could provide new insight on how this unique organ can impact energy balance and adiposity. One of the main goals of this project was to discover new depots of BAT in regions that are highly innervated by the nervous system and where thermoregulation is important. Early studies in our laboratory have found adipocytes within the bone marrow and in the tail of rodents, however the full identity of these cells was unknown. Based on the characterization of these tissues, we hypothesized that BAT would be detected in both regions. Bone marrow and tail snips were obtained from euthanized rats and mice from various studies in our laboratory. To determine if uncoupling protein 1 (UCP1), the hallmark gene for BAT, was present in the bone marrow of rats, we extracted mRNA from bone marrow using the Trizol method, created cDNA and performed qRT-PCR. mRNA from mouse tail was obtained using the Qiagen RNeasy minikit. Immunohistochemistry was performed on 8-micron thick tail slices to detect lipid droplets and UCP1 protein. While no UCP1 cDNA was measured within the bone marrow, measurable levels were found within the tails of mice from multiple species. Immunohistochemistry of both rat and mouse tails identified multiple small lipid droplets, under 10 microns in size, which is indicative of brown adipocytes. An additional assay was performed, and UCP1 protein was found co-localized with the small lipid droplets, indicating the presence of BAT within the rodent tail. Overall, we were unable to identify evidence of BAT within the bone marrow but found promising evidence of BAT within the tail. The results from these experiments could provide researchers with new ways to study BAT and new potential mechanisms to prevent weight gain throughout the lifespan.

Olfactory Learning of Gromphadorhina portentosa

Alexander Hedaya, Biology Major, BIOL; Presented in 2014

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The formation and retention of memories in arthropods is still not fully understood. Periplaneta americana has been shown to form stable olfactory memories that may persist for seven days or more. A previously unused method of training another species of cockroach, Gromphadorhina portentosa, was used in this experiment to form and test olfactory memory. The cockroaches were fed prior to the experiment ad libitum with dry dog food to increase motivation for sugary foods. Cockroaches were trained in groups of three to associate the scent of vanilla and peppermint with a reward (orange), and a punishment (salted orange). Cockroaches detest salted orange, and refuse to eat it. Scent preference was tested after each training period by determining the subject's proximity to each scent source. Care was taken to ensure that the negatively phototactic behavior of the cockroaches did not influence the discrimination of each scent. Roaches that were trained to pair vanilla scent with reward and peppermint scent with punishment surprisingly exhibited an increased preference for peppermint compared to the control group ($t=3.571$, $p=.0008$). Roaches trained to pair vanilla scent with punishment and peppermint scent with reward exhibited no significant increase in peppermint preference compared to the control group ($t=.1543$, $p=.8780$). This suggests that the mechanism of olfactory memory formation in G. portentosa may be more complex than previously thought. The study provides a valuable platform to understand the sensory performance of small arthropods.

Analyzing the influence of climate on the iron isotopic composition of Hawaiian soils

Caitlin Hodges, Water and Soil Resources Major, Department of Crop and Soil Science; Presented in 2014

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Iron oxyhydroxides play an integral role in sorption and exchangeability of nutrients in the soil system. Therefore better understanding of the behavior of soil iron is critical. This soil iron is primarily present in minerals as oxidized FeIII. However, as oxygen becomes scarce in the soil environment, biological and chemical reactions reduce the iron to water-soluble Fe^{+2}. Although the reduction of iron in the absence of oxygen is thermodynamically favored, certain types of soil bacteria that use FeIII as a terminal electron acceptor also accelerate iron reduction. A better understanding of the drivers of iron redox in soil is crucial to understanding soil formation and nutrient bioavailability. To investigate these iron redox reactions in the soil, we installed passive and active redox electrodes at four sites along a rainfall gradient on Haleakala in Maui. The passive electrodes are rusted steel rods. Rust is mainly composed of FeIII oxides that are very common in soil. In the same way that oxidized soil iron reduces and becomes water soluble in anoxic conditions, the rust reduces under anoxic conditions and the rod becomes unrusted. The more rust that leaves the rod, the more reduced the soil in which the rod was installed. By taking pictures of the rods and analyzing them using Photoshop, the amount of reduction that occurred at the sites 7, 11, and 14 days after installation was quantified. Using this analysis we examined the change in iron reduction with respect to rainfall and time. As rainfall increases along the gradient, we expected to observe an increase in reduced iron because the rainfall can induce anoxic conditions by saturating the soil. We found a significant positive relationship between rainfall and iron reduction after 14 days ($p = 0.016$, $\alpha = 0.05$), which supports our initial hypothesis. These results confirm a common assumption in soil science that, until now, has not been tested in situ. Additionally, this study suggests that rusted steel rods provide a cost and time effective alternative of examining iron reduction in the soil that has many applications in future experiments aimed at understanding iron and nutrient dynamics.

Learning Ability of Madagascar Hissing Cockroaches (Gromphadorhina portentosa)

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Although there have been an abundance of experiments conducted on the learning abilities of vertebrates through positive reinforcement, there have not been many experiments conducted on the learning ability of insects. The specific goal of my research is to test the learning ability of Madagascar Hissing Cockroaches, Gromphadorhina portentosa, through positive reinforcement. My particular experiment has been conducted on solely adult male Madagascar Hissing Cockroaches that weigh within a range of 5-8.5 grams. I separated cockroaches into three groups of five subjects each: two experimental groups and a control group. The experimental groups were housed in a closed 7.5" x 12"in plastic container in which a sponge wrapped in plastic was placed in the middle part of the top of the container to form a barrier between the left and right sides of the container. There was an equal distance both to the right and to the left of the sponge in the container. Plastic wrap was used to prevent the sponge from absorbing odors that may confound the results of the experiment A small piece of orange was placed to the right of the sponge in one experimental group and to the left of the sponge in the other experimental group to serve as a reward. No food was found in any other areas of these containers. The control group was housed in a plastic container that had orange pieces interspersed throughout. Each group was placed in an entomology closet that was kept at a constant temperature. (23.9 degrees C.). The goal of the experiment was to see if cockroaches that were housed in a container with a reward solely on the right or left would learn to travel in the direction of the reward when placed in a trial maze that was a replicate of their own experimental maze with no reward. The control group subjects were expected to go to either side or remain still as there would be no incentive to go to either side. The cockroaches in each group were observed every three days and their relative locations in their respective containers were recorded. A piece of orange was replenished in each group every three days. The cockroaches from each group were then tested in a trial maze that exactly replicated the experimental mazes. No food reward was placed on either side of the plastic-wrapped sponge.

Growth, body composition and skeletal characteristics of commercial broiler chickens under different feeding period regimen

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As the realm of the poultry industry expands, farmers and scientists are faced with the arduous challenge of selecting for a physically fit commercial broiler. One of the traits that is often sought after is rapid growth. Rapid growth in commercial broilers can lead to changes in body composition and skeletal integrity. However, management strategies hold the key to improving skeletal integrity since the genetic relationship between growth and skeletal maladies has been shown to be very weak at best. We subjected commercial broilers to two feeding period regimens from hatch until 4 weeks (12 hours versus 23 hours), and hereafter, both groups were on a 23 hour feeding regimen until 7 weeks, then slaughtered. Birds were fed ad libitum on standard poultry diet. Body (1634 vs 1272 g), metatarsus (28.33 vs 24.28 g) and tibia (18.99 vs. 12.48 g) weights were significantly ($P < 0.01$) heavier in unrestricted birds at 4 weeks than the restricted birds. However, at week 7, there were no differences ($P > 0.05$) between the two groups (3537 vs 3476 g, 50.11 vs 55.13 g, and 30.72 vs 35.68 g, respectively). Femur weight was lower ($P < 0.01$) in the restricted birds compared to the unrestricted birds (12.48 vs 16.51 g) until week 6. The restricted group had significantly ($P < 0.01$) higher carcass (2907 vs 2580 g), Pectoralis major (725 vs 651 g) and abdominal fat (1.94 vs 1.55%) yields compared to the unrestricted group. Early feed restriction did not appear to improve skeletal integrity, but it did improve lead to compensatory growth and improved carcass yield.

Economic Feasibility of Small Scale Aquaponic Systems

Amanda Miller, Agricultural Education Major, Department of Agricultural Leadership, Education, & Communication; Presented in 2014

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The world hunger report shows a steady increase in the number of US households that struggle with hunger from 3.5 million in 2002 to 5.7 million in 2012, an increase of 61% in over 10 years. When available, healthy food is often more expensive, whereas fast-foods are generally inexpensive and readily available in low-income communities. As a result, this contributes to the obesity epidemic due to high calorie, low nutrition diets that our nation is experiencing. Today's families are three generations removed from typical family farms. It is important that they be informed about ways to produce their own food that is low in cost and high in nutritional value, hence a small-scale aquaponics system. In order to model a way for families to produce their own food at a low cost, a family size aquaponics system was constructed. How It Works. In an aquaponics setup, the fish consume food and execrate waste in the tank. Bacteria in the tank convert the toxic ammonia in fish feces into nitrate. These nitrates are used as nutrients to help the plants survive. An 8′ x 4′ grow bed was constructed and covered with Herculite liner with a tank linked to it. On the other side of the tank, a pipe connects the tank to a sump tank / submersible pump. The water is pumped into the grow bed from the tank, and flows back into the tank by gravity. Results to Date. This small aquaponics system containing catfish, koi, and vegetables such as lettuce and tomatoes, and herbs was successfully constructed and displayed at the Future Farmstead on the University of Georgia's Tifton Campus for less than $500.00. Future Plans. The current system will be used to educate and train individuals in the community of the ease and feasibility of producing nutritional foods at a low cost. Workshops and training sessions will be hosted at the University of Georgia's Tifton Campus starting in the summer of 2014. Additional research is needed to determine the return on investment with this system.

Epigenetics and Obesity: How is the Methylation in CD4+ T-Cells Linked to Obesity?

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A possible mechanism for the rapid increase in obesity may be epigenetic factors interacting between genes and the environment. Epigenetics studies heritable changes in gene activity that are not caused by changes in the DNA sequence, such as DNA methylation. Methylation occurs on a cytosine residue and can block the binding of transcription factors. If the promoter of a gene is methylated, that gene is turned off. We hypothesized that there are differential methylation patterns of obesity related genes in obese compared to lean people, which affects gene expression in obesity. To test this hypothesis we had two specific aims: first to optimize the use of bisulfite conversion and nested PCR to analyze site-specific methylation in a more efficient manner, second to utilize the technique to analyze methylation of obesity related genes. A unique aspect of this study is the use of single cell types. So far in epigenetic research, most work has used whole blood, which confuses interpretation since it has been reported that each of the different cell types in blood has a unique methylation pattern. Thus, when cell types are analyzed together, the results are misleading. CD4+ T cells were chosen for this study because they play a role in the immune response, which is impaired in obesity. A novel method to isolate the 7 major WBC types from blood was used for these cells, and other isolated cell types are also under other analysis to fully study epigenetic reprogramming in obesity. This research is an important step forward for public health in that it will characterize methylation profiles of obese vs. lean individuals, providing insight into the epigenetic reprogramming of obesity, assessment of biomarkers for treatment, and monitoring compliance and benefits of treatments. We have so far worked on our first aim, to optimize the use of bisulfite conversion and nested PCR for a more effective method to analyze these site-specific changes in obesity related genes. We will continue to follow process improvement strategies and use our optimized method to analyze methylation profiles in our study population. This will be tested using CD4+ T cells isolated from whole blood in obese (N=6, BMI 37.6±2.41 kg/m2) and lean women (N=12, BMI 21.6±1.4 kg/m2) of reproductive age.

Fueling Minds of the Future through Education Outreach and Hands-On Experience in Biotechnology

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Applications from the field of biotechnology impact society on a daily basis, making our lives healthier and allowing more wise and efficient use of our precious resources. The goal of this outreach project was to improve student knowledge of biotechnology and one of its most basic protocols, which is DNA extraction. At the end of the learning activity, students should be able to define biotechnology, recognize examples of products and practices that utilize biotechnology, and understand the steps involved in DNA extraction. Pretests were conducted prior to the workshop to establish baseline data of students' understanding of the topics to be covered. Next, students were exposed to key developments in the history of biotechnology and were given examples of current and potential applications of biotechnology in medicine and agriculture. Then, students were guided through each step of the DNA extraction process as each student performed the necessary tasks using a strawberry and provided materials. Posttests were administered at the end of the workshop to assess any change in knowledge due to the workshop. The null hypothesis predicted that there would be no difference between the mean scores on the assessment before and after the learning activity. The alternative hypothesis predicted that there would be an increase in the mean scores on the assessment before and after the learning activity. The average score on the pretest was 38.3% and the average score on the posttest was 79.7%, an increase of 41.1%. The null hypothesis was rejected after this increase in performance on the assessment was determined to be statistically significant using a one-tailed paired t-test and a p-value of 0.05. In conclusion, the learning activity was successful in improving students' knowledge of biotechnology and DNA extraction methods. One drawback to using the t-test to assess changes in knowledge is that scores may improve merely due to the testing effect and not due to the treatment, in this case the learning activity. The utilization of a control group who completed the pre and post-test but did not receive the treatment (or learning activity) would allow the testing effect to be eliminated as a possible reason for improvement in performance on the assessment.

In Vitro Protease Digestion and Reduction of Tropomyosin using Shrimp and Tropomyosin-Enriched Samples

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Of the vast range of foods responsible for adverse allergic reactions, crustaceans have been and continue to be a growing concern. The reaction caused by the consumption of crustaceans is IgE mediated, as IgE antibodies bind to the food allergen which induces a release of potent compounds. These compounds trigger symptoms of allergic reactions such as anaphylaxis, angioedema and morbilliform rashes. This study focuses on determining the most effective protease and conditions for reduction of the allergenicity of tropomyosin, the primary allergen responsible for causing adverse reactions from the ingestion of crustaceans. The goal of this study was to degrade tropomyosin into peptide fragments through protease digestion, aiming to degrade IgE-binding epitopes. Tropomyosin enriched samples and masticated shrimp samples were treated with either trypsin or α-chymotrypsin in gastric fluid at a controlled acidity of pH 2.0. In addition, the interaction of pepsin, a naturally occurring stomach enzyme, with these proteases was assessed. Two methods of digestion were performed by use of a water bath and a gastrointestinal simulator. Hydrolysates were collected at various digestion times and samples were subjected to sulfate polyacrylamide gel electrophoresis (SDS-PAGE) to analyze alterations in the molecular weight of tropomyosin. The western blot method was additionally performed for further analysis of the degree of allergen reduction for particular digested samples. From multiple variable alterations, the proteolytic ability of trypsin at a 1:25 enzyme-protein ratio in the absence of pepsin within 10 minutes of digestion time was indicated. Upon expansion of this knowledge, it may be beneficial to incorporate trypsin into crustacean-containing foods prior to ingestion so that they may be nonallergenic and safe for consumption.

Maternal high fat diets create a sexual dimorphic response in increasing the risk of fatty liver disease

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Non-alcoholic fatty liver disease (NAFLD) is becoming a critical problem in our society especially among young children. Maternal obesity affects the liver of offspring and the sex of the offspring plays a role in hepatic metabolic signaling but not much is known about this effect. Thus, the objective of this study is to investigate the sex differences in the livers of the offspring of dams fed a high fat diet (HFD) and to determine if maternal obesity contributes to NAFLD in the offspring. We hypothesize that the female offspring will have reduced risk for NAFLD compared to the males because of chromosomal sex differences. C57BL/6 dams were fed a 4.3% low fat or 35% high fat diet for 6 weeks prior to and during pregnancy, gestation and lactation. Postnatal day 21 offspring were euthanized and gene expression related to inflammation, lipogenesis and insulin signaling was measured using qRT-PCR. Changes in gene expression will be confirmed using Western blots. To assess hepatic fat accumulation, hepatic triglycerides were isolated and measured. Hepatic fat was then confirmed using histological methods. Maternal HFD offspring increased in body weight ($p<0.01$). Sex differences impacted liver weight ($p<0.03$), with females from obese dams' having significantly smaller livers than both male groups ($p<0.10$). Furthermore, maternal HFD resulted in hepatic triglyceride accumulation compared to low fat controls ($p<0.05$). Both sexes had a two-fold increase in SREBP1c, a transcription factor, which affects lipid metabolism ($p<0.02$). GLUT4 was more highly expressed in females than males ($p<0.05$). The data strongly shows that sex differences of offspring from obese dams impact the early functionality of the liver, the risk of NAFLD and obesity.

Sugar Beet Pectin Characteristics and Emulsification Properties

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Sugar beet pectin is a complex polysaccharide that has been shown to be an advantageous food hydrocolloid and emulsifier in oil-water emulsions. This research seeks to evaluate sugar beet pectin emulsifying capabilities by isolating sugar beet pectin extract into fractions and examining how different fractions, with different chemical composition, could affect it's emulsifying stability. The chemical properties analyzed here from isolated sugar beet pectin were protein (via BCA assay), uronic assay (via sulfamic acid assay), and hydrophobicity (ANS external fluorescence assay). The origin of sugar beet pectin emulsifying abilities have been linked to hydrophobic acetyl groups and/or it's high protein residues. The objective of this research is to examine how both characteristics, hydrophobicity and protein content, affect the emulsifying capabilities of fractionated pectin in oil-in-water emulsions. Four fractions were produced from sugar beet pectin from CP Kelco and were characterized using the assays mentioned. In regards to protein content, there was little variation between all four fractions. Fraction 3 had the highest protein concentration (63 µg protein/mg of AIS), followed by fraction 4 (62 µg protein/mg of AIS) and fraction 2 and 1 (61 µg protein/mg of AIS). While protein content did not reveal much difference between the four fractions, the same was seen with hydrophobicity. Oil and water emulsions were made with the isolated SBP using canola, limonene, and medium chain triglycerides. The emulsions were stored at a controlled temperature for 13 days; stability measurements were taken each day for the emulsions using a Turbiscan instrument. Results showed fraction 4 displaying no minor changes of creaming, sedimentation, or flocculation in all three oils yet it is the least hydrophobic. The emulsion containing the control and limonene exhibited the most significant sign of creaming at the bottom of the tube. Control and canola oil also showed considerable creaming near the meniscus of the tube. Fraction 2 showed a great deal of instability in terms of flocculation though out the tube in all three oils. Between the three types of oil used, limonene seemed to be the least stable, which is expected. In conclusion, no direct correlation could be made from these two qualities based on the data retrieved. Nonetheless, this conclusion was not unexpected because the exact origin of sugar been pectin emulsifying abilities are still unknown to today.

Surveying the Concentration and Instar Stages of Northern Fowl Mites Present in Bluebird Nests

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Ornithonyssus sylvarium, the northern fowl mite, is the most economically detrimental ectoparasite in the North American poultry industry and has a negative effect on the industry by causing stress in birds that can cause lowered egg production. They can enter homes when wild birds inhabit developed areas with the potential to cause irritation to humans and pets. They can also cause fatality of wild bird chicks and reduce reproductive rates in wild birds, including those endangered species. The northern fowl mite is a blood feeding ectoparasite that can survive only on avian species. It can have these negative effects by causing irritation and stress to adult birds, or in large enough quantities cause anemia or death in chicks. Despite the economic and human effects, relatively little is known about the population numbers of northern fowl mites in wild birds, transmission of the mites, how common it is from one wild bird to the next, which of the five instars are most commonly found, or even how to survey wild bird mite populations. Due to their numbers in blue bird nesting boxes across the country, blue bird nests are the focus of this study, though a small sample of other wild bird nests was also collected. Bluebird nests were collected six months after the last fledglings and parent birds left the nests in 2011 and 2012, nest debris was extracted, and the resulting debris was microscopically examined to determine residual mite populations. Numbers of mites in each instar per nest and the living or dead status of the mites were also documented. There was evidence of mites in every nest without exception, and the mites that remained died in the nest after the birds fledged. Further analysis revealed that the 2011 bluebird nests had an average of more mites than those in 2012. These results indicate that northern fowl mites are prevalent in the vast majority of bluebird nests following fledging. It appears that mite eggs left in abandoned nests continue development but are prevented from maturation due to lack of a blood meal. Because none of the mites survived more than six months, there is little or no risk of infestation of bluebirds subsequently using the nest.

Ekbom Syndrome: Bugs in the skin or tricks in the mind?

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Ekbom Syndrome, also known as Delusory Parasitosis, is commonly described as the feeling of invisible bugs crawling on or in the human skin. Statistics show that this sensation is more common in older women who live alone. Although this is a psychological issue, many people seek help from entomologists and pest control companies first, hoping to gain information as to how to get rid of the bugs they are feeling crawling in and on their skin. The hypothesis for this study was that this delusion is more likely to occur in women over the age of thirty, and that it is more common during warmer months. In order to investigate this hypothesis, telephone interviews were conducted with people experiencing this sensation. Surveys were then completed based on the symptoms experienced; data were entered, maintained, and managed in an Excel spreadsheet. The results from this ongoing study confirm both hypotheses. Women who live alone over the age of thirty are more likely to experience the sensation of invisible bugs during the warmer months. The conclusion of this study determines that the only possible solution for this syndrome is to identify any samples of the "bugs" that were sent in for entomological examination by microscopic analysis and to recommend the people experiencing the problem see a physician as it is almost always not a bug problem, but a medical problem.

Single nucleotide polymorphism marker discovery and validation in peanut

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The importance of peanut production to the Southeast is at an all-time high with 1.636 million acres planted as of 2013. However, despite these records in yields, the crop still suffers from many yield limiting diseases. Genetic variation for resistance to many diseases can be found in the cultivated gene pool of peanuts. Molecular markers are needed to facilitate the mapping and identification of resistance. In this project, we used genomic sequence from three peanut varieties, Florida-07, SPT-06-06, and Tifrunner. These genotypes are parents of recombinant inbred line populations that are currently being evaluated for disease resistance. Single nucleotide polymorphisms (SNPs) were identified using this genomic sequence and bioinformatics pipelines for SNP detection. Since cultivated peanut is an allopolyploid, polymorphic SNPs are difficult to discern from homeologous SNPs, variations between collinear sub-genome loci. We identified SNP markers that showed variation in restriction enzyme recognition sites. Using the sequences, we were able to develop primers with Primer3, a web-based primer design tool. To validate this subset of SNPs, we used a cleaved amplified polymorphism (CAP) assay by amplifying the markers through PCR, performing an enzyme digestion, and then visualizing the results through gel electrophoresis. We were able to assay seven of the markers we designed. Of those seven, only two were shown to be polymorphic and were validated as harboring true SNPs. These results indicate that our SNP detection methods detect too many false positives. Despite this, the current study is highly informative to fine tune existing SNP detection methods in cultivated peanut.

The Effects of Using Ice as an Irrigation Method for Orchids

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The use of ice to irrigate orchids has been an accepted practice for over 25 years. Recently, a company that recommends this practice was challenged by a consumer to prove that ice is not detrimental to orchids. An experiment was developed to compare Phalaenopsis orchids irrigated with ice cubes verses plants irrigated with room temperature water. One hundred orchids were split into two groups, one group irrigated weekly with 3 ice cubes, and the other group irrigated with 88.7 mL water, the equivalent of the ice cubes. Eighty-eight orchids were then placed between four different buildings to be maintained for three months by employees. Plants were placed in offices in pairs (ice vs no ice). Plants were assessed at the end of the experiment for flower senescence. In a second study, thermocouples were embedded into the medium of the 12 potted orchids at 2cm intervals. Orchids kept under controlled lab conditions had the media temperature change monitored. Data was analyzed using the Statistical Analysis Software (Raleigh, NC) GLM Procedure. The lowest temperature was measured within 2 cm of the melting ice at 15 degrees Celsius, and that temperature held for less than two hours before re-warming. At 4 and 6 cm below the surface, the coldest temperatures were 17 degrees Celsius and 19 degrees Celsius respectively. These temperatures are well above freezing and are frequently experienced by orchids living in vivo. In this lab environment experiment, there were significant ice effects seen. Orchids treated with ice irrigation and significantly less senescence or more retained flowers than warm water treated orchids. However, for the multiple location study, no significant treatment effects were seen. The use of ice as a way to irrigate orchids was found not to have a detrimental or significantly different effect on senescence overall. However, significant differences were seen ($P>.05$) in cultivar response to environment. Cultivar was a good source of great variability that statistically masked treatment effects. It was very clear that some Phalaenopsis cultivars did not tolerate interior environments well, whereas others did. No evidence was found that using ice is harmful. However its use has advantages in that slowly melting ice is better absorbed by the orchid medium than rapidly poured warm water.

Nutrient values of beef: a study of changes in composition of raw and cooked ground beef

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The nutritional aspect of ground beef (GB) is important to consumers. However, GB nutrition labels are based on the raw product which may misrepresent the true nutritional profile of the cooked product. Few studies have been done comparing the composition of raw and cooked ground beef. Given the new FSIS regulations regarding meat nutrition labels, more research needs to be done on ground beef. Our objective was to compare the fat content of retail GB raw and cooked to determine if the labeled fat content matched the actual fat within 20% and the difference in caloric content between a 113.4g raw serving and 85.1 cooked serving. Ground beef packages weighing 0.454 kg were purchased from four retail stores and were separated in half for subsequent raw and cooked analysis. Ground beef packages were purchased in duplicate for five fat classifications (diet lean (DL) <10%; extra lean (EL) 10-13%; lean (L) 14-17%; regular (R) 18-23%; high fat (HF) 24-30%) from two suppliers from each store (n=66). If a sample was not available at a particular store no attempt was made to replace it. Samples were cooked as hamburger patties to a temperature of 71°C. Duplicate total lipid extraction was performed on the raw and cooked samples following the 2:1 Chloroform: Methanol procedure. Data was analyzed using Proc Mixed (SAS, Inc), supplier within store was considered the random term. Means were considered significant at $P \leq 0.05$. Deviations greater than 20% of label claim occurred in two of the fat categories (DL and R). The deviations in the DL category all exceeded the +20% limit but the deviations in the R fat category were less than the allowed -20% limit. Raw label and actual fat and caloric content decreased as fat category decreased ($P<0.05$). Label vs. actual fat % and caloric content was different for all categories ($P<0.05$) except for L and EL. Calories from cooked patties were lower than raw caloric content for HF, R and L product when analytically measured. Actual cooked caloric content was lower than label raw values in HF, R, and L. Caloric content for EL was the same between labeled raw and cooked product. The data showed that accurately estimating caloric intake from the raw product may be very difficult and usually results in an overestimation.

Effect of Terminators on the Expresion of GFP in Hairy Roots

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Historically, genes were thought to be controlled only by their promoters, the DNA right in front of them. Now it is apparent that terminators, the DNA right behind genes, can be as important. Therefore finding good promoter-terminator combinations is necessary for obtaining optimal gene expression in plant genetic engineering. This experiment tested the effectiveness of two different plant terminators to express green fluorescent protein (GFP) in soybean hairy roots. In each construct GFP is driven by the soybean ubiquitin 2 promoter, and terminated by either the Rubisco terminator (RbcST) from pea or the soybean Kunitz trypsin inhibitor terminator (KTIT). Vectors containing the two constructs were transformed into agrobacterium, which was then used to inoculate soybean cotyledons. Two parameters will be examined for events from each vector: GFP expression (mRNA levels) and total GFP protein levels. The GFP transcription levels will be tested by performing an RNA extraction of the root tip of each event. They will then be reverse transcribed into cDNA and quantified with PCR. Total GFP protein levels will be tested by extracting the protein and evaluating the fluorescence. ANOVA and T-tests will be used to compare these results to determine which promoter-terminator combination is best. The expected result of the experiment is that both terminators will work well. The terminators are expected to work well because RbcST is already used in plants and KTIT is from soybean. If there is a difference in expression then it will further support the claim that terminators differentially affect expression levels. If KTIT does not work well it could be because KTIT does not work well with the ubiquitin 2 promoter. No matter the outcome this work is the first step in testing new promoter-terminator combinations, and further replications and experiments will be needed to ensure the results are reproducible. Currently engineered soybeans largely use promoters and terminators obtained from viruses, which are strictly regulated compared to promoters and terminators from plants. The best promoter-terminator combination can be used in future soybean research and development and will not require regulatory approval.

The effects of betaine and folic acid supplementation on growth and feather development of methionine deficient diets in chicken

Chinyere Ijeoma Uzoigwe, Biological Science Major, Department of Poultry Science; Presented in 2014

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We studied the effects of betaine (BET), folic acid (FA) and methionine (Met) supplementation on the performance and feather weight in broilers hatch to 21 days. Three-hundred male chicks were placed in completely randomized design heated batteries and fed five dietary treatments (starter), with four replicates and fifteen chicks per replicate. The diets were treatment 1 (basal-negative control, NC) 0 mg/kg_1 BET, 1.57 mg/kg FA and 0.35% L-Met, treatment 2- NC + 1 mg/kg FA, treatment 3- NC +0.19 mg/kg BET, treatment 4-NC +0.19 mg/kg BET + 1 mg/kg FA and treatment 5 (positive control PC) supplemented with 0.19 mg/kg FA +0.19 mg/kg DL-Met. Weekly pen weight and feed intake were measured and at day 21, the eighth primary covert feather was unplugged and weighed. The NC group has significantly worse growth compared to all other treatments. Supplementing NC with either BET and or FA significantly improved growth, but did not match the positive control. FCR was 12% better between NC and PC. Differences in treatment for feather weight were similar to that of growth. Supplementation of methionine deficient diets were either FA and/or BET can significantly improve early body weight and feather growth in broiler chickens.

Effect of Methionine on feather follicle development of chickens

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We studied the effects of methionine supplementation on feather follicle development in dorsal and ventral area of Cobb broiler chicken at 21 days. The diets were treatment 1 (basal-negative control, NC) 0 mg/kg -1 BET, 1.57 mg/kg FA and 0.35% L-MET, treatment 2 – NC +0.19 mg/kg BET +1 mg/kg FA and treatment 3 (positive control PC) supplemented with 0.19 mg/kg BET + 1 mg/kg FA + 0.19 ng/kg DL-Met. One hundred eighty male chicks were placed in completely randomized design heated batteries and fed three dietary treatments (starter), with 4 replicates and 15 chicks per replicate.
Twenty-four chicks were killed and ventral and dorsal skin samples were taken (24 cm2) to evaluate skin and feather follicle histology at 21 days of age. The NC and NC+FA+BET groups had shallower follicle in ventral skin compared to PC group (186.7b, 238.3b, and 552.8a mm) and smaller diameter in dorsal skin (122.3b, 131.8b, and 743.8a mm) The PC diet increased the depth in dorsal (1565.0a vs 552.8b mm) and diameter (743.8a vs 226.5b mm) compared to dorsal area. The PC improved epidermis thickness compared to NC and/or NC+FA+BET (32.4a, 21.8b, and 23.8b mm) and dermis compared to NC (243.4a and 119.9b mm). The PC improves hypodermis thickness in comparison with NC and NC+FA+BET in ventral (1,617.5b, 388.8b, and 535.3a mm) and dorsal area (1,817.1a, 723.5b and 1,285.3b mm). Supplementation and methionine deficient diets with either FA + BET can support a good early ventral and dorsal feather follicle development and skin thickness. However, methionine requirement need to be met for proper feather follicle and feathering development.

Investigating the Metabolic Changes Associated with a High-Fat/High-Glucose Diet in Swine

Emily Vermillion, Animal Science, Dairy Science Major, Department of Animal and Dairy Science; Presented in 2014

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A pilot study was conducted to determine metabolic changes of time in pigs fed diets similar to human diets. There is considerable interest from the biomedical community as to what types of changes might be seen in pigs fed high-fat, high-sugar diets over an extended period of time. A minimum number of pigs were used for this pilot study. 6 of 9 pigs were assigned to 2 experimental groups, and the remaining 3 pigs were assigned to a control group. The experimental groups were fed a 12% fat, 20% sugar diet in predetermined rations to control ADG, and the control group was fed a normal diet according to NRC guidelines. Diets were analyzed for ADF, NDF, fat, protein, and caloric density to ensure nutritional content. Pigs were weighed weekly. Weights indicated that the pigs in the experimental group had a significantly lower feed:gain ratio, indicating expected weight gain associated with a high calorie diet. Following a 12 hour fast, pigs were bled via a jugular stick on days 1, 28, 56, 84, 98, and 112, and samples were tested for the metabolic markers triglycerides and glucose. Glucose levels and triglyceride levels showed little variation between groups. Additionally, on weeks 12, 14, and 16, one pig from each pen was transported to the UGA MSTC, slaughtered, and the heart, liver, kidney, and pancreas were harvested for gravimetric, observational, and ether extract analysis. Gravimetric differences existed between the groups, as the livers of the experimental pigs weighed an average 30g more than the control liver, and, additionally, some liver streaking was noted in both of the experimental pens, and was absent in the control group, indicating possible early onset of fatty liver disease. Ether extraction results showed that the experimental groups also had a greater percentage of fat in their organs than the control group, with a 1.23% difference in the liver, and a 3.7% difference in the heart. Results of slaughter indicate early onset of metabolic syndrome-type symptoms, such as fatty liver, central obesity, and atherosclerosis; however, triglyceride levels show little evidence of this. A study of longer duration and with a larger number of pigs may potentially yield results with significant variations in blood serum glucose and triglycerides.

Emulsifying Capacity of Sugar Beet Pectin in Different Oils

Luke Wallace, Food Science Major, Department of Food Science and Technology; Presented in 2014

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Introduction: The goal of this study was to examine the emulsion-forming capacity of sugar beet pectin solutions, which were chemically characterized in a related study, in different oils over time. Methods: Fractions were separated from a 2.0% SBP solution based on their solubility in ethanol. Dehydrated AIS samples were mixed with three different oils: limonene, canola oil, and MGT oil to form eighteen emulsions the stability of which was monitored over the course of two weeks. Results/Discussion: Both fractions compared (fraction two and four) formed more stable emulsions than the control pectin in all three oil mixtures. The most stable oil-fraction combination was fraction two and limonene, the particle size of which remained consistent over the two-week period (around 10 µm). Emulsions formed with MGT oil invariably showed signs of failure; usually experiencing an increase in particle size before the other two oils when mixed with the same samples. More consistency in regulating the pressure of the Avestin homogenizer could have improved initial emulsion stability and prevented shortages in the first few emulsions formed. Instead of simply inverting the test tubes before testing the sample particle size in the Malverin Mastersizer, using a test tube vortex could have improved the consistency of the sample measurements. The values obtained from this assay were subject to fluctuations over the course of the study. While more consistent that the particle size assay, computer issues with the turbidity assay led to issues in extracting the associated data. This resulted in missing data. Due to issues in sampling and time constraints incurred due to a lab flood, more data needs to be gathered to confirm these conclusions. Conclusion: While the data from this study suggests that alcohol insoluble solids from SBP may serve as a suitable emulsifier, more data is needed to confirm the trends in this study.

Characterization of Soybean Host Resistance and Asian Soybean Rust (ASR) Pathogen Variability for Durable Resistance

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The United States is the largest producer of soybean in the world. According to the USDA Statistic Service, soybean production is responsible for $37.6 billion earned in the United States and is therefore considered a major crop. As of 2004, Asian soybean rust (ASR) caused by Phakopsora pachyrhizi has posed a threat to soybean production in the United States. It was reported that ASR can cause up to 50% yield loss in U. S. farms. The resistance to ASR is controlled by five resistance genes (Rpp1-5) that have shown to be ineffective when challenged with different ASR isolates. The study of the genetics of resistance to ASR and the variability of ASR pathogen populations can assist in the rapid and efficient development of new durable resistant varieties. There are two objectives for this project: 1) To phenotype ASR isolates collected from Georgia fields from 2012-2013 on a set of soybean differentials and, 2) to analyze ASR pathogen variability and population structure. We have collected a set of field isolates from 5 different locations in Georgia and phenotyped the isolates on 8 differential soybean lines by scoring the resistance reactions 14 days after inoculation. Additionally, the ITS (Internal Transcribed Spacer) region in the collected isolates was cloned with a PCR-based approach, sequenced and used for phylogenetic analysis to further characterize the isolates. Correlation of the phenotypic and sequence data indicated that a total of 20 genotypes are present in the Georgia field isolate collection and represent 8 isolates. Each isolate is mixed and has a different combination of the 20 genotypes at the different locations. These data will provide a better understanding of the population structure of the current Georgia ASR field isolates and assist in the characterization of potential durable resistance against ASR.

Testing Clinging Strength of Madagascar Hissing Cockroaches

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The Madagascar Hissing Cockroach, Gromphadorhina portentosa is one of the biggest species of cockroaches in the world that grows to 2 to 3 inches at full maturity. They are wingless and inhabit rotting logs and leaf litter. They are kept as pets outside of their native range and are amazing climbers. They are known for making a loud hissing noise when disturbed. In this experiment the cockroaches' clinging strength was investigated whether their ability changes over time. There is little to no research on these cockroaches in this field except for a study on the foot morphology and substrate adhesion. Ten female and ten male cockroaches were divided into two groups of five, one being the control group and the other the experimental. Rings were glued to the pronotum of each roach. attached to the roaches that were placed on a wooden dowel below a box to which a string pulley system was attached. At one end of the pulley the string was attached to a graduated cylinder which was filled with water until the roaches let go of the dowel at the other end of the pulley. This experiment was conducted over a six week period. The data suggested a trend of the roaches getting weaker over time. Their were outliers but the roaches generally held less and less water over time. This might be due to a lot of roaches losing tarsi over the span of the experiment. The loss of tarsi prevented them from clinging to the dowel properly. Also, it was generally noted that females held more weight than the males.

The total level of uterine IgG and IgA measured relative to vaccination for bovine reproductie disease in dairy cows

Shireen Zolghardi, Animal Science Major, Department of Animal and Dairy Science; Presented in 2014

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Vaccination is an important tool in management of infectious diseases. Tritrichomonas foetus (Trich) is an important parasite of cattle. Trich causes reproductive problems in both cows and bulls. Cows can clear the parasite, but bulls generally develop chronic and persisting infection. One commercial vaccine, TrichGuard®, is available in North America for use in management of Trich. The study presented here is a component of a larger study conducted by the Food Animal Health and Management group in the UGA College of Veterinary Medicine. Seventeen cows were selected for the study based on showing no signs of reproductive problems and no evidence of Trich infection. The cows were split in two groups. One group received the TrichGuard® vaccination according to the manufacturer's directions (a priming injection followed by a booster injection after 3 weeks. Blood samples were collected prior to the first vaccination and at day 7, 14, 21, 28, 42, 56 after the first vaccine delivery. One hundred mL uterine flush with sterile phosphate buffered saline containing 0.5% bovine serum albumin were collected was collected at the same time. Serum from blood and uterine flush fluid were stored frozen. In this study, we measured the total quantity of IgG and IgA in flush fluid in each of the samples collected to give an idea of the level of circulating antibody enhancement and activation of local uterine immunity, respectively. Total IgG was measured using a sandwich ELISA (developed in Dr. Hurley's lab) and a commercial IgG standard. Total IgA was measured using a commercial reagent set (Bethyl Labs, TX). The cows were not sorted into equivalent groups for Trich antibody, so the IgG and IgA levels of control cows was much higher than in the vaccinates. We found that relative to the starting values of IgG the cows in the vaccinated trial group had an overall increase in IgG by days 42 and 56. In the reproductive mucosal tract we found that there was a significant increase in total IgA on days 21, 42 and 56 for the group vaccinated with TrichGuard®. No significant changes were seen in the controls. Our conclusions were that Trich vaccination caused a general activation of both systemic and local immunity in the vaccinated cows.

Anesthetic Complications in Dogs Undergoing Surgery for Liver Disease

Brigid Burns, Animal Science, Biological Science Major, Department of Animal and Dairy Science; Presented in 2013

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A dog with ongoing biliary disease may undergo a surgical procedure called a cholecystectomy, in which the gallbladder is completely removed. In the authors' clinical experience, patients with gallbladder disease tend to have a higher incidence of complications during anesthesia, including hypotension during manipulation of the gallbladder or following cholecystectomy. The purpose of this retrospective case-control study is to determine if there is a difference in the incidence of anesthetic complications between dogs with hepatic disease undergoing cholecystectomy compared to dogs undergoing other types of hepatic surgery. The hypothesis was that dogs that receive cholecystectomies would suffer a greater number and magnitude of anesthesia complications than dogs that do not undergo cholecystectomy. The medical records of dogs that underwent exploratory laparotomy for surgical management of liver disease at the UGA Small Animal Teaching Hospital from January 2007 to October 2011 were studied. Continuous data was analyzed using a Mann-Whitney U test, whereas categorical data was analyzed using a $\chi 2$ test. We found that dogs that had cholecystectomy had longer anesthesia durations and longer surgery durations than dogs that did not have cholecystectomy. No significant differences existed for temperature nadir (94.6 vs. 95.6 ºF; non-cholecystectomy vs. cholecystectomy), final temperature (96.1 vs. 96.7 °F), time to extubation (29.5 vs. 48.9 min), duration of hypotension (26.8 vs. 20.8 min), or blood pressure nadir (53.3 vs. 51.4 mmHg). Hypotension occurred in 66% and 74% and inotropes were used in 64% and 53%, for non-cholecystectomy and cholecystectomy patients, respectively. Dogs undergoing liver surgery for cholecystectomy did not suffer a greater number of anesthesia complications than dogs without cholecystectomies.

In-situ Enzymatic Oxidative Treatment for Perfluorinated Compounds

Josh Caldwell, Environmental Resource Science Major, Department of Crop and Soil Science; Presented in 2013

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Perfluoroalkyl compounds (PFC's), such as perfluorooctanoic acid (PFOA), are a group of persistent, toxic, and bioaccumulative compounds commonly used as surfactants in household items and industrial applications. PFC's are used in aqueous film-forming foams (AFFF's) which are utilized in fire-fighting applications. High concentrations of PFC's have been found in soil and groundwater surrounding fire-fighting practice sites around the United States. Currently no technology exists to effectively remediate PFC's from soil and groundwater. Dr. Huang and his lab have proposed a novel remediation scheme which may provide a method for in situ treatment of PFC's. Utilizing laccase (a fungal extracellular enzyme) along with cofactors may convert PFC's into free radicals to be incorporated into soil organic matter (SOM). A bench-scale study was performed to test the effectiveness of laccase/cofactor addition at degrading PFOA. 50 mL glass centrifuge tubes were used as batch reactors for the PFOA contaminated soil slurry. Soil was spiked to contain 10μg PFOA g-1 soil, and laccase was added along with 1-hydroxybenzotriazole to promote degradation. Soil slurries were mechanically shaken for 10 days, with addition of laccase every 48 hours, keeping a constant volume of 1.5mL in each batch reactor. After incubation, PFOA was extracted from soil via a solid-phase extraction procedure developed by our lab. Once extracted, PFOA was quantified using a Waters Micromass Quattra tandem mass spectrometer (Waters, Milford, MA). Data output was measured against five-point calibration curves generated using standard concentrations of PFOA ranging from 0.05mg/L to 20mg/L. PFOA presence in soil slurry was decreased 43.9% and 55.8% respectively in the presence of laccase and cofactors. No statistically significant PFOA removal was reported in blank batch reactors. Addition of laccase and cofactors into a PFOA contaminated soil slurry significantly decreased PFOA concentration in the slurry after 10 days of incubation. In laccase treated soils, PFOA, which remained unavailable after extraction may have been incorporated into humic substances in soil via covalent bonds. This is consistent with the hypothesis that organic pollutants convert into free radicals upon reaction with laccase and incorporate into SOM.

Choice of Conjugase Enzyme is Critical in the Determination of Folate Contents in Selected Fruits and Vegetables

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Folate contents in selected fruits & vegetables were determined by the classical trienzyme-microbiological assay. Various sources of conjugases – folylpolyglutamyl hydrolyzing enzymes – can be used. Chicken pancreas is the most common, but Difco™, the main supplier, has discontinued the product. The objective of this study was to evaluate the performance of chicken pancreas conjugase vs. rat plasma conjugase in the determination of folate contents in selected fruits & vegetables. A microplate assay using Lactobacillus casei subspecies rhamnosus-ATCC 7469, a folic acid standard, and a 96-well microplate reader was employed. Each conjugase tested exhibited a unique efficacy with regard to hydrolyzing folylpolyglutamates. Using chicken pancreas conjugase, the folate levels determined in µg/100g were for spinach (147±11.1), green peas (77±10.2), cauliflower (76±13.2), corn (53±2.2), green beans (40±1.4), strawberries (32±4.8) and blueberries (4±0.2). Employing rat plasma conjugase, the folate levels for all fruits & vegetables were significantly ($P<0.05$) lower; levels determined in µg/100g were for spinach (64 ±6.0), green peas (32±1.7), cauliflower (21±5.3), corn (21±3.5), green beans (26±3.3), strawberries (24 ±3.2) and blueberries (2±0.1). Comparing the results to values reported in the USDA National Nutrient Database for Standard Reference shows that samples digested by chicken pancreas conjugase are in line with the Database. The difference in folate levels between the conjugases is due to the food matrix and that the rat plasma conjugase is not as efficient in hydrolyzing folylpolyglutamyl residues to di- and monoglutamyl folate. The Lactobacillus casei requires the di- and monoglutamate for its growth, which is measured as an increase in turbidity by the plate reader. Factors to convert folate levels between rat plasma and chicken pancreas conjugase were determined and are for spinach (2.30), green peas (2.41), cauliflower (3.62), corn (2.52), green beans (1.54), strawberries (1.33) and blueberries (2.00). The greatest discrepancy in efficacy between chicken pancreas and rat plasma was in cauliflower and the least in strawberries. The conversion factors can be used to correct for folate contents in future research when only rat plasma conjugase is available.

Role of Reticulitermes in temperate soils: a correlational study of micronutrient availability and termite activity

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The purpose of this study is to determine the role of subterranean termites in the temperate soil ecosystem, specifically the role of Reticulitermes in micronutrient cycling. The treatments in this study included samples of 'soil' from the following: termite frass collected from laboratory cultures given only wood, shelter tubes collected from in-field termite feeding sites called inspection ports (IPs), and soil samples taken 1m away from the IPs. An IP consisted of a 15cmx10cm polyvinyl chloride pipe containing pieces of wood and capped by a plastic lid. The concentration of eighteen elements within the samples were analyzed by the University of Georgia Center for Applied Isotope Studies via a Mehlich #1 double extraction procedure, inductively coupled plasma mass spectroscopy (ICP-MS), and a Braun-Lubbe auto analyzer II. Using Excel, the localized concentrations were organized into bar graphs based on descending termite involvement and lines of correlation were drawn. The mean and standard error was also determined for each sample group. A a positive trend denoted a negative correlation between micronutrient availability and termite activity; basically, subterranean termites take the element in question from the soil habitat. A negative correlation was found between lead and copper concentration and termite activity. Conversely, a positive correlation was taken to indicate termites added specific elements into the surrounding soil. A positive correlation was found between termite activity and the following elements: potassium, sodium, manganese, boron and magnesium. Therefore, these elements were added to the soil by termites.

A Proteomic Analysis of Tomato Fruit Infected by Botrytis cinerea

Dervin Cunningham, Biological Science Major, Department of Poultry Science; Presented in 2013

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Botrytis cinerea attributes to the post harvest rot of more than 200 species of fruit and vegetables. As these produce ripen, their cellular wall drastically degrades, making them more susceptible to pathogens. Significant protein-protein interactions occur between the necrotrophic fungal pathogen, Botrytis cinerea, and the tomato fruit. By describing host and pathogen proteomes simultaneously in infected tissues, the plant proteins that provide resistance and allow susceptibility and the pathogen proteins that promote colonization and facilitate quiescence can be identified. This study is aimed to characterize the fruit and fungal proteins occurring in the B. cinerea/tomato interaction using shotgun proteomics. Mature green, red ripe, wild type and rin and nor mutant tomato fruit were infected with B. cinerea B05.10. After 5 days the infected tomatoes were gently agitated in a 1.5M NaCl solution followed by a SDS and heat treatment to collect solubilized proteins. The collected proteins were separated on a one dimensional SDS-PAGE gel, followed by in-gel digestion. Peptides were then analyzed by LC-MS/MS on a linear ion trap mass spectrometer. Data was searched using Mascot algorithm. Proteins were identified by combining the B. cinerea BO5.10 (Broad Institute, MA), and T4 databases (Genoscope, France) with a tomato protein database (SOL Genomics Network, Cornell University, NY). A decoy database was constructed by reversing the sequences in this target database. Statistically significant proteins were determined at a 1% protein FDR. The composition of the collected proteins populations and their putative functions allow for a better understanding of the plant-pathogen interaction mechanism.

The Bacterial Overexpression and Purification of Red Fluorescent Protein

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Red Fluorescent Protein (RFP) is bioluminescent protein that is routinely used as a marker protein in cell biology research. In these studies, it has been used as an epitope tag to analyze gene expression. For these types of experiments, a high quality antibody directed against RFP is essential. As such, relatively large amounts of the purified protein are required to serve as an antigen for the immunization of animals to generate antibodies against RFP. To generate sufficient quantities of the purified RFP protein, the pET28b bacterial overexpression system was employed. The gene encoding RFP was ligated into the multicloning site of the pET28b vector and the pET28b-RFP gene construct was transformed into BL21-DE3 host bacteria. In initial experiments, a time course of RFP expression was performed. Bacterial expression of RFP was analyzed by SDS-PAGE at 0, 15, 30, 60, and 120 minutes after induction with IPTG. Overnight induction n levels were also analyzed. Expression of the 34-kilodalton RFP was clearly detectable after 30 minutes of induction and high levels of the protein were generated at, 60, 120 and 180 minutes after induction. Overnight levels of induction were also high, and showed no signs of proteolytic degradation. The 6-His tagged RFP protein was subsequently purified via metal chelation affinity chromatography. A one liter culture of the pET28b-RFP / BL21-DE3 bacteria was induced overnight and a bacterial lysate was prepared. The bacterial lysate was subjected to metal chelation affinity chromatography using a 3mL His-Select column. Analysis of the column fractions using SDS-PAGE indicated that this technique generated a RFP protein that was approximately 95% pure.

Clinging Strength of Madagascar Hissing Cockroaches

Richard Evans, Biology Major, Biol; Presented in 2013

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The purpose of this experiment was to study the ability of a Madagascar roach to cling to a surface while weight was added via a hook attached to the roach pronotum. There is currently little to no research on the topic, as all that was found was a study on the adhesiveness of the Madagascar roach to various substrates (Codd, Journal of Insect Science 2010) This leaves the area of roach strength essentially untapped. The central questions are determining how much can the roach hold, does it progressively fatigue, and is it getting stronger? The experiment was carried out by first attaching a hook to the pronotum of the roach with super glue, and then weight was added to the roach by pouring water into an attached cup. The amount of water was then measured with a graduated cylinder and recorded as a measure of strength for each roach. This procedure was performed twice each measurement and three times a week. The results showed that on the second trial of measurement the roach could not hold as much as the first trial. Results also indicated that males, in general, hold more than do females. The last result worthy of note is that rear legs are the focus of the roach's attempt to hold on. This experiment achieved the goal of simply learning more about the ability of the Madagascar roach to hold weight. The roaches all seemed to display characteristics that helped them to either hold more or less weight based on what they were doing with the weight attached.

High Moistrue and Contact with Manure Decreases Paw Quality

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Footpad dermatitis (FPD) is a condition that affects the plantar surface of the foot in poultry. It is caused by a combination of high litter moisture, friction from bedding materials and contact with fecal material. Litter moisture is considered to be the primary causative factor. This condition not only results in downgrades and condemnations of saleable chicken paws, causing significant economic losses to broiler companies, but is also an indicator of how well a poultry house environment is managed in animal welfare audits. Previous work has indicated that FPD lesions form in the first 2 weeks of grow-out. The objective of the current study was to evaluate raised plastic flooring systems relative to the incidence and severity of FPD. The flooring systems used in the current study included: Trial 1 - a solid plastic flooring system designed to dry the manure, Trial 2 – a plastic flooring with 6.4mm holes, Trial 3 – a plastic flooring with 25mm holes. All of the raised plastic flooring systems were compared to a control of three inches of pine shavings, the most common bedding used in poultry production in Georgia. Weekly evaluations of FPD were conducted using a three-point scoring system. Three separate trials were conducted and each had different flooring materials compared to a control. The results indicated that FPD scores get progressively worse each successive week. When birds were reared on a raised plastic flooring system that allowed feces to fall through less manure contact with footpads), better footpad scores were observed. It is concluded the more contact that the birds have with high moisture litter and manure, the progressively worse the footpad scores will be. Rearing the birds on raised plastic flooring may be an way to reduce FPD. Additional work is needed to examine the economic, labor and performance factors associated with such a system.

The Integration of HB9 Mouse Motor Neurons in Chicken Embryo's Central Nervous System

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This project aims to investigate the potential of mouse embryonic stem cells (ES) to integrate into the central nervous system (CNS) of a developing chicken embryo. The chicken was chosen because it is a model for developmental biology and the embryo can be easily accessed. Mouse ES cells differentiated to a motor neuron (NM) fate using Purmorphamine and Retinoic Acid were injected into the chicken embryo at different stages of development. Approximately 10,000 mouse NM (either early or late staged) were injected into stage X and stage 15 chicken embryos and then allowed to continue to develop. Seven days after injection, the quantity and location of NM in the CNS were accessed. It is important to note that the mouse ES cells are a transgenic cell line that express a green fluorescent protein (GFP) reporter driven by a NM specific promoter allowing for efficient evaluation of NM survival and integration. Stage X chick embryo injected with early and late stage MN did not contain any GFP positive MN within the CNS. Both early and late stage MN caused significant mortality, 11% and 37% survival respectively. Thus the late stage MN appear to be less detrimental than early stage MN to stage X chick embryo viability. However, MN integration into the CNS could not be confirmed by GFP expression. When repeated with stage 15 chick embryos, 2 of 3 (66%) eggs injected with late stage MN and 4 of 6 (66%) eggs injected with early stage MN survived the injection. One from each group contained GFP expressing cells. Stage 15 chick embryos were more conducive to NM injections than stage X chick embryos. Based on these results, mouse derived NM can survive within chicken embryos and further refinements to the experimental protocol will improve MN viability and integration into the chick CNS.

Motor Function Analysis in a Middle Cerebral Artery Occlusion Stroke Pig Model

Jessica Guthrie, Animal and Dairy Science Major, Department of Animal and Dairy Science; Presented in 2013

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Worldwide, stroke affects 15 million people per year, killing 5 million of these individuals and leaving 5 million permanently disabled. Despite its worldwide significance, there is only one FDA-approved treatment for strokes largely due to the limitations in stroke research. A major limitation is the reliance on rodent models to test the effectiveness of stroke treatments. Due to the anatomical similarities between human and porcine brains, a porcine model could revolutionize research in stroke therapies. A major parameter used to study the deficits and recovery in post-stroke patients is motor function which can be assessed through changes in gait symmetry. The objective of this study was to determine gait symmetry in Yucatan pigs before and after induction of ischemic stroke by cauterization of the middle cerebral artery. Synchronized high-speed cameras placed perpendicular to the line of travel captured footage on each side of the pig as it walked through a chute. These videos were recorded at 3 pre-stroke and 5 post-stroke time points ranging from 24 hours to 30 days for two pigs. Videos then underwent quantitative analysis utilizing EquineTec (Monroe, Ga, USA) software to assess changes in swing and stance time, step length, velocity and hoof height for both front and hind legs. After statistical analysis, significant gait asymmetries were found to be present in both pigs for front hoof height, step length, swing time, and stance time. In previous human studies of middle cerebral artery ischemic stroke, similar asymmetries were seen in step length, swing time, and stance time supporting the use of porcine models for human stroke study. Due to the small sample size and individual discrepancies seen in this study, further studies are warranted to ensure the reliability of this study's findings.

Analyzing the influence of climate on the iron isotopic composition of Hawaiian soils

Caitlin Hodges, Water and Soil Resources Major, Department of Crop and Soil Science; Presented in 2013

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Soil iron provides significant ecosystem functions; thus it is critical to understand iron's behavior during soil development. My study focuses on the role of rainfall in redistributing iron in the soil profile and uses isotopic techniques to describe the behavior of soil iron. Both equilibrium and kinetic isotope effects predict the heavier isotopes will be retained in the soil preferentially. Redox reactions are the main drivers of soil iron isotopic fractionation; therefore the greatest isotopic fractionation should be observed at the highest rainfall. This climate-influenced process of iron fractionation is documented on 400 ky soils, the question I seek to answer is whether iron isotopic fractionation also occurs on younger soils, and if so, whether there is a difference in rate of isotopic fractionation. I expect isotopic fractionation to manifest at much higher rainfalls on the 20 ky old soils than on the 400 ky soils because the soils have had less time to weather. For my study of iron fractionation, I selected a site in which all factors of soil formation are well constrained. I selected a 20 ky lava flow on the island of Hawaii for my study because it provides an ideal isolation of slope, climate, parent material, and biota. I isolated the factor of climate using soil samples of varying elevation. At the higher rainfall end of the climate gradient soils remain anoxic for sufficient periods of time to generate iron-reducing conditions, which I expect to drive the most pronounced isotopic fractionation. To analyze my selected samples, I digest and purify the soils to remove all other metals, salts and organics. First, I dissolve the mineral soil using undiluted ultra-high purity acids. Then, using anion exchange resin columns I isolate iron from the solution. Once I complete the digestion and purification process for all of my samples, I plan to send them to our collaborators at Oregon State University who will analyze the Fe isotopic composition on a multi-collector inductively coupled plasma mass spectrometer.

Foraging Behavior in Solenopsis invicta

Rachel Hughes, Entomology Major, Department of Entomology; Presented in 2013

Faculty Mentor: Marianne Shockley Cruz, Department of Entomology

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Ants are eusocial insects with complex foraging practices. Solenopsis invicta, the red imported fire ant, is an invasive species and poses threats to local wildlife and farmed commodities. Understanding the foraging methods employed by S. invicta may shed light on how to improve management practices and control as well as broaden the general behavioral knowledge base on ant foraging methods. The basis of the experiment came from prior observations I made about S. invicta responding to cat's milk supplement that had been left out for rodents. I preliminarily observed that the fire ants came in great abundance to the cat's milk supplement and also collected and arranged debris in and around the liquid. I decided to do a more controlled experiment to explore this further. This study focused on how the ants responded to different liquid variables: whole milk, cat's milk supplement and water, which served as a control. To study both quantitative and qualitative reactions and behaviors with the liquid variables, I employed the use of video recording. I analyzed over eighty hours of footage, focusing on arrival times, number of ants, temperature conditions and use of debris in the foraging process. Each trial went from around 9:30 in the morning until dusk. Cat's milk supplement trials overall had the earliest arrival times, the largest number of ants, the most growth in number of ants over the time period as well as significant use of debris. Whole milk showed a moderate arrival time, a lesser number of ants overall at a fairly static rate and little or no use of debris. Water, the control, showed a late arrival time, very little if any activity and no use of debris. Air and soil temperature throughout all of the trials remained fairly consistent. The results were intriguing and warrant further study. In the future, I would like to expand this work with laboratory controlled trials isolating specific chemicals within the liquid variables to understand the higher attraction rate to cat's milk supplement as well as taking a closer look at the use of debris.

Omnigen-AF supplementation enhances L-selectin expression and reduces the level o fmastitis in dairy heifers

Jeanette Jiricek, Animal Science Major, Department of Animal and Dairy Science; Presented in 2013

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Mastitis is an infection of the mammary gland that increases the level of somatic cells in milk and damages the mammary tissue, potentially leading to a permanent decrease in the animal's productive capacity. Because of dairy cattle's increased susceptibility to developing mastitis, especially around the time of calving, mastitis has become one of the most common and costly diseases in the dairy industry. Our project was to determine the effectiveness of Omnigen-AF, a yeast and B-complex vitamin feed supplement, as a management tool to prevent mastitis in bred dairy heifers. It was our hypothesis that feeding Omnigen-AF 60 days prior to parturition would stimulate the animal's immune system to better recognize and protect against mastitis-causing agents that enter the mammary gland, thereby resulting in less mastitis cases and increased milk production. The heifers on the Omnigen-AF trial were split into 2 groups and received either control feed or feed supplemented with Omnigen-AF. Monthly blood and mammary secretion samples were collected from both groups and tested for immunological parameters such as bacteriological status, total somatic cell count, and differential cell count in mammary secretions, and L-selectin expression on peripheral blood leukocytes, which is an adhesion molecule that helps draw leukocytes into infected tissues and heightens disease resistance. Results to date demonstrated that L-selectin activity was greater in blood from the Omnigen-AF-supplemented heifers. Additionally, supplemented heifers exhibited a 2.7-fold reduction in mastitis (11.1% vs. 30.1%) by 10 days post calving. Somatic cell counts were reduced 2.4 fold (183,000 cells per ml vs. 441,000 cells per ml) in the Omnigen-AF supplemented heifers. Moreover, supplemented heifers exhibited a 7-pound increase in milk production by week 5 of lactation. These data support our hypothesis that feeding Omnigen-AF during the pre-partum period protects dairy heifers against mastitis by stimulating the L-selectin activity of the immune system. Data also suggest that Omnigen-AF leads not only to an overall increase in milk production, but also helps produce a better quality product due to the lower prevalence of somatic cells in milk.

Population dynamics of Cowpea Curculio in Georgia

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Field management of the cowpea curculio, Chalcodermus aeneus (Boheman), a major pest of southern peas or cowpea, Vigna unguiculata (L.), was evaluated in 2012 at Tifton, GA with the intent of providing the best strategy to prevent pod damage and document population dynamics. Cowpea curculio has developed resistance to pyrethroid insecticides in recent years in Georgia which has been the primary tool for control. New insecticides with new modes of action were evaluated for the control of this pest and several products/product combinations provided good weevil control including fipronyl (Regent), oxamyl (Vydate), beta-cyfluthrin (Baythroid) + PBO, chlorantraniliprole + lambda-cyhalothrin (Voliam Express), and chlorantraniliprole + thiamethoxam (Voliam Flexi) plus zeta-cypermethrin (Mustang Max). Unfortunately, Vydate and Regent will likely not be labeled on southern peas. A new modified Tedder's trap was developed for monitoring curculio population dynamics. This new trap design is providing exceptionally good early season counts and clearly shows that adults move as early as April 16th. Population dynamics of cowpea curculio was described for a complete annual cycle.

CTAB and Qiagen DNA extraction protocols more effective for wide range of plant species than SDS extraction protocol

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Extraction of high quality DNA, a requirement for various downstream applications, from plant tissue is often complicated by the presence of secondary metabolites, resulting in poor DNA quality or low yield. Success of the extraction is largely dependent upon the protocol used and secondary metabolite production in the study species. This study tested for differences in the quantity and quality of DNA extracted by three methods from species producing high amounts of alkaloids or terpenoids, secondary metabolites frequently problematic in DNA extractions, to learn if the extraction methods differed in their effectiveness at dealing with presence of alkaloids and terpenoids. DNA was extracted from Asimina triloba and Vinca minor (alkaloid producers), and Pinus strobus and Aloysia citriodora (terpenoid producers) using a cetyltrimethylammonium bromide (CTAB) protocol, a sodium dodecyl sulfate (SDS) protocol, and a Qiagen DNeasy kit. Samples were analyzed by NanoDrop spectrophotometry to measure quality and quantity of DNA and run out on agarose gels to confirm presence of nucleic acids. Non-degraded total genomic DNA was recovered from all species and extraction methods except SDS extraction of P. strobus. Regardless of species, Qiagen extractions produced relatively low DNA yield but very consistent yield and overall DNA quality. CTAB extractions produced high DNA yield in all species, but yield and overall quality were variable between species. SDS extractions produced samples with low protein contamination from all species, but salt contamination varied from low to very high across species. No trends between secondary metabolite produced and overall quality of DNA recovered from extraction method were observed. Based on these observations, Qiagen kits are useful for extracting average to good quality DNA from a broad range of plant species where low yield and higher cost per extraction are acceptable. CTAB is a cost-effective extraction method for a broad range of species where DNA yield is prioritized over purity. Quality of DNA recovered from SDS extractions is too variable for SDS protocols to be preferred for most species. These findings may help guide researchers in selecting a DNA extraction method to begin work with new species of study.

Addition of a Weighted Load Causes Gait Adaptation in Performance Horses

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Injuries to a performance horse's lower leg are common and often result in lameness causing the horse to be retired. Adaptation to carrying weight, asymmetries in the weighted load, or natural asymmetries in an individual horse's motion may affect joints directly related to weight bearing due to the pressure placed on lower leg bones and tendons. One can assess the potential impact of this on the longevity of the horse's career by analyzing the relationship between symmetrical and asymmetrical added weight distribution and its influence on the corresponding joint angles and other stride parameters. Using synchronized high-speed cameras, eight sound horses were recorded for multiple repetitions trotting through a 24.4×1.5 meter chute to evaluate stride length, stride velocity, swing time, stance time, and angles of front and hind leg using the program EquineTecTM. Each horse was subjected to three treatments in a random order: no added weight, equal distribution of 45 kg added weight, and unequal distribution (40:60) of 45 kg added weight. Observations indicate that horses bring their limbs farther underneath their center of gravity when carrying a load, which increases the dorsiflexion of the fetlock joint ($P<0.05$). Unequal distribution of weight does result in some gait adaptations, primarily in the proximal portion of the limb compared to the distal portion. The most stimulating finding was the smaller minimum front fetlock angle, which indicates that more pressure is placed on tendons, ligaments, and bones in the lower leg with added weight. Some natural gait asymmetry is present in horses, as observed by asymmetrical results across treatments in some gait parameters, including hind fetlock dorsiflexion. Research of this topic is limited due to the difficulty of creating standard conditions measuring appropriate values to determine if there is an association between rider weight distribution and degree of lameness.

Effect of Branched Regions of Pectin on Glucose-Binding Capacities

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Pectin is an anionically charged, heterogeneous polymer extracted from plant cell wall, composed of partially methyl esterified linear backbone of α-(1,4)-D-galacturonic acid (smooth region) and rhamnogalacturonan, a highly branched structure with neutral sugars (hairy region). Although pectins are known to bind to nutrients to prevent their absorption in the small intestines, which aspects contribute to binding is still unknown. This experiment investigated the possible role of sugar beet pectin, citrus pectin, and various modified pectins to lower postprandial serum glucose. Sugar beet pectin (SBP), citrus pectin (CP), pectin methylesterase charge modified citrus pectin (MP) and ethanol precipitated SBP (F3SBP, F5SBP) were used as samples. Each 1% (w/v) pectin solution was dispersed in water and separately mixed with 50 mM of glucose. An aliquot of 1 mL of each sample was dialyzed for 6 hours at 37°C and free glucose in the dialysate was measured by a colorimetric assay at intervals of 30, 60, 120, 240 and 360 minutes. Pectins incubated with water served as controls. The amount of uronic acid and neutral sugars in the samples were determined by the m-Hydroxydiphenol method with D-galacturonic acid standards and the subtraction of uronic acid content from the total carbohydrate content, respectively. The amount of glucose bound by pectin ranged from ~57% to ~67% initially. Release rate of free glucose increased with time until about 120 minutes and was between 80-85% at 360 minutes. CP and SBP had similar release rates at all times. F3SBP showed a relatively lower glucose release after 120 min compared to other pectins. However, the neutral sugar portion of F3SBP was not higher than other samples. Therefore, the data from this experiment suggests that the hairy region of pectin does not affect their glucose-binding capacities. Although the pectin with the best glucose-binding capacity did not have the most branches with neutral sugars, pectin blunts the glycemic response by binding glucose so further studies need to be done to investigate other components that affect binding.

Physiochemical factors affecting metmyoglobin reducing activity and color stability of postmortem beef skeletal muscle

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The primary goal of this research project was to develop a reliable, rapid, and simplified method to determine the color stability characteristics and quantification of myoglobin (Mb) redox forms (oxymyoglobin OMb; deoxymyoglobin DMb; metmyoglobin, MMb) during aging and retail display of the beef skeletal muscle. The objectives of this study were: 1) to determine the effects of different post-mortem aging (PA) periods (10, 30, and 90 days); and 2) to assess most effective concentration (0.1% and 0.3%) of nitrite on MRA and relative Mb redox forms of the beef skeletal muscle. Results suggest that 0.1% nitrite was as effective as 0.3% for the oxidation of Mb to MMb. PA of the beef skeletal muscle for 10, 20, and 90 days exhibited varied responses for the muscle ability to resist formation of MMb. The aging of beef for 20 and 90 days exhibited a higher resistance for Mb oxidation as compared to 10 day aging. The 10-day aged beef was found more susceptible to Mb oxidation during retail display. The nitrite concentration of 0.1% demonstrated the most differences in the color stability for the beef skeletal muscle aged for 10, 20, and 90-days. The incubation period of 12 hrs., demonstrated stability of the Mb redox forms. The 12 hrs. incubation time at 0.1% nitrite increased %MMb for meat aged 10 and 90 days, but decreased for meat aged 20 days as the display days advanced 0 through 6. After 12 hours incubation time and 0.3% nitrite, %MMb increased for meat aged 10 days, but decreased for meat aged for 20 and 90 days as display days advanced 0 through 6. The DMb redox form of the beef did not change among the aging regimen for 10, 20, and 90-days. However, the oxy- redox form of Mb decreased with display days 0 through 6 for 10-day aged beef and increased for 20 and 90-days. In conclusion, 0.1% will be effective for MMb reducing assays and aging will affect Mb redox forms at different rates with advancement in retail display. Application of 0.1% nitrite can be effectively used for the characterization of the beef skeletal muscle subjected to different aging regimen. This method could benefit the US beef industry to strategically design the postmortem management of the fresh beef during merchandising and retail display.

The Wood Preference of Eastern Subterranean Termites, Reticulitermes

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This project involves examination of subterranean termite wood preference using several different bioassay designs and measures of 'preference'. The first objective was to demonstrate the effect of bioassay design. The bioassay designs tested included no-choice, paired-choice, and four-choice designs testing all possible combinations within each design using four types of wood (redwood, pine, yellow poplar, and red oak). The second objective was to compare three measures of wood consumption; mg wood/g of termite/day, percent wood loss, and mg of wood consumed per day to evaluate the affect of data presentation on ranking termite wood preference. A last objective was to examine the survivorship and the preference comparing blocks of pine to a type of wood that claims to be termite proof trestlewood, wood formerly used as railroad trestle over Utah's Great Salt Lake. The termites to be used for these experiments were collected from logs and stored in an environment chamber at approximately 26°C. The wood samples used in the experiments were 1-cm3 blocks that were oven dried for 24 h prior to and after placement in bioassay. Prior to each trial, the desiccated wood was soaked in water for 24-hr. Three hundred termites were placed in each area for a total of 3300 termites per replicate and the wood was exposed to the termites for 21 days. The collected consumption rate data were analyzed using ANOVA analysis to determine the most preferred wood type. A series of t-tests were conducted comparing the consumption rates of different woods to determine the hierarchy of preference. Controls were used to calculate the weight difference of the wood samples in the absence of termites. The hierarchy of preference of the four wood samples were 1)Pine, 2)Red Oak, 3)Redwood, and 4)Poplar. When given the salt marsh wood samples, termite survivorship was high, and the consumptionwas nearly as high as that of the pine. The trials have shown pine to be the most preferred of the wood samples, and the specimens were able to survive on the trestlewood sample indicating that it is not termite-proof as advertized.

Despite the Advancement of C30 Reversed-Phase LC Columns, Normal-Phase HPLC is Still Best for Quantifying Individual Vitamin E isomers in Edible Oils

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Since the initial discovery of Vitamin E in 1922, the health benefits and antioxidant properties of this family of compounds have been extensively studied and documented. Vitamin E, consisting of α-, β-, γ-, and δ-tocopherols as well as tocotrienols, is often quantified in foodstuffs through extraction and subsequent separation and quantification via normal-phase high-performance liquid chromatography (NP-HPLC) and fluorescence detection. The development of C30 reversed-phase (RP) LC columns has led to an increase in the employment of RP systems for the separation of hydrophobic bioactives. These two methods, though fundamentally opposite, are used interchangeably in the analysis of vitamin E; yet, few analysts have rigorously evaluated the performance and utility of the two methods. The objective of the present study was to compare NP- and C30 RP-HPLC in the determination of tocopherol isomers in edible oils. Parameters evaluated included selectivity, resolution, linearity of detection, limit of detection, limit of quantification, interassay variance, recovery and repeatability. Pecan and peanut oil samples were analyzed in this work. NIST Standard Reference Material® 3278, “Tocopherols in Edible Oils”, allowed for accuracy and bias determination. NP-HPLC proved to be a superior technique, because it required minimal sample preparation, and afforded greater sensitivity as well as superior selectivity. For C30 RP-HPLC, saponification and extraction steps were required before sample injection. Advantageously, the NP silica column permitted direct injection of oils without saponification or extraction, minimizing losses in sample preparation. Nevertheless, greater control of method parameters in C30 RP- vs. NP-HPLC resulted in less interassay variance and more consistent retention times. With regard to selectivity, NP-HPLC fully resolves the β- and γ-tocopherol peaks, whereas RP-HPLC cannot, resulting in β+γ-T co-elution. Recent in vivo data suggests that γ-tocopherol has been an underappreciated nutrient, in that it can effectively scavenge reactive nitrogen species. As such, the efficient separation and accurate quantification of individual tocol isomers, particularly γ-tocopherol, is important in potentially assessing the health benefits of edible oils.

Kinematic Analysis of a Biomedical Pig Gait to Establish Consistent, Symmetrical Parameters

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There is increasing interest in kinematically analyzing and defining the gait of pigs, due to their increasing use in the biomedical field, as well as current concern regarding lameness in production sows due to housing, flooring, and husbandry issues. Previous research has been dedicated to analyzing various surfaces (i.e. slatted concrete, bedded, or solid concrete) for friction characteristics and effects on pigs' biomechanics and slippage, as well as general welfare. Gait and force analysis have been principal techniques used to link claw injuries and floor properties, as claw disorders may lead to lameness, entry of spreading infections, and ultimately result in economic loss. While kinetic pressure distribution measurements and kinematic video analysis methods have been used to analyze claw lesions, no study has made definite conclusions regarding gait symmetry. Thus, this project aimed to establish pigs as a biomedical gait model, with emphasis on the consistency and symmetry of temporal and spatial gait parameter over three time points. Eight male Yucatan biomedical pigs were video recorded using two synchronized high-speed GigEye cameras using a 1.83m recording frame. Video footage was analyzed using EquineTec software for swing and stance time, stride velocity, stride length, and maximum hoof height for both front and hind legs. Statistical analyzes were applied to determine if the gaits were symmetrical with respect to the right and left side, and whether results were consistent and repeatable over time. These results did confirm that all but a single variable (front maximum hoof height) showed excellent symmetry at most time points. We also recognized that velocity timers should be employed to control for velocity across time points as significant time differences existed in each parameter measured, and thus have utilized these timers in further studies of post-stroke models. This experiment has allowed us to obtain information on the symmetry of swine gait for further use as a biomedical gait model and potential comparison to post-stroke pigs.

Development of a PCR-based marker to identify overwintering sites for Exobasidium sp. On blueberries in Georgia

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Exobasidium sp. causes Exobasidium fruit and leaf spot of blueberry, an emerging disease in Georgia and the southeastern United States that significantly decreases marketable yield of berries. We are interested in understanding the disease cycle, particularly where the fungus overwinters, so that improved management strategies can be developed. Our hypothesis is that Exobasidium sp. overwinters in buds of blueberry plants. Exobasidium sp. grows very slowly and is difficult to isolate from other fungi on growth medium, so in order to detect it we have developed an Exobasidium-specific PCR-based marker for the internal transcribed spacer (ITS). Our results demonstrated that successful amplification of ITS is possible at low Exobasidium cell concentrations (≈4 cells/μL) in the presence of blueberry plant tissue, indicating that our PCR-based marker is reliable for detection of potential overwintering sites. We used the marker on blueberry buds and stems collected in the winter from previously diseased field plots to determine if the fungus was present. Additionally, bud and stem samples from disease-free field and greenhouse plots, either amended with Exobasidium DNA or left untreated, were tested with our marker as controls. We obtained a detection frequency of 60% on buds from highly-diseased plots, 20% on stems from highly diseased plots, 100% from Exobasidium-amended control samples, and 0% from untreated control samples. These results suggest that Exobasidium sp. overwinters primarily in buds.

Investigating the Indirect Effects of Gupy Introduction on Populations of a Shredding Caddisfly in Trinidadian Streams

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In Trinidadian steams, guppies (Poecilia reticulata) have naturally colonized or were introduced to regions where previously only one other fish species, the killifish Anablepsoides hartii, existed. A survey of macroinvertebrates in eight streams, each with paired reaches with and without guppies shows that guppy presence is associated with higher abundances of the leaf-shredding caddisfly Phylloicus hansoni, an important decomposer in these stream ecosystems. Reaches with long-term guppy presence exhibit the greatest differences when compared to their killifish-only reaches. Our aim is to tease apart mechanisms for these observed differences. Benthic macroinvertebrates are important resources for both fish species. We hypothesize that interference competition between introduced and native fishes will result in niche partitioning within the community. To determine this, we are analyzing killifish gut contents from killifish-only reaches and guppy+killifish reaches, which are at different time points of guppy introduction: 2-3 years, 35 years, and 100+ years. This experimental design allows us to assess differences in how killifish forage in response to guppy presence through time. Relative amounts of defined food categories in gut contents are being quantified and compared between reaches, especially concerning amounts of surface versus benthic invertebrates present. We predict that guppies' benthic foraging behavior causes killifish to feed preferentially on surface invertebrates compared to benthic invertebrates, including Phylloicus. Because Phylloicus is such a prominent decomposer of allochthonous material, differential predation by killifish on this aquatic insect would be an important factor affecting rates of leaf breakdown in these streams. This analysis is ongoing, but preliminary results have shown that Phylloicus individuals are in fact a prominent component of killifish diets in the majority of streams studied here, thus confirming that killifish have the potential to play an important role in measures of Phylloicus abundances.

Effect of Digested Blackberry Anthocyanins on Anti-inflammatory Markers in Murine RAW 264.7 Cells

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Anthocyanins and the fruits from which they originate are widely thought by consumers and researchers to have beneficial health effects. Blackberries, being an abundant source of polyphenolics and anthocyanins, were investigated to determine how these phytoactive chemicals influence inflammation markers in murine RAW 264.7 cells before and after an in vitro digestion step. Navaho cultivar blackberries were collected from Paulk Vineyards (Wray, GA) in June 2012 and either subjected to in vitro digestion or left as such. In vitro digestion was performed in a thermostated shaking water bath with artificial saliva, gastric bile and duodenal juices. Phenolics were extracted from each sample using aqueous acetone (70% {v/v}+ 0.1% HCl), passed through an Amberlite XAD-16 column, residue lyophilized, and then made up to a standard 4 mg/mL gallic acid equivalents (GAE) total phenolics content solution. Inflammation was initiated in murine RAW 264.7 cells by treating with Escherichia coli O111:B4 lipopolysaccharide, three concentrations of digested and undigested extracts were each applied, and NO content of the media was measured by the Griess assay to determine any anti-inflammatory endpoints. The only samples to show a reduction in NO production were those treated with the highest concentration of undigested blackberry extract ($t=6.63$, $p<0.0001$). These findings suggest that not only may cells require higher concentrations of these extracts to affect a benefit, but also the digestive process may reduce or eliminate the efficacy of blackberry phenolics.

Promoter strength affects how well foreign gspC genes, but not a native gspC, restore Ralstonia solanacearum type II secretion

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Ralstonia solanacearum (Rso) is a plant pathogenic bacterium that causes lethal wilting diseases of many important crops. Rso uses its type II secretion (T2S) system to secrete multiple exo-proteins that are important for pathogenesis. T2S systems are complex nano-scale machines comprising 12 to 15 proteins. One of these, the GspC protein, helps to select the exo- proteins that for secretion. This year we studied how the level of gene expression affects the function of native and foreign GspC proteins expressed in a Rso T2S mutant strain lacking a gspC gene. Our initial tests were conducted using replicative plasmids, but due to strain instability, despite antibiotic selection, we switched to a genetic system that inserts cloned DNA into the Rso genome. We tested various promoters coupled to the gspC open reading frame from three closely related organisms: Rso, Cupriavidus metallidurans (Cme), and Burkholderia thailandensis (Bth). Restoration of T2S function was evaluated by measuring secretion of polygalacturonase (Pgl) and endoglucanase (Egl) exo-enzymes. When paired with their native promoters, all three gspC restored secretion of Pgl but only Rso and Cme gspC restored Egl secretion. When paired with the promoter of a Rso housekeeping gene (Pgap) only Rso gspC was functional. When paired with the regulated promoter for Rso the extracellular polysaccharide operon (Peps) Rso and Cme gspC fully restored Pgl and Egl secretion whereas Bth gspC weakly restored only Pgl secretion. To examine promoter strength independent of GspC function, we coupled the Escherichia coli β-galactosidase gene (lacZ) to these promoters and found that PgpsC did not drive lacZ expression and that Peps expressed lacZ over 500-fold better than did Pgap. Surprisingly, the Rso gspC open reading frame without any coupled promoter partially restored secretion of both Pgl and Egl. These results suggest that a low level of transcription of gspC genes is sufficient to restore function of the T2S system and is better than an intermediate level of expression, but that over-expression of foreign gspC genes can partially or fully compensate for their less than perfect function.

Effect of X-Ray Scanning on the Sensory Quality of Onions

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All food products undergo a unique process to ensure their safety prior to reaching the consumer. X-Rays are currently used in the food industry to detect hidden contaminants or defects in a food product. This poster reviews the consumer acceptability of onions that were treated with X-Rays. This research project was conducted to refute the perceived concerns that some consumers, researchers, or food scientist hold regarding the X-Ray technique. There is concern from consumers that food products treated with X-Rays could have altered sensory characteristics which may include distorted taste, smell, texture, and overall quality of the food product. Three difference tests were conducted to determine whether consumers could identify differences between an onion that had been treated with X-Rays an an onion that had not been treated with X-Rays. Data collected demonstrates that consumers were not able to distinguish any differences between the onions showing that negative beliefs regarding the effects of the X-Ray technique on the sensory qualities of the onions may be unwarranted.

Body Size and Temperature: An Investigation of Moths Through Digital Photography

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Because insects are ectotherms, their activity depends on temperature. We hypothesize that the flight activity of smaller moths will be more affected by temperature than the flight activity of larger moths. To test this hypothesis, a data set of 71,000 photographs of moths was analyzed. In this study, a community of moths was attracted to a study site in Clarke County, Georgia and documented nightly, in photographs, for two years. Of these photographs, 94% of moths have been identified to more than 880 species, and most photographs contain rulers from which wing size may be measured as a proxy for body size. We performed an analysis correlating NOAA nightly weather data with moth body size and discovered that average moth body size decreases 15% or more across the annual range of temperatures at which we sample them. Relatively more smaller moths fly at warmer nightly temperatures.

Cuticular pheromones and fire ant queens: What's the smell of a green beard?

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The fire ant Solenopsis invicta has been the subject of intense research because of its status as a serious invasive pest. One major emphasis of study in ant biology focuses on the question of how pheromones (chemical signals) are used for communication. This question applies especially to the polygyne (multiple-queen) and monogyne (single-queen) social forms of S. invicta. Previous research has found strong genetic control for the social organization of S. invicta into polygyne or monogyne societies. These two social forms feature specific genotypes at a single Mendelian locus and phenotypic differences in behavior, physiology, and biochemistry. We studied the process by which colonies of each social form accept new queens. Workers in queenless colonies of both social forms will accept a new queen under certain circumstances, but polygyne workers only accept into their colonies polygyne queens and monogyne workers only accept into their colonies monogyne queens, in a fashion predicted by Richard Dawkins' "green beard effect." Preliminary studies have indicated that this worker discrimination behavior may be influenced by chemicals found on the cuticle of queens. We first showed that fresh polygyne and monogyne queen corpses elicited the same worker responses as live queens, with acceptance and rejection based on queen social form; this result demonstrates that queen behavior does not influence worker discrimination. We then showed that chemically extracted queen pheromones, deposited onto inanimate surrogates (paper wicks), also elicited appropriate worker ant discrimination behavior. Finally, we determined the genotype frequencies of polygyne workers found attacking monogyne surrogates to test the possibility of using the "green beard effect" to verify the findings of our behavioral methods. These results support the hypothesis that worker discrimination behavior is elicited by chemical differences between queens of the two social forms. The high-throughput assay we developed will facilitate future research on the chemical and genetic differences that mediate fire ant worker discrimination of queens on the basis of social form.

Measuring society: A sociometry of the tropical fire ant Solenopsis geminata in one annual cycle

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The social insect colony has been considered a “superorganism,” with sometimes hundreds of thousands of individuals behaving as a coherent unit. These insect colonies are selected upon as single individuals under natural selection and thus contain many adaptive colony-level phenotypes. To discover and study such phenotypes, one must investigate the basic attributes of the colony, measuring the numbers and characteristics of workers, sexuals, and brood. Such an undertaking is termed a “sociometry.” Here we present a sociometry of the tropical fire ant, Solenopsis geminata, in Monteverde, Costa Rica. We sampled colonies in November 2011, May 2012, July 2012, and February 2013. At each sampling date, 7-12 colonies across a range of sizes were fully excavated into a large bin, weighed, and then a representative sample of ants was collected from each colony. These samples were exported to the United States and will be used for further analysis in summer 2013. We will describe the demographics of each individual colony, allowing us to predict how a single colony develops throughout its 7 year lifespan and how it fluctuates in an annual cycle in a number of traits. Traits to be estimated include: colony mass, number, size, and type of workers, brood, and sexuals, colony-level investment in reproduction and growth, fat content, and other characteristics. We have also described the first known multiple-queen (“polygyne”) colonies of this species in Central America, and found results that may suggest an unexpected mode of reproduction for these colonies. Finally, two species of putative social parasites, a mite and a staphylinid beetle, have been observed in the fire ant colonies and have been collected for further investigation. This sociometric analysis will provide important basic biological data about S. geminata that may be used for ecological purposes and to drive further investigation of this unique ant.

An Analysis o fthe Effect of Phytase on Phosphorous Absorption and Growth in Nursey Pigs

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Phytase is an enzyme that breaks inorganic phosphorous found in plants from its phytic ring into organic phosphorous that can be absorbed and utilized in the animal diet. The porcine gastrointestinal tract lacks phytase, therefore cannot effectively absorb inorganic phosphorus from its plant-based diet. To meet nutritional requirements, pigs must either consume large quantities of supplemental phosphorous in the form of dicalcium phosphate, which is still poorly absorbed and excreted in large amounts, or phytase must be added to the diet. In this study, 24 nursery pigs of mixed gender were randomly assigned to 12 pens. There were 3 feeding phases which correspond to weeks 1-3 following weaning. There were two dietary treatments in each phase, one with phytase and a control diet without. Samples of the phase I diet, and phases II and III control and phytase diets were all analyzed to determine initial nutrients available. Fecal samples were collected from each pen at the end of each dietary phase and analyzed for excreted nutrients; thus total absorbed nutrients could be measured. Experimental procedures used to measure these values included bomb calorimetry to measure energy content, petroleum ether extraction to measure fat content, acid and neutral detergent fiber rinses to analyze fiber contents, and spectrophotometer colormetric assays to analyze mineral levels. Additionally, pigs were weighed weekly to measure and compare growth rates. The hypothesis is that if phytase is added to the recommended diet, then pigs should be able to absorb more available phosphorous and grow at a faster rate. Results showed that altering the nutritional composition of swine feed through reducing phosphorous supplements and adding phytase indeed improved overall nursery pig performance. When phytase was added to the diet, higher percentages of dietary phosphorous and crude protein were absorbed, resulting in greater feed intake, greater average daily gain, and a greater feed to gain ratio. This ultimately will influence future swine diet composition to be more economical and provide better nutrition to support improved nursery pig performance.

MRI and Histological Characterization of a Porcine MCAO Ischemic Brain Injury Model

Amber Williams, Animal Science Major, Department of Animal and Dairy Science; Presented in 2013

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Stroke is the number one cause of long term disability and third leading cause of death in the United States. The devastating health, social and economic effects of stroke have led to a concerted effort to develop a treatment. However, only one treatment has been developed with significant limitations. The limited success in treatment development is believed to be due in part to testing of treatments in rodent models, which have significant differences in brain size, composition and architecture. These differences have lead to a call for a better model more similar to humans, such as the pig. Our goal in this study was to characterize middle cerebral artery occlusion (MCAO) ischemic stroke within a pig model utilizing magnetic resonance imaging(MRI) and histology. The MCAO stroke was surgically induced by cauterization of the MCA in 4 male Yucatan miniature pigs. MRI was performed 24 hrs post stroke on a GE 16-channel fixed-site Signa HDx 3.0 Tesla MRI system. Diffusion weighted imaging (DWI) and apparent diffusion coefficient (ADC) maps were analyzed using Osirix(R) software. At day 90 post stroke, brains was extracted sectioned and hematoxylin and eosin stained. Infarct mean ADC values and volumes were determined by MRI to ascertain the extent and size of the damaged region. Regions with an 80% reduction in ADC value were considered damaged and 40% reduction indicated a region of complete ablation. Mean ADC value of normal control tissue ($731.75 \pm 40.49 \times 10^{-6}$ mm/s) was significantly (p-value < 0.05) higher than both 80% ($508.86 \pm 31.01 \times 10^{-6}$ mm/s) and 40% (320.43 ± 3.22 ($\times 10^{-6}$ mm/s)) ADC means. Average infarct volumes were 91.76 ± 21.70 cc and 10.56 ± 5.21 cc for 80% and 40% ADC thresholds respectively. Histological examination at day 90 supported MRI stroke findings. Coronal sections of brain through the area of infarction demonstrated severe atrophy and white matter in affected cortex region could not be defined due to loss of normal elements. In this study we demonstrated that MCA occlusion resulted in significant infarction by both MRI and histology. These results were similar to what has been previously seen in humans and suggest that the pig may be a robust model for further ischemic stroke studies.

Genetic Diversity of Exobasidium sp. From Single Lesions on Blueberry

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The plant pathogenic fungus Exobasidium sp. is very genetically diverse, which is unexpected for any fungus, particularly one that is emerging. Fungi of the class Exobasidiomycetes have historically received little research due to their mostly economically-insignificant impact on Ericaceous hosts; however, Exobasidium sp. has placed significant pressure on Georgia's $93 million annual blueberry industry. Now able to cause symptoms on both foliage and fruit, the fungus renders affected blueberries unmarketable due to unsightly, unripened lesions. In order to better manage the disease, a greater knowledge of the fungus’s life cycle is imperative. The aim of this study was to determine how many unique basidiospore haplotypes are present within single lesions on infected plants, which would provide a better understanding of the fungus’s means of reproduction, mating system and life cycle. It was predicted that two haplotypes would be present within each lesion, representing the products of meiosis from a dikaryotic parent that initiated the infection and produced the lesion. Infected tissue was collected from blueberry fields with high disease incidence, and a selection of isolates for use in this study were sampled from different geographical locations and host cultivars. Eight single-basidiospore isolates derived from each of six lesions were isolated, cultured and sequenced at the internal transcribed spacer (ITS) region. Spores originating from the same lesion were then compared and analyzed for genetic variation. Sequence data revealed that two haplotypes could indeed be found within each lesion, suggesting the presence of one parental dikaryotic mycelium. However, two colonies showed no genetic variation among its spores within the ITS region, suggesting either a self-mating event or that the two haploid individuals forming the dikaryon were simply the same at ITS. Due to the extreme genetic diversity observed thus far at the ITS region of this fungus and evidence of multiple haplotypes found in this study, we hypothesize that mating is occurring between individuals arising from a single mycelium. To confirm this working hypothesis the spores will be sequenced at other regions, which may provide evidence of recombination and/or inbreeding.

Development of a Lucid™ Key for Identification of New World Monotomidae (Coleoptera: Cucujoidea)

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The ease of use and distribution of electronic, synoptic-style identification keys has made them important and highly practical tools for sharing taxonomic and biological information among researchers in academic, educational, industrial, agricultural and conservation spheres. Because they are based on queries of a database rather than a predetermined sequence of diagnostic questions, synoptic keys are much more flexible and powerful than traditional, dichotomous keys. Electronic keys are interactive, intuitive, and can be used easily by non-experts as they are constructed around illustrations rather than anatomical terminology. The goal of this project is to build an electronic, synoptic key to the New World genera of Monotomidae using LucidTM software with original morphological illustrations and photomicrographs. The new key is presented here along with an introduction to the LucidTM software and the microscopy, imaging, and illustration techniques used to produce it. Taxonomic characters discussed in the literature were re-examined and re-scored, producing a matrix of 12 taxa by 46 characters, which was imported directly into the LucidTM program. Figures were produced to illustrate character states. This tool will be especially useful to entomologists in forestry and conservation, as some members of this beetle family are known vectors of plant pathogens or are associated with destructive forest pests. Despite their significance, the taxonomy of Monotomidae is in poor condition. This new identification key attempts to summarize all the known diagnostic information about the group and includes concise fact pages detailing each genus and high quality images of representative species.

Madagascar Hissing Cockroaches: An analysis of their Reaction to Inhibition of Mobility by Bodily Inversion

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The Madagascar Hissing cockroach is unique in morphology and is capable of something that some insects are not- flipping over if turned on its back. Hissing cockroaches, Gromphadorhina portentosa in particular, are a species that can flip over if turned on their backs. However, not all cockroaches from a selected group can flip over. The purpose behind this experiment is to determine, if existent, a trend in cockroach flips. Cockroaches were obtained from two colonies, one from the UGA entomology department and one from Dr. Paul Guillebeau's residence. Four groups of 20-25 cockroaches were selected from these colonies. One group was separated into categories A, B, C, and D. A-cockroaches that flip over within 5 sec, B-cockroaches that flip over within 30 sec, C-cockroaches that attempt to flip over for 15 sec but fail and D-cockroaches that give up within 5 sec. All four groups were eventually tested for simply whether or not they could flip over after being prodded at a temperature of 80°F. The length, sex and effort were all measured to look for a trend. There were no trends regarding length and effort; however, sex was a possibility of trend. It was found that males are more likely to flip over, but the results were not overwhelming. The most significant finding was whether or not flipping was an action that cockroaches do out of skill, or if they really cannot flip over. After 5 trials with the same cockroaches an equal number of cockroaches from each group (A, B, C, D) could flip over except for two of the trials in which the difference in two of the groups was 1-2 cockroaches. In other words, it was evident that the cockroaches that could flip either by themselves or after some prodding had learned to do so by arching their backs and wiggling side to side at the same time until standing upright. Cockroaches that did not flip over were predicted to die upside-down because of their limited effort. These cockroaches had not yet learned how to arch their backs and wiggle synchronously. From this experiment it was determined that sex has a questionable but evident relationship to cockroach flipping. It was also found that cockroach flipping is a skill that cockroaches may learn on their own or from other cockroaches.

Proteomic Analysis of the Tomato/Botrytis Cinerea Interaction

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Botrytis cinerea attributes to the post harvest rot of more than 200 species of fruit and vegetables. As these produce ripen, their cellular wall drastically degrades, making them more susceptible to pathogens. Significant protein-protein interactions occur between the necrotrophic fungal pathogen, Botrytis cinerea, and the tomato fruit. By describing host and pathogen proteomes simultaneously in infected tissues, the plant proteins that provide resistance and allow susceptibility and the pathogen proteins that promote colonization and facilitate quiescence can be identified. This study is aimed to characterize the fruit and fungal proteins occurring in the B. cinerea/tomato interaction using shotgun proteomics. Mature green, red ripe, wild type and rin and nor mutant tomato fruit were infected with B. cinerea B05.10. After 5 days the infected tomatoes were gently agitated in a 1.5M NaCl solution followed by a SDS and heat treatment to collect solubilized proteins. The collected proteins were separated on a one dimensional SDS-PAGE gel, followed by in-gel digestion. Peptides were then analyzed by LC-MS/MS on a linear ion trap mass spectrometer. Data was searched using Mascot algorithm. Proteins were identified by combining the B. cinerea BO5.10 (Broad Institute, MA), and T4 databases (Genoscope, France) with a tomato protein database (SOL Genomics Network, Cornell University, NY). A decoy database was constructed by reversing the sequences in this target database. Statistically significant proteins were determined at a 1% protein FDR. The composition of the collected proteins populations and their putative functions allow for a better understanding of the plant-pathogen interaction mechanism.

Carbon accumulations in MiGD system and the factors that promote stabilization

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Since the early 2000's, the southeastern United States has witnessed an accelerated conversion of row-crop land to management intensive grazing dairy (MiGD) systems utilizing multiple pastures and a 12-h rotation schedule. This land-use change represents a radical shift in the carbon cycle, one that differs fundamentally from what would be exhibited by conventional dairies or typical no-till pastures. To assess the impact of this land-use change on the carbon (C) cycle, we sampled a chronosequence of row-crop to MiGD conversion in southeastern Georgia, capturing pastures at 2, 3, and 5 years since conversion. Total and clay-associated soil carbon increased since time of conversion in the top 40 cm, with the greatest increase occurring from 3-5 years since land-use change. This resulted in a 63% increase in surface (0-5cm) bulk soil carbon and a 24% increase in clay-associated soil carbon. We observed root mass to increase from 12.3 g kg-1 to 52.5 g kg-1 soil from 2-5 years since conversion, an indication that long-term rotational grazing strategies increase belowground primary productivity. The objective of this project is to determine the stability of freshly accumulated carbon, using a 30% w/v hydrogen peroxide treatment coupled with isotopic analysis, and relate to mineral composition and amorphous iron content. It is hypothesized that presence of amorphous iron constituents will increase the proportion of stabilized carbon as evaluated. Samples taken from the oldest site were utilized to gain information on mineral composition in both bulk and clay (<2μm) fractions, "amorphous" or AAO-extractable iron, and total iron as determined by a modified CBD-extraction. XRD analysis shows the bulk soil horizons to be composed only of quartz with some kaolinite at depth (50-75cm) and clay fractions to be completely X-ray amorphous, except for the presence of kaolinite at depth. While some mineral forms may be shielded from diffraction by organic material, extraction data backs up the XRD findings, showing amorphous Fe content to range from 20.7 + .06% of total Fe in the surface horizon down to 5.29+.80% in the 50-75cm horizon.

Effects of Daily Oral Supplementation of Glucosamine Sulfate on Joint Range of Motion and Serum Oxidative Stress in Aged Performance Horses

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Glucosamine sulfate is a dietary supplement widely used in both humans and animals to increase joint comfort. Mechanism of action for glucosamine is not completely understood, however limited studies have been performed to determine dietary levels needed to achieve detectable concentrations in the joints of supplemented subjects. Recent studies have indicated that glucosamine sulfate may possess antioxidant properties. Oxidative stress in joints can be caused by high concentrations of reactive oxygen species (ROS) which cause the breakdown of cartilage due to the presence of free radicals and pro-oxidants. Natural antioxidants such as glutathione, peroxidases, and vitamins E and C work to help keep the number of ROS down, however the effects of the antioxidant system on joint degeneration have not been well documented. Horses performing into their later years can experience long term exposure to stress on their joints due to workload intensity that causes both mechanical friction as well as exposure to chronic oxidative stress. Studies have not yet quantified potential beneficial effects of glucosamine sulfate on joint range of motion in the horse nor attempted to look at the relationship between glucosamine supplementation and global oxidative stress. In the current study, twelve horses paired by age and workload were randomly assigned to either a treatment or control group for a 90 day supplementation period. Treatment horses were given daily oral supplementation of 10,000 mg glucosamine sulfate, while control horses received an oral placebo. To assess changes in biomechanics, horses were video recorded on days 0, 14, and 28 prior to supplementation and again at days 28, 56, and 84 during supplementation. Reflective markers were placed at the following joints on each side: scapula, shoulder, elbow, carpus, pelvis, hip, stifle, hock and fetlocks. Horses were recorded by two synchronized cameras placed on each side of the horse as they walked and trotted in hand for six repetitions at each gait. Data was analyzed for measures of gait quality and joint range of motion using EquineTecTM to quantitatively analyze videos by frame. Blood was collected via jugular puncture and analyzed for reduced, total and oxidized glutathione in whole blood as well as levels of malondialdehyde present in plasma. Data was analyzed statistically using SAS version 9.2, proc mixed for repeated measures over time with $P<0.05$ being considered significant.

Now you see them, now you don't: intron variance in the ABCB-1 gene

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There has been long standing debate on the origin of introns in eukaryotic genome. "Intron early" theory hypothesizes that introns were involved in the assembly of the first eukaryotic genes while "intron late" theory assumes introns were gained during the later phases of evolution and these gain events happened independently across lineages. As there is no conclusive proof for either theory, tracking intron loss/gain events across species may provide valuable insight into mechanisms of intron gain or loss and the functional importance of introns. ABCB-1 (ATP-Binding cassette subfamily B), a highly conserved gene that codes for a P-glycoprotein involved in auxin transport, appears to have undergone rapid intron loss in the grass family Poaceae. Based on initial sequence analysis, all sequenced dicots species and the selected monocot lineages Muscaceae (represented by banana) and Aracaceae (represented by datepalm) contain nine introns. In contrast, intron number within the Poales ranges from two (rice, pearl millet, foxtail millet, tef and brachypodium) to four (sorghum and maize), and only one intron is common among all the species suggesting a conserved function in regulating gene expression. As the currently available data indicate that gene loss is specific to the family Poacecae and/or order Poales, we have collected/isolated DNA from members of tribes in the Poaceae, Ecdeiocoleaceae, Flagellaricaceae, Mayacaceae and Bromeliaceae, as well as from the outgroup families of Zingerberaceae and Asparagales, to test this hypothesis. Using sequence alignment of orthologous ABCB-1 genes across monocots and dicots, we are designing conserved sets of primers that can amplify the entire gene across a range of monocot species. Amplification products will be cloned and sequenced. Acquired sequences will be analyzed to verify intron presence and clarify the timing of intron variance events. Analysis of the phase and intron/exon boundary sequence of the removed introns will provide information regarding the process of intron variance in other organisms as well as offer insight into the evolutionary history of monocots.

The Effect of Omnigen-AF on Differential Leukocyte Counts of Bovine Blood and Mammary Secretions

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Mastitis, a bacterial infection of the udder, costs the US Dairy industry approximately $2B per year. In attempts to combat this disease, producers have made improvements in milking hygiene, environmental sanitation, and herd genetics. More recently, vaccination programs have been implemented, which have reduced the prevalence of mastitis caused by Staphylococcus aureus by up to 60%. Although this is an appreciable reduction, it has been proposed that feeding an immunostimulant, such as Omnigen-AF, in conjunction with vaccination would enhance the bovine immune response to mastitis-causing agents even further. Omnigen-AF has been shown to promote white blood cell (leukocyte) function, thereby preventing mastitis in dairy cows. Based on this evidence, we hypothesized that there would be differences in differential leukocyte counts of blood and mammary samples between heifers that were fed Omnigen-AF and unsupplemented controls. To test this hypothesis, 82 heifers at the UGA teaching dairy were split into 7 groups based on age. Half of each group was fed Omnigen-AF daily at a rate of 4.0 grams of Omnigen-AF/100 gm body weight, and the other half was fed a control diet. Blood and mammary samples were taken once a month. Blood smears were prepared on microscope slides, stained with Wright's stain, and viewed under a light microscope at 1000x magnification. Mammary secretions were processed through a cytospin and stained and viewed as above. Percentages of blood lymphocytes, neutrophils, macrophages, and eosinophils were recorded after counting 100 cells/slide. Analysis of blood leukocytes demonstrated no differences between supplemented and unsupplemented heifers. Across treatments, differential counts averaged 65.1% lymphocytes, 22.4% neutrophils, 8.8% macrophages, and 3.7% eosinophils. Likewise, analysis of mammary secretions demonstrated no differences between supplemented and unsupplemented heifers. Across treatments, differential counts averaged 13.5% lymphocytes, 34.7% neutrophils, and 51.8% macrophages. In conclusion, results do not support the hypothesis that Omnigen-AF influences differential leukocyte counts in blood or secretions; thus, future studies will focus on alternative mechanisms of immunopotentiation by this feed supplement.

The Effect of Antioxidant Concentration within Seminal Plasma on Comb Color and Size in Broiler Roosters

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Many birds use elaborate sexual ornamentation to display honest signals of quality to females. It has been suggested that the most immediately useful signal to a female is an indicator of a male's fertility, and it has been hypothesized that male ornaments may indicate sperm quality to females. We tested this idea using two experiments in domestic roosters, which exhibit bright red combs as ornaments; females prefer to mate with males that have redder combs, however the signal content of combs remains unclear. In our first experiment, we photographed combs of 20 roosters using a Kodak 10 megapixel camera and analyzed size and color using Adobe Photoshop software. From the same roosters, we also collected semen samples and analyzed sperm mobility, sperm concentration, and the percentage of viable sperm. We related those measures to both comb size and color using simple regression analyses. Birds with the smallest combs also had the reddest combs ($p < 0.001$) and comb redness was a significant predictor of the percentage of viable sperm produced by roosters ($p < 0.01$). In experiment 2, we took a closer look at the components of seminal plasma in attempt to explain the differences we observed in sperm viability. Previous studies indicate that seminal plasma contains potent antioxidants that serve to protect sperm and in some avian species, birds with the most elaborate ornaments deposit more antioxidants into seminal plasma. We surveyed the relationships of comb color and size with antioxidant concentrations found in seminal plasma from 20 broiler roosters. Again, the smallest combs were the most saturated in color ($p = 0.02$), but neither comb color nor comb size showed any relation to total antioxidant count ($p \geq 0.08$). Overall, our findings suggest that comb size and color honestly signal semen quality to females, but that these differences are not due to variation in the antioxidant content of seminal plasma. While further research must be done to understand the mechanisms at play, these and future results could help not only females, but also workers in the poultry industry to select males with certain traits based on simple assessments of comb color.

Development of a Healthy, Nutritionally Enhance, and On-the-Go Hamburger Meal by Incorporating Full Serings of Fruits and Vegetables to Improve American's Healthy Life Style

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The objective of this research project was to create a hamburger patty that consisted of fruits and vegetables. The main premise of this research project was to enable American consumers to consume more fruits and vegetables in their diet. Furthermore, the addition of fruits and vegetables in hamburger meat would lower the fat percentage in meat, thereby providing a reduced fat patty. Fruits and vegetables were limitedly added to keep the identity of the hamburger patty. The new hamburger patty consisted of 2 parts, which are the hamburger shell and an inside hamburger mixture (hamburger meat mixed with fruits and vegetables). Methods for making the hamburger patties included an incorporation of fruits and vegetables. The processing steps that were involved in developing this product was obtaining the raw materials, mixing the ingredients, forming the mixture, cooking, freezing, and packaging. About two portions (40 and 100 gm) of hamburger meat (85% lean and 15% fat) were separated and later each were mixed with 1% salt and 20% cold water (~2 °C) mixed thoroughly until protein was completely extracted. 2.0 g of tomatoes, 1.0 g of green bell peppers, 1.0 g of mushrooms, 2.0 g of peaches, 7.0 g of tomato paste, 1.0 g of onions, 0.2 g of thyme, 0.1 of basil, 0.1 g of oregano, and 0.3 g of garlic were further added and thoroughly mixed. The mixture was rolled into a ball on a cutting board and then placed on the side. The 100 g of meat was separated into 90 g and 10 g. The 85 g of meat was rolled into a ball to push out any air and flattened to about ¾ of a centimeter. The meat was cuffed around the mixture forming a shell but leaving a small opening at the top of about 1.5 cm in diameter. The 10 g of meat covered the opening closing the mixture entirely. The product was placed into a hamburger presser and pressed with a diameter of 12 cm in diameter with a thickness of about 1.5 cm. The formed patty was placed on an aluminum sheet on a metal tray. Next, the tray was placed into a preheated oven set at 375 °C for about 15 min or until the center was 160 °C. The fully cooked meat patter was cooled for 15 min, vacuum sealed, and stored into a freezer set at -5 °C. Results obtained from sensory analyses showed consistent texture throughout the patty due to the addition of a water absorber, oat flower in the outside shell and inside hamburger meat. Having the right amount of consistency of fruits and vegetables also kept the texture consistent through a full bite. Herbs were utilized in the patty in conjunction to bring out the right combination of flavors. Several different hamburger patties were tried in the sensory analyses

Charge Modified Pectin Inhibition of Lipase Activity and Weight Management

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Obesity is a growing epidemic in America. With over half of Americans considered overweight or obese, effective weight loss strategies are vital. Fruits and vegetables are filled with dietary fibers such as pectin. Past studies have shown that pectin inhibits lipase activity but the inhibition depends on pectin type. The objective of this project is to test various pectins for inhibition of lipase activity. Based on past research, we hypothesize that charge modified pectin will have an increased level of lipase inhibition. Two different types of pectins, high methoxyl, low charged pectin (HMP) and low methoxyl, highly charged pectin (LMP), and a pectin-free negative control were tested using an in vitro titrimetric method for lipase activity. Oil emulsions were made from medium chain tri-glycerides with β-lactoglobulin as emulsifier, in the presence of pectin. Bile and $CaCl_2$ were added to mimic intestinal fluid conditions. Pancreatic lipase was added to the enzyme mixture and titrated with NaOH to maintain the pH at 7.0. Lipase activity was determined by measuring the amount of NaOH needed to maintain the pH of the titrator at the pH 7, 37°C. In control assays, lipase activity was variable, possibly related to excess lipase added. In pectin added assays, the results did not show lipase inhibition. This is possibly due to an over concentrated lipase solution. A less concentrated lipase solution will be needed to in order to obtain a measurable difference in lipase activity.

Effects of standard and low crude protein diets on nursery pig growth performance, intake and efficiency

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A total of 72 nursery pigs were used in a 35□d study to determine the effects of low and standard protein levels in a diet. Two diets were formulated, both containing low and standard crude protein. These diets (either UGA or modified) were allocated to 24 different pens of 3 pigs each. The diets were fed in three phases. Phase 1: days 0□7, phase 2: days 7□21, phase 3: days 21□35. Low and standard protein levels were fed. Every week each pig was weighed. The left over feed was weighed back to determine how much was consumed, and blood was taken. The blood was used to run Blood Urea Nitrogen (BUNs) analysis to determine how much nitrogen was available in the blood. Low crude protein diets result in lower BUN levels, the results show just that. The modified diet showed a more dramatic drop in BUN levels every week. After week one, the BUN level for the UGA diet was at 12.01 and 10.01 mg/dl (standard and low crude protein respectively). For the modified diet the BUN level was at 11.3 and 13.1 mg/dl. By week five, the UGA diet showed a BUN level of 13.5 and 10.5 mg/dl. The modified diet showed a BUN level of 15.4 and 11.4 mg/dl. The effect of low crude protein diets, regardless of it being UGA or modified, resulted in lower amounts of nitrogen in the body. Environmental effects of nitrogen can be dangerous at high levels, so the importance of finding a way to lower theses levels begins with the feed. Another area that can have a positive effect is from an economic standpoint. Once a producer finds a cheaper way to achieve increased pig weights, intake and efficiency, then the consumer will pay far less at the butcher or grocery store.

Differentiating C2C12 Myoblast Cells in Environments Suitable for Motor Neuron Growth

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The objective of this study is to identify an effective means of differentiating mouse myoblast cells to myocytes in an environment that supports the growth of motor neurons. The possibility of differentiating myoblast cells in low serum media is advantageous because high levels of serum have been shown to be toxic to motor neurons. The experiment was carried out by maintaining C2C12 mouse myoblast cells for several serial passages in DMEM media supplemented with 10% fetal bovine serum (FBS). The myoblast cells were differentiated according to two different low-serum methods. The first utilized a differentiation media of DMEM + 2% horse serum, and the second method the myoblast cells were rinsed once with Hank's buffered salt solution, and then cultured in DMEM media + 0.5% heat inactivated FBS. Both differentiation methods were done on matrigel coated cell culture surfaces. As the experiment progressed, the C2C12 myoblast cells differentiated by both methods formed myocytes. However, the C2C12 myoblast cultured in 0.5% heat inactivated FBS showed a more complete differentiation by forming larger and more numerous muscle fibers. To determine if the environment would support motor neurons, mouse motor neurons derived from HBG3 mouse embryonic stem cells were plated on top of the myocytes differentiated in 0.5% heat inactivated FBS. Co-cultures of myocytes and motor neurons were maintained in ADFNK media for 7 days. Increased myotube formation and motor neuron migration was observed indicating an environment conducive for both myocytes and motor neurons. The myocytes were seen twitching, and the possible formation of neuromuscular junctions (NMJ) was also observed. In conclusion, the method of differentiating C2C12 mouse myoblast cells in 0.5% heat inactivated FBS on a matrigel coated surface creates an environment suitable for co-culture with motor neurons. The successful co-culture of myocytes and motor neurons affords the opportunity for the formation of NMJ in vitro. Immunochemical staining provides for the identification of NMJ, and this technique represents the future direction of experimental investigation.

Legal Approaches to Addressing Water Pollution Risks Related to Hydraulic Fracturing in the Marcellus Shale Region

Heather Hatzenbuhler, Environmental Economics & Management Major, Department of Agricultural and Applied Economics; Presented in 2012

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Hydraulic fracturing, or "fracking" is an industrial process used to harvest fossil fuel reserves that lie deep underground. The rocks that store these natural resources are cracked open by injecting deep wells with large quantities of water and specially selected chemicals at high pressures allowing oil and natural gas to flow to the surface. This process has led to a significant increase in the economic reserves of natural gas in the United States. Natural gas that was once unreachable is now being piped out by the ton and the price in all sectors (commercial, residential, and industrial) is at a five year low. However, evidence of negative environmental impacts from fracking continues to be exposed and concern from the public is mounting. The potential for water contamination, land destruction, air pollution, and geologic disruption at every step in the process has brought safety of this extraction method into question. States such as New York, New Jersey, Maryland, and North Carolina have put moratoriums on fracking until further research and review of environmental and human health impacts are completed. This paper looks specifically at the impacts that these processes have on local water supplies and seeks to identify the best legislative or regulatory approach to mitigating these risks in the Marcellus shale region. Existing state and federal laws, government data, and peer-reviewed academic studies and articles will provide a base of information for analysis and development of policy alternatives. Criteria such as ecological impacts, political feasibility, and operational practicality will establish framework for this evaluation and ultimate policy recommendation.

Identification of Regions Associated with Cell Porduction in the Developng Apple (Malus x domestica) Fruit Using In situ Hybridization

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Fruit size is a commercially valuable trait in apple. Cell production is one of the key factors contributing to fruit growth. Within the apple fruit, there are distinct tissues such as the core, cortex, and epidermis. The precise location of cell production within these tissues has not yet been determined in apple. We sought to determine the specific areas of cell production in the apple cultivar, Gala. We hypothesized that the majority of cell production occurs within the fruit cortex close to the vascular bundles. Cell cycle genes such as CYCLINS are closely associated with cell production and the localization of their transcripts can be used to specifically mark tissues involved in cell production. We determined the specific location of cell production within the apple fruit using in situ hybridization with two cyclin genes, MdCYCA2;1 and MdCYCB1;1. Gene-specific primers also containing the T7 promoter were designed for each of these genes. Reverse-Transcriptase Polymerase Chain Reaction (RT-PCR) was used to amplify these genes from apple fruit RNA. Using these as templates, strand-specific DIG (digoxygenin)-labeled ribo-probes were developed through in vitro transcription. Localization of these transcripts was performed in fruit harvested at ten days after full bloom, a period of intensive cell production (n = 3). Fruit samples were embedded in paraffin and sectioned using a microtome. The probes were hybridized to tissue sections and subsequently visualized using microscopy. MdCYCA2;1 was localized to the cortex especially near the vascular bundles, and the seed epidermis. MdCYCB1;1 was also localized within the cortex, along the vascular bundles, and the epidermis of the fruit and seed. These data suggest that the above regions are involved in active cell production during the early fruit development of apple. However, the sense probes for these genes also showed a significant amount of signal, which is likely due to non-specific binding. Future efforts will be targeted towards troubleshooting the protocol to reduce the background signal and non-specific binding. Subsequently, further studies will explore additional stages of early fruit development to gain a better understanding of the spatial and temporal patterns of cell production in apple fruit.

Fiber and Glucose Adsorption

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In this project, we analyzed glucose adsorption to hydrocolloids to determine fruit potential, especially pectin rich blueberries, to adsorb glucose and therefore to moderate the glycemic response. A moderated or reduced glycemic response has great health benefits such as a lesser need for insulin and therefore a lower chance of diabetes. High-and low-methoxyl citrus pectin and sugar beet pectins were chosen as our hydrocolloids. These pectins were mixed with glucose at different concentrations and incubated for 24 hours at 37°C. Free and bound glucose were separated using semi-permeable filters and centrifugation. Filtrates were analyzed by a colorimetric reaction with sulfuric acid and phenol to determine free glucose and bound glucose (estimated by difference). It was discovered that with higher concentrations of pectin, there was a higher percent of bound glucose that varied depending on the type of pectin. The higher concentrations of pectins found in different fruits may correlate with more glucose adsorption. Dried blueberries are rich in pectin, phenolic compounds and sucrose. While one of the health benefits of blueberries may be glucose adsorption in the gut, due to the high amounts of sugar in blueberries, it was not possible to accurately estimate glucose binding directly from freeze dried blueberries. Future experiments will involve isolation of pectin from blueberry powder and testing glucose adsorption. We will also test potential synergistic effects of pectin and anthocyanins in blueberries to affect glucose adsorption in the gut.

Effects of temperature on a defensive symbiosis in pea aphids

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Many insects, including the pea aphid, Acyrthosiphon pisum, form symbiotic relationships with heritable bacteria that play important roles in their ecology and evolution. All pea aphids harbor the obligate nutritional bacterial symbiont, Buchnera, and many are also infected with the facultative symbiont, Hamiltonella defensa, which confers protection against parasitic wasps. H. defensa must itself be infected by a toxin-encoding bacteriophage, APSE, for host protection. Symbiotic interactions may be influenced by environmental factors, but this remains poorly studied. Previous studies suggest that the defensive benefits of H. defensa are lessened when parasitized aphids develop at high temperatures, but mechanisms underlying the loss of protection are not known. Anthropogenic climate change will produce changes in average and extreme temperatures, which can influence the aphids' defensive symbiosis in ways which potentially impact the range of this pest species or the efficacy of biological control programs. In this study, I sought to confirm that higher temperatures lead to a reduction in the protective benefits of H. defensa. We hypothesized that less H. defensa or APSE could leave the aphid more venerable to parasitism. To test this we conducted parasitism assays of several aphid clonal lineages with and without H. defensa reared at temperatures ranging from 20 to 30°C and found that higher temperatures did indeed reduce the effectiveness of symbiont-based protection, although mortality was also a major factor at the higher temperatures. Next, we conducted quantitative PCR on DNA extracted from individual aphids to estimate the copy number of Buchnera, H. defensa and APSE to determine if the reduction in protection is correlated with a reduction in symbiont titers. We estimated symbiont copy numbers in aphids at two time points (84hr. and 110 hr. old aphids) reared at three temperatures (20, 25, and 27° C). We found no differences upon statistical analysis with ANOVA in the abundance of the defensive symbiont, H. defensa, in aphids reared at high temperature, but we did find a significant reduction in the abundance of APSEs. This phage encodes toxins that are suspected to target wasp tissue and fewer genomic copies of APSE may result in a decrease of toxin and higher wasp survivorship. We also found a reduction in Buchnera at higher temperatures, which the wasp relies on for nutritional supplementation. This suggests that even though the wasps are more likely to complete development in H. defensa-infected aphids reared at high temperatures, they may still suffer negative effects of a nutritionally compromised host.

A Qualitative Analysis of Social Limitations and Nutritional Gains for Poultry Production in Mali

Helena Huguley, Environmental Economics & Management Major, Department of Agricultural and Applied Economics; Presented in 2012

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Due to the high number of malnourished and impoverished women and children in West Africa, and especially due to the increased severity of climate fluctuations, the objective of my research is to analyze the potential nutritional and social gains that small-scale poultry production has for Malian communities. My research encompassed analyzing readings in both nutrition science and anthropogenic case studies. Through the analysis of previous development projects, along with the potential nutritional gains of poultry products, I have concluded that poultry production can greatly change the nutritional and economic status of Malian women. With the increase of fluctuating climate patterns, such as severe drought, many communities are left extremely vulnerable to widespread malnutrition. Owing to socio-cultural limitations, women and children are most affected by malnutrition; in Malian culture, it is believed that only men need protein, because they are working in the fields. In Mali 15% of children under the age of five are malnourished. The leading cause of malnutrition is linked to protein and energy deficiencies. Thus, UGA's poultry production project has the opportunity to help empower Malian women. The nutritional benefits of poultry products are very extensive. Chicken meat and eggs are very high sources of protein and have a highly productive rate of feed input to total meat output. Compared to other livestock, the chicken is arguably the most cost effective in percentage of inputs benefits retained. Chicken products are a great source of healthy fats and essential nutrients. Chicken liver has one of the highest concentrations of iron for animal products. Iron is an essential nutrient that can increase the physical development of children, boost the physical activity of adults, and decrease the likelihood of contracting sickness. Through the implementation of a small-scale poultry hatchery, a poultry production and distribution system can be developed in surrounding Malian communities. Traditionally, taking care of poultry is seen as women's work in Mali, and thus women will be major partakers in the project. The project is aimed to not only get a small means of income into the hands of Malian women, but to also increase the nutritional status of these women and thus inherently their children as well. Culturally, women are limited in the role that they can play in Mali society. However, the roles that women do partake in (care taking, food providing, child rearing, market selling, etc…) are extensive and vital to their families' overall health and well being. Through the financial and nutritional empowerment of women, we can implement a chain reaction that

Development and Characterization of a Novel Middle Cerebral Artery Porcine Stroke Model

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The National Stroke Association estimates that stroke is the third leading cause of death and the leading cause of long-term disability in the United States. A significant amount of research has been conducted in hopes of developing treatments with over 700 drugs being approved for clinical trials. Only tissue plasminogen activator, a treatment with significant short-comings, has been approved by the FDA. A critical determinant in the success of a drug is the model which is used to test the treatment prior to clinical trials in humans. Most experiments pertaining to strokes use mice as experimental models. The mouse brain, however, has significant differences with respect to gray:white matter composition, size and other key elements of brain architecture when compared to the human brain making it less than an ideal model. These differences have likely lead to the large numbers of drugs that have entered clinical trials and failed as a result of critical safety or efficacy challenges. In our study, we propose the development of a novel pig stroke model as the pig brain has significant similarities to the human brain which overcome the previously mentioned limitations in the mouse. We hypothesized that occlusion through cauterization of the middle cerebral artery (MCA) will mimic an ischemic stroke and lead to impaired neurological function to be determined by magnetic resonance imaging (MRI) and gait analysis. Utilizing MRI, we demonstrated that pigs could be successfully stroked by MCA cauterization. Diffusion-weighted images showed the development of large infarcted regions of the brain affecting frontal, temporal, and parietal lobes. The brain showed significant amounts of edema and apparent diffusion coefficient images showed clear signs of excitotoxicity, a hallmark of stroked brain tissue. To further characterize the stroked pig model, a gait analysis assessment test was developed. Initial control studies demonstrated that a video capture and computational quantitative imaging approach can be utilized to determine changes in stride length, velocity, and swing and stance time. This development of the MCA stroke pig model will enable the generation of critically needed devices, drugs, and cell therapies for stroke and represents a significant advancement.

Potential of a Native Lace Bug as a Biological Control Agent of the Invasive Plant Ligustrum sinense (Chinese Privet)

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Ligustrum sinense (Chinese privet) is an invasive plant species that significantly decreases native plant biodiversity. Exotic lace bugs, Leptoypha hospita, have been evaluated as biocontrol agents, but have been found to also feed on Foresteria acuminata (native swamp privet) which may prevent it from meeting release criteria. Native congeneric lace bugs, Leptoypha mutica, inhabiting swamp privet are not known to transfer to the invasive Chinese privet. These observations led to the hypothesis that Chinese privet may be an unsuitable host for native lace bugs. Therefore, the objective of this research was to determine if the native lace bugs could feed and develop on exotic Chinese privet. Lace bug populations were collected from two sources: native swamp privet in Macon County and Chionanthus virginicus (fringe tree) in Spalding County. For the experiment, three plant hosts were evaluated: Chinese privet, swamp privet, and fringe tree. Plant host and lace bug populations were placed in plastic containers for observations. Four lace bugs (2 males and 2 females) were added to each container with approximately 10 centimeter host samples. There were five replications of each lace bug population-1 (fringe tree collection) and population -2 (swamp privet collection) by each plant host combination, resulting in a total of 30 containers. Containers were maintained in an environmental chamber under controlled conditions at 27oC (± 1o) and 14:10 (L:D) photoperiod. After 25 days, frass (excrement) spots on the upper and lower leaf surfaces, number of eggs, and survival of the insects were recorded. Data were subjected to ANOVA using the GLM procedure of SAS, with mean separation by LSD. Both lace bug populations and host plant were significant sources of variation ($P < 0.05$). When Chinese privet or fringe tree was the host, both lace bug populations performed equally, i.e. number of eggs, frass spots and survival ($P > 0.05$). Significantly, more eggs were deposited by population-1 lace bugs on swamp privet than by population-2 lace bugs ($P < 0.05$). Fringe tree supported the greatest number of eggs and frass spots among the three hosts. These data did not support the hypothesis indicating that Chinese privet may be a suitable host for native lace bugs suggesting their potential as a means of biological control of Chinese privet.

Generation of Constructs to Identify Heart Transcription Factor Enhancer Elements

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Historically the chick embryo has provided a wealth of information regarding the development of a vertebrate organism. Current research in the chicken has been inhibited by the lack of genetic tools that would provide molecular insights into development and disease. The objective of this study is to develop a system to analyze enhancer elements that drive the expression of genes in the embryonic heart. These molecular tools will be used to follow normal heart development and design other molecular tools to generated disease models in the heart. To accomplish this, enhancer elements for the chicken islet-1 gene and wnt-response genes were identified either through bioinformatics by looking for areas in the DNA sequence upstream of the coding portion of the gene that had the greatest common similarities in the chicken, mouse, and human. PCR primers were designed to isolate the putative DNA enhancer elements. Additionally, an expression construct was generated that contained a minimal promoter upstream of the Green Fluorescent Protein gene and is flanked by piggyBac transposon inverted repeats. Enhancer elements isolated by PCR were coned upstream of the minimal promoter in the expression construct. Cloning of these DNA fragments was verified by restriction digest and sequence analysis. My work successfully PCR amplified the islet-1 and wnt-response enhancer elements. The wnt-response enhancer element has been cloned into the expression vector. We are currently in the process of cloning the islet-1 enhancer. Future study will test these construct to determine if the isolated enhancer elements will drive the expression of the Green Fluorescent Protein in the chick embryonic heart.

The Effectiveness of Diatomaceous Earth on Darkling Beetles

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The darkling beetle (Alphitobius diaperinus) is an important pest in the poultry industry, both as a vector for disease and in causing damage to poultry houses. Due to the heavy increase in marketing, diatomaceous earth (DE) for darkling beetle control was tested for effectiveness on adult darkling beetle populations in experimental colonies. Three DE treatments, diatomaceous earth with pyrethrin (DEP), a second product with diatomaceous earth and pyrethrin(DV), and diatomacoues earth (DE), were administered separately to colonies of 100 adult beetles, each at four concentrations of 0 g, 5.6 g, 11.3 g, and 22.6 g. For each concentration three trials were performed, totaling 36 beetle colonies overall. Diatomaceous earth was applied on the surface of the shavings, a bedding material commonly used in broiler houses and effectiveness was observed by counting the number of dead adult beetles at Days 7, 14 and 21 post application. Data were analyzed in SAS JMP ver9.0 using an analysis of variance (ANOVA) with the main effects being treatment and concentration. Significant differences were considered $P \leq 0.05$. Means were separated using the Tukey's method. No differences in concentration were observed and there was no interaction between treatment and concentration. The DEP and DV treatments had significantly greater numbers of dead beetles compared to the DE and control treatments. The DEP and DV treatments had 100% dead beetles by 7 and 21 days respectively. DE was not statistically different from the control in all three weeks, suggesting that diatomaceous earth is not effective in killing adult darkling beetles over a three week period.

Exposure to UV Light as a Control Method for Surface Bacterial Diseases of English Ivy

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Many foliage plants, including common houseplants such as Philodendron and Begonia species, are vulnerable to bacterial infections. Frequently caused by bacteria from Pseudomonas and other generas, infections cause symptoms ranging from leaf spots and blights to stem rot. Plant bacterial infections are not always lethal, but commonly cause unsightly surface symptoms and leaf discoloration. A simple treatment method would benefit both casual gardeners and commercial plant suppliers. Exposure to short wave ultraviolet (UV) light (<300 nm) is widely used as a surface sterilant to control bacterial populations. The goal of this experiment was to determine the effect of UV radiation on plants with a bacterial infection on the leaf surface. Hedera helix (English ivy) plants were inoculated with Pseudomonas aeruginosa, a Gram negative, opportunistic plant pathogen, and placed under two light treatments: a non-UV producing fluorescent light and a UV-B light emitting light at 280-315 nm. Surface exposure to UV radiation tends to result in bacterial death. Therefore, it was hypothesized that less P. aeruginosa would be isolated from the leaves of the plants receiving the UV light treatment than those receiving no exposure to UV light. In an attempt to cause a bacterial infection within the experiment's time parameters, a 20 mm incision was made the leaf surface and a controlled amount of P. aeruginosa was pipetted directly onto the incision. In each treatment, leaves that were lacerated but not inoculated with bacteria served as experimental controls. The amount of bacteria present in each incision at specific times pre- and post-inoculation was calculated by passing sterile swabs over each leaf's incision, vortexing the swabs in phosphate buffered saline (PBS), making serial dilutions of the samples into more PBS, and then spread plating onto Pseudomonas isolation agar plates. The plates were incubated at 21°C for ~48 hours then observed for colonial growth. Plates with 30-300 colonies were used to calculate the amount of bacteria present in the samples. However, reoccurring abnormal trends such as constant or increased colonial growth at higher dilution levels render most of the collected data unusable and suggest a systematic flaw in the method or technique. Due to the lack of usable data, the hypothesis was neither supported nor refuted. The experiment must be repeated before any conclusions about the hypothesis may be drawn.

Carbon mineralization in iron redox fluctuating tropical forest soils

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Presented in 2012

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Studies within the past decade have begun to indicate that iron reduction plays a large role in carbon availability, particularly in soils typical to tropical forests. The objective of this experiment was to compare microbial activity in oxic environments versus those in anoxic environments. I subjected the soil solutions to 4 different types of treatment including three and six day anoxic/oxic oscillations and complete anoxic and oxic conditions. Throughout the experiment I took iron (II) and carbon dioxide samples at the same time for every sample to map carbon flux in each environment. Results are anticipated due to minor setbacks with the measuring instruments. I will measure carbon dioxide using infrared gas analysis and iron (II) concentrations using ferrozine and UV-visible spectrometry. I hypothesize carbon dioxide production will be slightly lower in anoxic conditions due to the higher energy required to use iron (III) as an electron shuttle in comparison to oxygen. In addition, in oscillating environments carbon dioxide production will increase over time more quickly than in non-oscillating anoxic environments.

Differences in Litter Sampling Methods on Moisture Content and their Relationship with Foot Pad Dermatitis in Broier Chickens

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Foot pad dermatitis (FPD) is a condition that is associated with lesions on a broiler chickens' feet. These lesions downgrade a product that is valuable for export, and can be prevented by maintaining paw quality with good litter. Poor or wet litter is associated with higher incidence and more severe FPD. We compared two sampling methods for measuring moisture content of the litter in commercial broiler houses to evaluate the differences between methods and how they relate to incidence of FPD in the flock. One method is a traditional trench method and involves digging a trench through the litter from the middle of the house to the sidewall for sampling; it is commonly done to analyze the litter for use as a fertilizer. The second method is a top sampling method that only uses samples from the top inch of litter. We hypothesized that most of the moisture affecting the birds would be in the top layer, so those samples should have higher moisture content that would be associated with increased incidence and severity of FPD. Two trials were done, each from one broiler house on two different farms, collecting multiple samples of each method that were pre-weighed then dried for 24 hours at 90F to analyze for moisture content. FPD scores of 100 broilers per house were evaluated using a three point system. Data were analyzed with SAS JMP software with litter sampling method as the main factor. So far, data supports our hypothesis that topsoil samples have higher moisture content, but neither sampling method related to FPD very well. More samples should be taken before being conclusive. Ventilation rates in cold weather are determined by relative humidity (RH) with the goal to keep RH between 50 and 70%. If RH gets greater than 70%, then litter moisture will increase. FPD scores that we measured were probably a result of RH and litter conditions a week or more prior to our sampling rather than the samples collected that day. Monitoring houses for RH may provide better litter conditions than monitoring the litter moisture. These data will help integrators use the proper procedures when monitoring litter moisture associated with FPD in commercial broiler houses.

Determination of nutritive value of a supplemental byproduct feed for cattle from expired grocery foods

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A feeding trial was conducted in response to a commercial effort to recycle outdated vegetable foods from large retail grocery stores into cattle feed. Eight yearling Holstein steers (267 kg BW, SD=29 kg) were fed increasing dietary concentrations of grocery byproduct feed (GBP:commercially processed as Readi-Blend, Viridiun, LLC) in a replicated 4 X 4 Latin Square designed experiment. The main objective of the feeding trial was to determine the nutritive value of the GBP. Steers were fed 0, 18.8, 37.3 and 55.5% ensiled GBP (dry matter (DM) basis) as part of a total mixed ration (TMR). The control TMR on a DM basis was 68% wheat silage and 32% concentrate (81% soyhulls, 9.5% soybean meal and 9.5% ground corn). The TMR rations averaged 34.4, 30.5, 27.5, and 25.0 % DM with increasing supplemental GPB. Steers were fed rations daily to provide 1.2 times their previous day intake with chromic oxide included as a digestibility marker. Individual intakes were measured daily and BW was determined at weekly intervals. Overall, steers exhibited 1.25 kg ADG during the 8 week feeding trial. DM intake, expressed as a percent of BW, was 1.88, 2.13, 2.11 and 2.02 (SE=.05) and increased (quadratic, $P<.01$), with incremental levels of GBP. DM digestibility (DMD) averaged 56.9, 61.1, 63.8 and 66.4 % (SE=1.4) and digestible energy (DE) averaged 2201, 2443, 2606, 2787 (SE=51.8) mega-calories/kg (Mcal/kg). DMD and DE increased linearly ($P<.01$) with incremental levels of GBP. Using a linear regression equation (Mcal/kg=9.712 (GPB %) + 2238 Mcal/kg; $P<.01$, r2=.38) GBP was estimated to contain 3517 Mcal/kg and 79.8% total digestible nutrients (TDN) on a DM basis. Based on its DE and CP (11.7%) and current Atlanta, GA market prices for corn ($292/ton) and soybean meal ($274/ton) GBP is worth $56/ton on an as-fed basis. Recycling GPB into cattle feed has considerable economic value for our cattle feeding industry especially during this time of unprecedented feed costs.

Riparian Zones of Urban Streams

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Streams in urban areas encounter a variety of disturbances as they make their way through our cities. They have altered riparian zones and bottom substrates, and are subjected to rapid rises in water flow from runoff of paved surfaces. Many are engineered with concrete channeling to prevent erosion. Runoff from the urban landscape pollutes these streams to a significant degree. Samples were taken from a set of urban streams in the Athens area in various settings and subject to various impacts (n = 6). Macro-invertebrates were used as indicators of environmental health of the research streams, and their communities sampled and analyzed from each site. A reference stream, found in the Oconee National Forest, was chosen to compare urban streams to. Although none of the urban streams had the richness and diversity of biotic life found in the reference stream, a correlation was noted between the quality and continuity of riparian zones to the overall diversity and thus health of the streams. It is predicted that the longer a stream has a diverse riparian zone found on its banks the healthier it will be.

Does Eggshell Pigmentation Reflect Female Condition in Broiler Breeder Hens?

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Brown eggshell pigmentation varies substantially among broiler breeder chicken eggs and is generated by the pro-oxidant protoporphyrin, a metabolite intermediate formed during the biosynthesis of heme. Protoporphyrin can cause oxidative stress, creating reactive oxygen species and damaging cells and tissues.We hypothesized that due to the costs of protoporphyrin generation and deposition, a positive correlation would exist between female condition and egg color allowing for simple assessment of hen condition by analyzing the color of eggs she produces. To test this, six consecutive eggs were collected from each of thirty-one broiler breeder hens and colors were analyzed using a Kodak 10 megapixel digital camera and Adobe Photoshop software. During the period of egg collection, the condition of each hen was assessed through weighing, tarsus length measurements, and blood collection for subsequent analysis of circulating levels of corticosterone (a stress hormone), heterophil/lymphocyte ratios (a measure of stress and immunity), and total antioxidant capacity of blood. Condition indices were then related to average measures of hue, saturation, and brightness to determine whether darker egg colors reflect better female condition. We predicted that hens laying darker eggs would continuously lay darker eggs through the six day period and would also weigh more, have lower stress indicators, and exhibit a better antioxidant capacity. In line with our predictions, egg colors produced by each hen stayed consistent over the six day period. ($R2=0.63$, $p<0.001$). However contrary to predictions, simple regression analyses showed no statistically significant relationship between the egg color variable and egg size ($R2=0.036$, $p=0.031$), residual bird weight ($R2=0.09$, $p=0.11$), corticosterone ($R2=0.036$, $p=0.34$), or blood plasma antioxidant levels ($R2= 0.001$, $p=0.85$). Thus while egg color varied substantially and individual females consistently laid eggs of similar color over the six day collection period, that color was not related to any measure of condition used in this experiment. Future research should examine varying of feed constituents, induction of chronic stress to alter hormone and antioxidant levels, or other measures of female condition in relation to eggshell pigmentation.

Promoter Strength Effect on Function of the Burkholderia thailandensis GspC protein in the Ralstonia solanacearum type II protein secretion system

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The type II secretion (T2S) system is a complex nano-scale machine used by many Gram-negative bacteria to secrete a subset of periplasmic proteins. The T2S system contains 12 to 15 proteins, one of which is GspC, the focus of our work. Ralstonia solanacearum (Rso) is a plant pathogenic bacterium that causes lethal wilting diseases of many important crops worldwide. Rso uses its T2S system to secrete multiple plant cell wall-degrading enzymes as well as other proteins that are essential for pathogenesis. A mutant in which the gspC gene has been removed from the Rso genome (ΔC) is secretion negative and nonpathogenic. Burkholderia thailandensis (Bth) is a bacterium closely related to Rso, but has a distinctly different gspC that, depending on the plasmid construct used, may or may not restore T2S function of the Rso ΔC mutant. Our goal this semester is to determine whether or not this variation in GspC function is due to the strength of the plasmid promoter used to express Bth gspC. We modified existing plasmids and created new ones by splicing in and out the promoters of an Rso housekeeping gene (PgapA) and the native gspC promoter (PgspC). Both promoters had been previously proven to drive gspC complementation of the Rso ΔC mutant. Either the β- galactosidase protein-coding region (lacZ) or gspC protein-coding regions were placed downstream. This was all accomplished via a series of restriction digests and ligations. These plasmids were later introduced into Escherichia coli and Rso. All constructs were determined to be correct by DNA sequencing. Although the GspC coding sequence is the gene of ultimate interest, plasmids with lacZ provide an easily analyzed reporter for promoter strength. In both E. coli and Rso, PgapA yielded high levels of β-galactosidase activity whereas PgspC yielded virtually none, indicating that PgapA is the stronger promoter. Previous results showed that when expressed from their native promoters in an Rso ΔC mutant, both Rso and Bth gspC genes restore T2S. When driven by PgapA, however, only Rso gspC is functional. We are still in the process of creating the plasmid in which PgspC drives expression of Bth gspC to determine if it restores T2S function. If true this will show that promoter strength affects the ability of the Bth GspC protein to complement Rso ΔC.

Studies on elevated blood progesterone levels in relationship to stress and neutrophilic function in equine

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Neutrophils are critical cells of the immune system, and they are the first to arrive at sites of infection in the body. Phagocytic in nature, neutrophils are composed of enzymes that aid in killing and digesting microorganisms. A major facet of the killing and digestive processes is that the phagocytic vacuoles contain reactive oxygen species (ROS) molecules. The ability of a neutrophil to produce ROS is defined as a respiratory burst. The amount of stress displayed by a given individual can be determined by assessing respiratory burst levels of circulating neutrophils. From this, the ability of an animal to adapt to stress can evaluated from neutrophil function. The objective of the study is to develop a rapid, practical and repeatable method for determining neutrophilic function that can be used by veterinarians to determine whether a given horse is experiencing altered stress levels. Blood (450 µl) was obtained from research mares and incubated with 50µl if the synthetic progestin, atrenogest (Regu-Mate®). Synthetic progesterone reliably postpones mares from entering estrus, and mimics pregnancy. Following the incubation, 30µl of the Regu-Mate®/blood complex are combined with an additional 70 µl of Regu-Mate®, 465µl of Phosphate-buffered saline (PBS), and 100 µl of 1mM luminol in an assay tube. Three replicates of a given concentration and three replicates of a control are placed in a water bath (37°C) for 10 minutes. Baseline readings for each replicate are taken using a 3M Clean-Trace™ Luminometer. Thirty-five µl of 5 x 10-5M phorbol 12-myristate 13-acetate (PMA) is added to each tube, staggering the additions to the tubes by 30 seconds. The relative light units (RLU) were read at 2.5, 5.0, 10.0, 15.0, 20.0, and 30.0 minutes. This data is used to generate average RLU, +/- Spectra Energy, and to plot RLU/1000 neutrophils versus [Regu-Mate®]. The IC50 is determined from the graph using GraphPad Prism. The data showed that the Regu-Mate® significantly ($p < 0.05$) increased the reactivity of neutrophils compared to controls. This data supports other data that pregnant mares immune system is more reactive.

Determination of Virulence Factors Associated with Histomonas meleagridis in Blackhead Disease in Poultry

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Histomonas meleagridis is the causative agent of Blackhead Disease in gallinaceous birds. It causes cecal inflammation and can spread to the liver leading to liver failure and death. This disease is known to have 80-100% mortality in turkey flocks. In a previous study, H. meleagridis was shown to lose virulence upon passage in culture suggesting a variation in pathogenicity that is also observed in the field. Our lab has identified potential virulence factors whose expression is lost upon passaging in laboratory cultures. To test the ability of these genes to cause disease, we are designing experiments to express putative virulence factors in a non-virulent strain of H. meleagridis via transgenesis. We are currently designing a transformation protocol specifically for H. meleagridis. My research project has been to design, generate, and test this expression system. To do this, I cloned the H. meleagridis beta-tubulin promoter upstream of the neomycin resistant gene. A polyadenylation signal sequence was also cloned downstream of the neomycin gene to promote stable mRNA expression. Currently I am testing several electroporation conditions to assess the ability of this construct to confer resistance to G418. Upon successful transformation of H. meleagridis we will generate new vectors that contain sequences encoding virulence factors in place of the neomycin resistance gene, and test their affect on the pathogenicity of Histomonas meleagridis in turkeys. Virulence genes identified in these studies will be targets for future drug development and vaccine production.

Reasons to Limit Animal Husbandry Practices in the United States

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Currently in the United States there is discussion on whether or not animal producers should be allowed to use animal husbandry practices that are known to cause pain and distress to the animal. Specifically two animal husbandry practices that are under public criticism due to view that they cause animals to suffer are: tail docking of bovine animals, and castration without an anesthetic agent of bulls and boars. Hence, the objective of this research was to determine if current scientific literature could justify claims that these specific animal husbandry practices ought to be further regulated and limited in practice. The need for individual U.S state legislatures to adopt more stringent regulations on limiting animal husbandry practices should be depend upon scientific observation on how these selective practices affect the animal's welfare. Tail docking can potentially cause significant welfare problems such as the formation of neuromas, which can lead to chronic pain in the stump of the docked tail, behavioral and psychological signs of distress, and the inability to control flies. Literature cited in this paper also found that the benefits of tail docking are not justified by scientific studies and observation. Castration of bulls can be either acutely or chronically painful depending on the specific procedure chosen, and cattle demonstrate significant pain responses during and/or after castration. These responses can include struggling, kicking of the hind legs, tail swishing, foot stamping, head turning, restlessness, and reduced activity. Castration of boars also has both chronic and acute pain implications with surgical castration, which is the most common method chosen. Castration has also been shown to provoke visible signs of pain behavior. This included behaviors such as huddling up, spasms, trembling and high frequency vocalization. The use of anesthesia to provide pain relief, however, is not mandated nor commonly used in the United States for either bulls or boars. The scientific literature cited in this paper suggest that claims to limit these practices on the grounds that they can cause significant welfare issues for the animals have merit. It is suggested that castration of boars and bulls ought to be done at an early age to minimize overall welfare complications. The use of anesthesia reduces overall acute pain implications and is beneficial for animals castrated at an early age and those that are not. The potential for tail docking to have negative welfare implications and the claimed benefits of the practice seemingly debunked by scientific literature suggest that the practice ought to be banned from further use.

The Effect of Seasonality on Insect Colonization as it Applies to Forensic Entomology

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Forensic entomology is the use of insects and related arthropods to aid in criminal investigations. Most often, insects are used to determine the post-mortem interval, or PMI, (time of death) of human remains. Patterns of insect colonization aids investigators in determining PMI. This experiment sought to determine if the weather patterns associated with different seasons had an effect on the process of insect colonization of decomposing remains. Methods included four chicken carcasses being placed in cages (1/4” openings) to decompose in a field, while the process of colonization was documented. Two carcasses were placed on the outskirts of the field, near the tree line, while the other two were placed near the center of the field. Two carcasses were removed approximately 30 hours into the experiment by unknown sources, most likely vertebrate scavengers, leaving two carcasses. The data represents colonization patterns during the spring season. The findings were then compared to data collected by a study on colonization of carrion during summer and fall to identify any differences in the patterns. The results differed greatly between the two carcasses. Site #1, near the tree line, decomposed at a much quicker rate than site #2. The pattern of colonization was also quite different. Site #1 showed a large number of flies on day one, with maggot activity occurring soon after. Initially, the main colonizing species were Calliphorids and Muscids. Later in decomposition (beginning day 6), the beetle families Silphidae and Staphylinidae also became prominent. Site #2 was colonized by ants (Formicids), with an abundance of beetle activity (mainly Silphids), and very little fly activity. It was not until a vertebrate scavenger fed upon the carcass, making wounds, that fly activity began (day 9). After the wounds were made, the main colonizers were Calliphorids and Silphids. The results differed only slightly from the comparison study’s findings of the colonization during summer. This is not unexpected, considering the high temperatures that were closer to summer averages. The study data from the fall differed greatly from the collected data. This was also expected, considering the great temperature differences. It can be concluded that seasonality affects the insect colonization of decomposing remains. The carcasses in this study had noticeably different decomposition and colonization patterns, due to placement within the field, amount of direct sunlight, and the presence of ants within the field.

Manipulating tropical fire ant populations to decrease the coffee berry borer in shade coffe farms in Costa Rica

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The coffee berry borer Hypothenemus hampei is the most important pest of coffee production worldwide. We tested the hypothesis that the tropical fire ant, Solenopsis geminata, indirectly protects the coffee berry borer by suppressing other ant species which are the coffee berry borer's primary predators. We found that removing S. geminata from coffee plots significantly increased the disappearance rate of adult coffee berry borer beetles from coffee berries compared to control plots. Approximately 5% of beetles disappeared from plots with S. geminata while 28% of beetles disappeared from plots from which S. geminata was removed. This pattern was observed on two shade coffee farms, one in the rainforest and one in the cloudforest, which had marked differences in management intensity and ant diversity. If the results of this small-scale study can be economically replicated on the farm level, then S. geminata removal may represent a new partial control technique for the coffee berry borer throughout Central and South America.

The Effect of Reduced Crude Protein on a Modified Piglet Nursery Diet on Growth Performance

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The use of high levels crude protein in piglet nursery diets is essential for optimum growth and development. However excess crude protein is then excreted into the environment causing an increase in soil nitrogen levels, which negatively affects the environment. Therefore the objective of this study was to determine if a modified diet using reduced crude protein (using a soybean concentrate) and incorporating higher levels of crystalline amino acids (to maintain the key dietary components) could be sufficient when fed in an ideal standard ratio for optimum growth performance. Lactose was also incorporated into the modified diet to be used as an energy source and for an enhanced intestinal environment. The study utilized 72 nursery piglets, starting once the piglets were weaned, with an average initial weight of 4.49 kg. The 35-day study was divided into 3 phases. In Phase I (Day 0-7), all the piglets were given a standard diet to create a uniform control point. In Phases II (Days7-21) and III (Day 21-35), the compositions of the diets were increasingly modified with decreasing crude protein levels, while a control group was fed modified diet without a decrease in crude protein to analyze overall growth performance. Throughout the study, the piglets had free access to feed and water and were weighed and the feed intake was determined in weekly intervals. Diet samples were taken to evaluate the nutrient profile after completion of the study. Crude protein utilization was measured by taking biweekly blood samples to measure blood urea nitrogen (BUN) content, which has a direct correlation between protein utilization and nitrogen excretion. The benefit of using BUN is that it indicates that the pigs are not being overfed protein. BUN content was measured using a spectrometer along with an enzymatic procedure, using urease coupled to a color indicator reaction. The urea concentration was determined by a standard curve. The overall results showed a direct correlation between the crude protein levels in the diet with the BUN levels from the blood samples. As the crude protein levels decreased in the piglets fed the modified diets, the BUN content also decreased. Additionally, there was not a significant difference in overall feed:gain ratio and overall average daily gain between the modified diets with and without reduced crude protein levels. In conclusion the modified diet with less crude protein did meet expectations. Therefore reducing crude protein levels in the diet can play a role in reducing the excretion of excess nitrogen into the environment, while maintaining the optimum growth patterns in the piglet.

Neural Differentiation and Derivation of Neural Rosettes from Pig Induces Pluripotent Stem Cells

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Induced pluripotent stem cells (iPSCs) have the ability to undergo spontaneous neural differentiation under the influence of certain cellular signals. The efficient in vitro neural differentiation of iPSCs is a crucial component of stem cell research for it provides a stable source of neural cells used for biomedical research and the treatment of neural degenerative diseases. Our goal is to develop cryopreserve porcine neural cells for future neurodegenerative and neural injury studies. Our objective is to test various culture conditions and determine which in vitro system is ideal for neural differentiation. Cryopreserved pig iPSC derived neural rosettes were the starting neural stem cell population. After thawing, the neural rosettes were propagated in Neural Progenitor (NP) N2 Derivation media + 4 ng of basic Fibroblast Growth Factor (bFGF) on four passages to expand initial neural rosette populations. One differentiation media used consisted of AB2 media + ANS supplement, which has shown to direct differentiation of human neural progenitor toward various neural phenotypes. The other media was the NP N2 derivation media without bFGF. The growth factor bFGF was eliminated to decrease cell proliferation and promote cell differentiation. Six different initial concentrations of neural rosette populations were tested in 6 wells coated with Matrigel. After two days, the neural rosettes that received AB2 media + ANS supplement showed a poor rate of development with no elongation or further neural differentiation. All the neural rosette populations were dead as the experiment progressed, making AB2 media + ANS a non suitable medium for pig iPSC neural differentiation. The neural rosette populations in NP Derivation medium without bFGF showed a high rate of differentiation with signs of elongation and neural differentiation. However, antibody immunostaining is needed to demonstrate robust neural differentiation. Therefore, expression of the neural proteins class III beta-tubulin/microtubule-associated protein 2 (neuronal), glial fibrillary acidic protein (astrocytes), and foxhead box protein O4 (oligodendrocytes) will be used to test for the presence of the central nervous system lineages in differentiated cultures of pig neural rosettes.

Effects of Shortening Breakover at the Toe on Gait Kinematics at the Walk and Trot

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The point of breakover can be described as the portion of the hoof capsule last in contact with the ground as the hoof leaves the ground during the terminal stance phase of a limb. It can be influenced by many factors, one of which being the craniocaudal placement of the shoe on the hoof. Moving the point of breakover back from the toe can be treatment for frequently seen lameness issues such as laminitis and navicular as well as a preventative measure against future lameness problems seen in horses. The practice of moving the point of breakover caudally from the toe has been suggested to decrease strain on the deep digital flexor tendon and navicular bone as well as improve the alignment of the P2/P3 axis. The current experiment involved eight sound horses between the ages of 3 and 21. Regular farrier care was maintained before the experiment, and all horses had their hooves trimmed one day prior to the study. The horses were also fitted with aluminum plate shoes adhered to their front hooves. Plates were drilled and tapped to allow additional aluminum plates of varying lengths to be attached to the plates while the back hooves were left barefoot. Each horse was hand walked over a distance of 70 meters for 6 repetitions and then trotted in hand over 70 m for 6 repetitions. The treatments were then applied to the front hooves in random order. Each treatment was video recorded three times to the left and three times to the right with reflective spray paint on certain joints as tools for calibration. A licensed veterinarian also took radiographs the day following the video recording. Both front hooves of each horse were radiographed wearing the heel plate and longest treatment plate. The video clips were analyzed using EquineTec software program and the researchers were given codes so they would be blinded to the treatment. Step length, step velocity, maximum knee height, maximum hoof height, and location of maximum hoof height, as well as protraction and retraction of the front leg was analyzed after calibration. The results of the study show that there are likely benefits to stride kinematics that can occur through shortening the point of breakover. The amount of drop seen in the fetlock joint when weight bearing was reduced when the breakover point was moved caudally from the toe. The theory that there would be increased support for DAL, deep digital flexor tendon, and navicular suspensory ligaments is supported by the outcome of this experiment.

Can more efficient irrigation reduce the fertilizer needs of ornamental crops?

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Controlled release fertilizers (CRF) are essential to nursery crop production and provide a steady supply of nutrients to the plants. However, excessive irrigation, common in nursery production, can leach nutrients from the substrate, resulting in surface water eutrification. Leached nutrients also represent a significant economic loss to growers. More efficient irrigation can decrease the leachate volume and reduce the amount of fertilizer needed in the production process. There is no quantitative, research-based information on the effect of better irrigation efficiency on fertilizer use and loss due to excessive irrigation. Therefore, our objective was to determine the effects of irrigation efficiency and fertilizer rate on the amount of nutrients leached and on the amount of nutrients remaining in the substrate mix (pot EC) over an entire production cycle. Lantana 'sunny side up' was grown in 3.6 L containers filled with a soilless substrate. Soil moisture probes were used to precisely control irrigation based on the volumetric water content (VWC) of the substrate. Irrigation in the control treatment was triggered if the VWC of control plants fell below 45%. The four treatments were watered for 15, 20, 25, or 30 sec until the control reached 45% VWC. We also compared 6 fertilizer rates; 25 to 150% of standard industry rate (Harrell's 16-6-11, 5-6 month CRF). Each irrigation/fertilizer rate treatment combination was replicated 8 times. Leachate from all treatments was collected weekly and measured for volume and dissolved nutrients to quantify nutrient loss. Electrical conductivity (EC) of the substrate was measured during the trial to quantify how the treatments affected nutrient availability to the plants. As the volume of the leachate increased, leachate EC decreased but the amount of leached fertilizer increased. The decreasing leachate EC with increasing leachate volume could be interpreted as a positive, yet was simply due to the leached fertilizer being diluted as the leachate volume increased. The amount of leached fertilizer also increased as the fertilizer rate increased, regardless of the irrigation treatment. All plants in the study were salable, suggesting that using 25% of the recommended fertilization rate combined with near zero leaching produced acceptable plants. Using 25% the industry fertilizer rate, along with a near zero leaching irrigation treatment, growers would save $1,170/acre on their fertilizer costs. After 4 weeks, this treatment would prevent 12.1 lbs/acre of fertilizer from being released into the environment.

Effect of Cation Chelators on Biofilm Formation in a prolific versus non prolific biofilm forming strain of Listeria monocytogenes

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The mechanisms involved in Listera monocytogenes biofilm formation are largely unknown. Previous studies involving other bacterial pathogens suggest cations contribute to biofilm formation. The goal of this study was to provide insight into some of the external factors that enable efficient biofilm formation and persistence of L. monocytogenes on food processing surfaces. This study determined the effect of the cation chelators EDTA and EGTA, a calcium specific chelator, during biofilm formation on stainless steel surfaces by L. monocytogenes strain 311 (prolific biofilm former) and ATCC 19115 (poor biofilm former). Epifluorescent microscopy was used for visualization and quantification of the biofilms, and bacterial counts were obtained using the spread plate method. Microscopy results indicated that the presence of 30 mm of the cation chelators EDTA and EGTA completely inhibited bacterial growth and attachment when added initially and after 6hr of biofilm growth. Chelating cations in the growth medium appeared to enhance biofilm formation once biofilms had formed after 24 or 48 hours. Plate counts showed 2-3 log decreases in bacterial growth of both strains following the addition of EDTA initially and after 6hr and 3-4 log decreases following the addition of EGTA but no significant difference after 24 and 48 hours. Collectively, the data suggest that cations, especially calcium, play an important role in bacterial attachment and the subsequent biofilm formation. The information obtained from this study will provide insight into the external factors that enable effective and efficient biofilm formation in L. monocytogenes. This information can then be used as a tool to formulate effective intervention strategies against this pathogen of extreme importance.

The effect of polysulfated glycosaminoglycan injections on joint range of motion in aged performance horses

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A performance horse is greatly influenced by its joint function. As it ages, the joints can become inflamed and start to degenerate, limiting the horse's ability to perform. There are many products on the market for the function of relieving pain and slowing degeneration of the joints. One such product, Adequan, is intramuscular injections of polysulfated glycosaminoglycans. The product has been shown to prevent degeneration and help induce cartilage synthesis on a cellular level. Eleven performance horses, ranging in age from 5-21 years, were used in a research study examining how a treatment course of polysulfated glycosaminoglycan injections would affect joint range of motion. The horses were fed as a group, housed in a 12 ha field, and ridden 4 times per week during the entire study. The horses were videotaped at days 1, 14, and 31 prior to receiving any treatment. The horses were then paired by age and each pair was divided, with one half acting as a control group and the other half as a treatment group. Treatment horses received 500mg polysulfated glycosaminoglycans every 4 days for 7 treatments. Both groups were again videotaped at days 4, 16, and 44 post treatment. Reflective markers were placed on major joints of each horse. Horses were taped at the walk and trot in hand on a flat asphalt surface. The reflective markers were then used to analyze the minimum (min) and maximum (max) angle and range of motion (ROM) for the following joints: elbow, carpus, tarsus, and fetlock. Statistics were run using SAS version 9.2 proc GLM with $P<0.05$ denoting significance. Treated horses did not show any consistent effect on joint angles or range of motion. Treatment did significantly influence min and max angles of the fetlock, but no change in ROM was observed. Treatment horses had a larger min and max left fetlock angle following treatment but a smaller min and max angle on the right side ($P<0.05$). No other angles measured exhibited a treatment effect. The results of this study show that intramuscular injections of polysulfated glycosaminoglycans have little effect on range of motion in aged performance horses. Changes were observed in specific joints but were not consistent bilaterally or overall.

Insights into the Population Genetics of an Asain Bug, Megacopta cribraria (Fabricius), in Georgia from Comparative Maternal Genomics

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The stinkbug Megacopta cribraria (Fabricius) is the first hemipteran species of the family Plataspidae to be reported from the Western Hemisphere and it was discovered in North Georgia in October 2009. Identified to species from morphological and genetic characters, the insect was reported in nine Georgia counties in March 2010 and by November 2010 it had been identified in 80 Georgia counties as well as in counties in the contiguous states of Alabama and North Carolina. Mitochondrial DNA (mtDNA) gene and genome sequence show only a single female lineage (GA1) was introduced and this lineage appears to be rapidly dispersing across geographies. A 2367 bp mitochondrial gene fragment extracted from samples identified as M. cribraria from China, Taiwan and Japan were then phylogenetically analyzed with the GA1 haplotype sequence to determine the intraspecific variation across the samples. Although a Megacopta group or clade was observed, only the samples from Japan formed a subgroup or subclade with GA1. The other samples formed separate subclades indicating different species groups. A project to sequence and compare the mtDNA genomes of selected samples each from Japan, China and Taiwan was then initiated. The purpose was to test the hypothesis that Japanese samples and the Georgia GA1 haplotype form a species group separate from the Megacopta stinkbugs collected in China and Taiwan. Polymerase chain reaction (PCR) – mediated sequencing of the mtDNA genomes was accomplished using species-specific primers originally designed to sequence the M. cribraria GA1 genome, deposited in GenBank (JF288758). PCR products for each sample were purified, sequenced, analyzed and then formed into consensus sequences. Phylogenetic genome sequence analysis showed concordance with the gene sequence data. Results indicated that stinkbugs in Georgia and Japan formed a clade which did not include samples collected in China and Taiwan. The data shows, therefore, that the Japanese and GA1 M. cribraria stinkbugs are likely a different species from the stinkbugs collected in China and Taiwan. Samples, therefore, must be verified as M. cribraria with mtDNA gene sequence then deposited into GenBank to facilitate molecular taxonomic identification of Megacopta species in the future.

Prevalence of mastitis and analysis of somatic cell counts among milking cows at the University of Georgia Teaching Dairy

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Mastitis is an inflammation of the mammary gland, and it is most commonly caused by microorganisms. This malady is the most costly disease of dairy cattle because it results in lowered milk production, thereby reducing profits to dairymen. Fortunately, mastitis caused by several different bacterial species is treatable using antibiotics, thus the identification of the specific species responsible for an infection can be a vital tool to help dairy farmers control this disease. The objective of this research was to identify the prevalence and specific causes of mastitis among Holstein cows in the milking herd at the University of Georgia Dairy for potential treatment with antibiotics. Between July and November 2010, approximately 376 quarter milk samples of 55 lactating dairy cows were analyzed. Following collection, samples were streak plated onto trypticase soy blood agar plates and incubated at 37°C for 48 hours to allow for bacterial growth. Microbes were identified based on colony morphology, Gram stain, and biochemical testing. A Direct Cell Counter was used to determine somatic cell counts (SCC)/ml of milk in each sample. Results demonstrated that the most prevalent sources of infection were the coagulase-negative staphylococci (53.7%), Staphylococcus aureus (25.0%), Escherichia coli (15.4%), Streptococcus spp. (3.5%), Proteus mirabilis (1.2%), and Arcanobacterium pyogenes (1.2%). Average SCC for uninfected and infected quarters were 70,600 and 198,100/ml. respectively. Among infected quarters, SCC were highest for E. coli (365,000/ml) and lowest for P. mirabilis (137,000/ml). The combination of bacterial culture results and SCC provided a basis for selecting cows and quarters for antimicrobial treatment. Approximately 80% of cows were identified as being either infected in at least one quarter or contaminated in at least one quarter. Overall contamination rate was 15.7%, which is considered high, and it is recommended that more sanitary practices be adopted by milking technicians when collecting milk samples for microbiological culture. This high contamination rate also suggests that udders are not being properly prepared for milking, which may lead to an elevation in overall herd prevalence of mastitis, thereby reducing profits to the UGA Dairy.

Who eats fast food and why

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Increased consumption of fast foods is one cause of rising obesity within America. Understanding the characteristics of individuals who have relative high levels of fast foods in their diet will aid in developing solutions to obesity. Based on a national survey, a model is developed to determine the underlying characteristic of fast food consumers. Results will indicate how individuals can change their habits and potentially decrease both their consumption of fast foods their waistline.

Effect of GIPC-GAIP Coexpression on LPA Induced Signaling in CHO-K1 Cells Stably Expressing the LPA1 Receptor

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Ovarian cancer accounts for more deaths than any other cancer of the female reproductive system in the United States. Lysophosphatidic acid (LPA) serves as a signaling molecule that induces proliferation, metastasis, and migration of ovarian cancer cells through a set of G-protein-coupled receptors (GPCRs) and guanine nucleotide-binding proteins (G-proteins). Regulator of G-protein signaling (RGS) proteins play a direct role in regulating signaling cascades initiated by GPCRs by accelerating the deactivation of the Gα-subunit of G-proteins. RGS proteins negatively regulate LPA signaling in ovarian cancer cells; however, the exact process through which RGS proteins bind to Gα-subunits and initiate their deactivation is unknown. Previous research suggests that the regulatory process is coordinated by both G-proteins and GPCRs. The scaffold protein GIPC has been shown to interact with both RGS19/GAIP and the LPA1 receptor through a complementary PDZ domain, thus it is possible that GIPC regulates the interaction between LPA1 and RGS19/GAIP proteins. To investigate the relationship between LPA1, RGS19/GAIP, and GIPC, we tested the effect of expression of RGS19/GAIP and/or GIPC on LPA signaling in CHO-K1 cells stably expressing the LPA1 receptor. The ability of LPA to stimulate inhibition of adenylyl cyclase (cAMP) was measured in adenylyl cyclase activation assays. No consistent regulation of LPA stimulated Gαi activity was observed, suggesting that RGS19/GAIP and/or GIPC do not significantly alter activation of this pathway. Future experiments will test regulation of other pathways and additional RGS candidates. Establishing a novel mechanism for LPA signaling has the potential to advance prevention and treatment methods for ovarian cancer.

No evidence for temperature-dependent sex determination in chickens

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A study was performed to determine if temperature-dependent sex determination exists in the chicken by examining if small incubation temperature deviations influence offspring sex in two strains of broilers. In the first trial, Cobb 500 broiler eggs from a 42 week old flock were placed in one of three Natureform incubators at standard temperature, 37.7°C, below standard, 37.4°C, or above standard temperatures, 37.9°C. Air temperatures throughout the top, middle, and bottom sections of each incubator were monitored. Hatched chicks from each treatment were vent sexed, and one tray from each treatment were sex separate reared to 31 days and necropsied to assess the presence of male or female gonads to determine the accuracy of the sexer. PCR confirmed a match between genotypic and phenotypic sex of the reared birds. The vent sexer was 98.4% accurate. The sexed male ratios were not significantly different (52% in the below standard temperature treatment, 49.8% in the standard treatment, and 50.4% in the above standard treatment). A second trial of this experiment was conducted using Cobb 700 broilers from a 43 week old flock. Similar incubation temperatures were used, and the chicks were vent sexed and a subset was dissected to check the vent sexer accuracy. The vent sexer was determined to have 98.5% accuracy. No differences in male sex ratios were observed (50.6% in the below standard temperature treatment, 52.1% in the standard treatment, and 45.3% in the above standard treatment). Within the incubation temperature deviations of these studies, there was no evidence that temperature influences offspring sex in chickens.

Effect of polysulfated glycosaminoglycan intramuscular injections on gait quality at the walk and trot

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A major factor influencing a performance horse's ability to have a balanced, ground-covering gait is joint function. Aging leads to joint degeneration and can dramatically shorten a horse's performance career. Products such as polysulfated glycosminoglycans (trade name Adequan) have been developed to reduce joint degeneration and allow horses to perform at a maximum level. The purpose of this research was to investigate the effects of a manufacturer recommended protocol of intramuscular administration of polysulfated glycosaminoglycans on gait quality in the equine. Eleven riding horses (ages 5-21) owned by the University of Georgia were group fed and housed in a 12 ha field and ridden 4 times per week for the duration of the study. Horses were paired by age, and within each pair one horse was used as a control while the other received 500 mg polysulfated glycosaminoglycan (5 ml total volume) every 4 days for 7 treatments. Horses were videotaped day 1, day 14, and day 31 pretreatment and day 4, day 16, and day 44 post treatment at the walk and trot in hand on a flat asphalt surface over a distance of 66.5 m (recording frame of 5.5 m at the center). Videos were analyzed using OnTrack EquineTM for stride length, fetlock height at midstance, and protraction/retraction of the fore and hind limb. The base value was an averaged value of the data from the three pretreatment tapings. Differences were calculated for each post treatment time period by subtracting the base value from the measurements at each time point. Data was analyzed using SAS version 9.2 proc GLM with $P<0.05$ considered statistically significant. No treatment effect was observed on step length at walk and trot, on protraction or retraction of the front leg at the walk, or in fetlock height of the left front leg, although right fetlock height was observed to be lower to the ground midstance following treatment ($P<0.05$). Results of this study indicate that intramuscular injections of polysulfated glycosaminoglycans had little effect on gait quality in aged performance horses.

Intron loass and gain in the Br2/Dw3 gene across grass subfamilies

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Intron Loss and Gain in the Br2/Dw3 Gene across Grass Subfamilies Documentation of intron loss and gain in conserved genes provides insight into the mechanism of genome evolution across organisms. This is a relatively unexplored area in plants. Studies in Arabidopsis and rice, two species that diverged around 150 -200 million years ago, have shown differential presence for about 5% of introns, mostly due to intron loss. This study will look in particular at the orthologs of a highly conserved gene that codes for a p-glycoprotein involved in auxin transport. This gene, known as Br2 in maize and Dw3 in sorghum, has mutated forms that reduce the height of a plant by reducing the length of its internodes. Comparison of the sequence of the recently isolated gene in pearl millet with the orthologous gene sequences from maize and rice has shown evidence of at least two independent intron gain or loss events in the evolution of this gene in the three species. We have designed primers in conserved exons of the gene and are using those to amplify the introns in selected members of four grass subfamilies. Sequencing of the introns and intron-exon boundaries may provide insight into the mechanism of intron gain and loss. We aim to explore the evolutionary history of this gene in the grass family and identify which grass has the most ancestral form of the gene.

Got staph? Testing the effectiveness of the current methods for visually identifying Staphylococcus aureus

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A trial was conducted to verify the accuracy of the current method of visually identifying the pathogen, Staphylococcus aureus. This organism is a major mastitis-causing bacterial species in dairy cows, as well as a serious medical concern in humans, and antimicrobial therapy is required to control this contagious pathogen. Therefore, it is beneficial both economically and medically to be able to detect S. aureus accurately and to treat accordingly with antibiotics. A study was performed to determine if S. aureus could be visually identified with an acceptable degree of accuracy, based solely on the presence of beta hemolysis when plated on trypticase soy blood agar, which has historically been an accepted form of presumptive identification. Isolates were processed from frozen milk samples collected from local Georgia dairies by plating onto trypticase soy blood agar plates and placing them in an incubator for 48 hr at 37°C. A preliminary identification was made based on colony morphology and whether the culture exhibited a zone of hemolysis. If the isolate exhibited no zone of hemolysis, it was presumptively identified as the bacterial group coagulase-negative staphylococci (CNS), and further testing was carried out to confirm that the isolate in question was not S. aureus. A total of 103 bacterial isolates were visually diagnosed as CNS. These samples were then tested for the presence of the enzyme coagulase, which is confirmatory for S. aureus; 18 of the samples were found to be coagulase positive. The coagulase-positive isolates were then plated onto mannitol salt agar plates because fermentation of mannitol is further confirmation of S. aureus; 17 of the isolates fermented the mannitol, and were thus confirmed to be S. aureus. Results demonstrated that approximately 18% of isolates were misdiagnosed as CNS, and should have been correctly identified as S. aureus. By using the current method of visually identifying S. aureus based on the presence of beta hemolysis, a successful detection can be expected approximately 82% of the time. This level is unacceptable as it is critical to correctly identify S. aureus and treat in a timely manner with appropriate antimicrobial drugs to prevent the spread of this contagious species to other cows in a dairy herd.

Analysis of a new purificaiton method for aqueous suspensions of single-walled carbon nanotubes

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Due to the enhanced physical, chemical, and mechanical properties of single-walled carbon nanotubes (SWNTs), there has been a great deal of interest is using them for commercial and scientific applications. Their possible applications include field emission devices, photovoltaic devices, chemical sensors, and hydrogen storage materials. Unfortunately, as-produced (AP) grade SWNTs contain a combination of various types SWNTs (varying from semiconductive to metallic conduction), metal catalyst nanoparticles, and amorphous carbon. The formation of stable, purified suspensions of SWNTs is necessary to increase the proficiency of the desired devices. Therefore, there is great interest in the development of methods for purifying SWNT suspensions without damaging the nanotubes enhanced properties. The most common methods for the purification of SWNT solutions involve oxidizing acid treatments that damage the SWNTs, changing their electric properties. Further, high temperature oxidation treatments have a similar effect. Ultracentrifugation, removes the long, unbundled SWNTs needed for electronic materials. The development of a purification method that involves low centrifugal force (18,000 G) is an effective method for producing purified SWNT suspensions enriched in high-aspect-ratio SWNTs. This study reports how the quality of SWNT suspensions changed over the course of multiple centrifugations. For this work, AP grade SWNT soot was dispersed by probe sonication into sodium dodecyl sulfate (SDS) solution by adding 0.2 grams of SWNTs to 200 milliliters of SDS solution. After each 45 minute centrifugation cycle, the suspensions were analyzed by liquid and surface Raman microscopy, UV-Vis and near-IR transmission. This data indicated that multiple cycles of centrifugation have are an effective as a purification method.

Sediment fingerprinting across southern piedmont watersheds

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Southeastern piedmont streams are inundated with sediment and this has become a serious threat to water quality. Techniques have been developed to better understand where this sediment has originated from by matching characteristics of sediment with that of soil sources. This "Sediment Fingerprinting" relies on tracers that show an ability to definitively differentiate between different sources of sediment. This study's objective was to show that tracers shown to uniquely identify sediment in one southeastern piedmont watershed (N. Fork Broad River) could be applicable across the piedmont. A multitude of tracers were originally used to determine sediment sources in piedmont streams. From the original tracer list four were chosen to be used in this study based on monetary reasons and the relative ease of use for other state agencies. Forty soil samples from potential sources (forests, pastures, dirt roads, and stream banks) from the South Fork Broad River watershed area were collected and analyzed for 15N, 13C, and total Carbon and Nitrogen. Using discriminate analysis to statistically represent data showed using 15N and Total Carbon uniquely differentiated known source samples of forests, pastures, dirt roads, and stream banks. Based on the positive results of this study it can now be shown that these tracers can be used in various watersheds across the piedmont where "Sediment Fingerprinting" is designated as an acceptable monitoring treatment.

Generation of Green Fluorescent Protein Antibodies in Laying Hens

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Green Fluorescent Protein (GFP) is a bioluminescent protein that is routinely used as a marker protein in cell biology research. The generation of antibodies against GFP would provide a valuable reagent that could be employed in antibody-dependent cell biology techniques such as Western Immunoblot analysis and Immunoprecipitation procedures. Since avian species deposit relatively large amounts of antibodies in the egg yolk, immunization of laying hens with GFP represents a practical approach to generating large amounts of polyclonal antibodies to this marker protein. In the current study, five Leghorn hens were immunized with purified GFP. The immune eggs were collected from the hens and GFP antibodies were isolated from the egg yolks using a Polyethylene Glycol (PEG) precipitation technique. To further purify the PEG precipitated antibodies, Diethylaminoethyl (DEAE) column chromatography was employed. Sodium Dodecyl Sulfate Polyacrylamide Gel Electrophoresis (SDS-PAGE) was used to monitor the antibody purification procedure. To test the functionality of these GFP antibodies, Western Immunoblot analysis of cultured DT-40 cells that had been transfected with a GFP fusion protein construct (c-Thy-28/GFP, DT-40 N4 cells) was preformed. The antibodies readily detected the c-Thy-28/GFP fusion protein in these cells, as well as GFP that was expressed in DT-40 V11 cells containing the GFP expression vector alone. In addition, the GFP antibodies were covalently linked to a chromatography matrix and used to immunoprecipitate the c-Thy-28/GFP fusion protein present in cell lysates of DT-40 N4 cells. Isolation of antibodies from the eggs of laying hens that have been immunized with GFP represents a powerful means of generating large quantities of reagent grade antibodies to this marker protein for use in cell biology experiments. The two-step isolation procedure described herein, using PEG precipitation and DEAE column chromatography, was an effective means of purifying the avian antibodies. Furthermore, the utility of these antibodies was demonstrated using Western Immunoblot and Immunoprecipitation procedures.

Changes in consumers' food purchases due to new legislation on food labeling may affect livestock production practices in the United States

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Consumer demand for additional information on food labels has been accompanied by legislation and judicial edicts that are expected to affect livestock production in the United States. The first development involves legislation enacted by the State of Ohio that severely limits labels on milk and milk products concerning the use of the supplement recombinant bovine somatotropin, commonly called rbST. Dairy processors challenged the regulations because they wanted to be able to tell consumers more about whether products contained milk from cows treated with rbST. Because of increased risk of lameness and a reduction of fertility in cattle, as well as potential concerns for dangers to human health, some consumers are willing to pay more for milk produced from cows that were not treated with rbST. An appellate court found some of the Ohio labeling restrictions to be unconstitutional. This decision should facilitate more labeling, a reduction in market share for milk from cows treated with rbST, and a corresponding need for more dairy animals. A version of the abstract of this paper has been accepted to appear as a chapter titled “Changes in Consumers' Food Purchases Due to New Legislation on Food Labeling May Affect Livestock Production Practices in the United States.” The chapter is a part of a new book titled Livestock: Rearing, Production Practices and Diseases scheduled to be published by Nova Sciences Publishers, Inc. of Hauppauge, New York. In the following paragraphs the following topics about the paper will be covered in greater detail. The objective of the project will be covered. The methodology used in creating the paper will be shown and how from it new ideas can be drawn and synthesized utilizing the data. From the information created from the data, the results of the paper will be discussed. Finally, any conclusions that can be taken from the results will be discussed. The objective of the project is the first item to be discovered. The topic of the United States' allowing the use of rbST as a supplement in dairy cattle to increase milk production differs from most other developed nations in that the United States allows these cattle to produce milk and milk products for human consumption. By utilizing the methodology yet to be discussed, we can develop the raw data from which the results of the paper can be drawn and compared to widely accepted economic principles.

Role of pectate lyase in watermelon blossom colonization by Acidovorax citrulli

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Bacterial fruit blotch (BFB) is an important bacterial disease of cucurbits, caused by the Gram-negative bacterium Acidovorax citrulli. This bacterium is seed borne and under favorable environmental conditions can cause up to 100% yield losses. Management strategies for BFB are limited and knowledge of the biology of seed infection is critical for managing this disease. Female watermelon blossoms are a pathway of A. citrulli invasion leading to seed infestation within a symptomless fruit. Additionally, in phytopathogenic bacteria, virulent factors like cell wall degrading enzymes play important role during infection. Hence, the objective of this project was to investigate the role of pectate lyase in A. citrulli in colonization of watermelon blossoms under greenhouse conditions. Female watermelon blossoms were either pollinated or non-pollinated followed by inoculation with 10µL (104 CFU/mL) of a wild type A. citrulli strain, a pectate lyase mutant or its complemented strain, separately. Samples (stigma and style tissues) were collected at 0, 6, 12, 24, and 48 hours post inoculation (hpi). Two-three blossoms per treatment were harvested and populations of A. citrulli were enumerated by serial dilution and spread plating on semi-selective medium. Mean A. citrulli populations (Log10 CFU/blossom) for each treatment were used to generate area under growth progress curve (AUGPC). The AUGPC of pollinated blossoms inoculated with the pectate lyase mutant was not significantly ($P>0.05$) different to the wild-type and complemented strain in both pollinated and non-pollinated blossoms at 48 hpi. However, the AUGPC of blossoms inoculated with pectate lyase in non-pollinated blossoms was significantly lower than for the wildtype and complemented strains in both pollinated and non-pollinated blossoms at 48 hpi. Results suggest that pectate lyase secreted by A. citrulli is not critical in the colonization of pollinated blossoms but that A. citrulli requires pectate lyase like enzymes secreted from pollen grains.

Is Biopharming living up to its promise? Latest trends and implications for the Agricultural sector

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Biopharming efforts started more than two decades ago with the promise to develop significantly less expensive pharmaceutical products. Many in the agricultural sector hoped biopharming would also provide an alternative source of income for farmers. The first biopharming products are already in the market and many more are in different stages of clinical trials. Yet, to date most studies of biopharming products have focused on the technical aspects of production of specific products or, more generally, on the types of products being developed. This paper provides a synopsis of the current state of biopharming products. In addition the paper focuses on the number of people impacted by biopharming applications. Finally, the potential impact of biopharming on the agricultural sector is examined through measures of the agricultural area that may be involved in biopharming and through a review of concerns related to the use of agricultural areas for biopharming. We carefully review the vast literature on biopharming and provide back of the envelope calculations on the number of people and the agricultural area related to the main products of biopharming. Currently there are three plant derived proteins in the market; Avidin, Trypsin, and β-glucuronidase. However, Avidin and Trypsin are used more as a support product (e.g. to purify other proteins) in the pharmaceutical industry and β-glucuronidase is used in pulp and textile industries. There are over ten plant derived pharmaceuticals currently in human trials that are planned to enter the market over the next five years. Some of the pharmaceuticals currently in the human trials stage are expected to be used in a very large scale. For example, hepatitis B (currently in phase 1 of human trials), may benefit over two billion people affected by the disease. There are various vaccines that are in human trial stages that will cure numerous important ailments, including diarrhea and vitamin B-12 deficiencies. Currently the largest concern related to biopharming is the possibility of pollen drift and contamination of the food supply. There have been several instances where adjacent crops to biopharmaceutical crops had been cross pollinated and caused the unaltered crops to be ruined and lost. Our preliminary findings suggest that biopharming will not benefit many farmers in terms of raising biopharming crops at a large scale for pharmaceutical companies.

Structure function properties of HPMC relating to encapsulation

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Hydroxypropyl Methylcelluloses (HPMCs), derivatives of cellulose, are used in the food and drug industries. Different HPMCs vary in the substituents attached to the cellulose backbone and molar mass. The modification of the celluloses likely affects the surface hydrophobicity and particle size. This study will determine some structure function properties of different HPMCs to be used for flavor or nutrient encapsulation in the food industry. HPMCs were provided by Samsung Corp. Seoul Korea: AN6, AN50, BN40M, and CN40H, listed in order of increasing viscosity as declared by the manufacturer. Particle size, zeta potential, and surface hydrophobicity (So) were tested on the four HPMCs. Particle size and zeta potential were tested at 0.05% and 0.1% with the Particle Size Analyzer with the BI-Zeta option (90 Plus, Brookhaven Instruments Corporation, Holtsville, NY) with a 50 mV diode laser (90° angle) and a BI -9000AT correlator. So was measured with an external probe, 1-anilinonaphthalene-8-sulfonic acid (ANS). So was estimated from the relative counts per second (cps) at 0.75% HPMC. Relative fluorescence was measured with a Fluorolog-2 Spectrofluorometer (Horibin Jobin Yvon, Edison NJ) with excitation and emission wavelengths of 340 and 475nm respectively. The viscosities of the HPMC samples declared by the manufacturer correlated well with a qualitative assessment of relative thickness of HPMC dispersions. The more viscous samples were less water soluble, had larger particle sizes and lower zeta potentials than less viscous samples. The particle sizes at 0.1% HPMC range from 26nm to 189nm from the least viscous to the most viscous. At 0.75%, AN6, the least viscous HPMC, emitted a peak at 10,012cps, AN50, the second least viscous, emitted a peak at 3624 cps, and CN40H, the most viscous cellulose, emitted a peak at1875cps. Information on viscosity, particle size, surface charge, and hydrophobicity of HPMC can be used to predict performance of HPMC which can assist in development of encapsulation technologies using HPMCs in the food industry, such as nutrient encapsulation to add omega 3s and the fortification of foods with vitamins to make otherwise unhealthy food healthier.

Effects of Steel and Aluminum Shoes on Forelimb Kinematics in Stock Horses

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Horseshoes of various materials have been adopted to satisfy the need of performance horses. Steel shoes are commonly used for their affordability and longevity; however, the use of aluminum horseshoes is being appropriated to the various requirements of equestrian activities, such as accentuating foreleg action for ameliorated movements in disciplines requiring a lesser degree of knee action. Consequently, the purpose of this study is to assess the effect of steel and aluminum shoes on forelimb kinematics of trotted horses using two-dimensional kinematics. The objective is to determine which shoeing type allows for improved quality of gaits in order to increase performance in its various aspects. By performing two repeated measures crossover study on nine healthy stock-type horses, the effects of these two horseshoe types on forelimb kinematics were analyzed at the trot. Horses were trotted in hand for three repetitions over a distance of 50 meters every other week for two shoeing cycles. Video footage was then analyzed using gait analysis software (OnTrack EquineTM) for each repetition. A preliminary six-week study showed a trend towards increasing carpal angle in horses wearing aluminum shoes versus steel shoes. A secondary study was conducted with more controlled marker placement and extended shoeing cycles by two weeks to allow for additional recording and data. The results obtained were analogous to the preliminary study in that there was a significant treatment effect with horses wearing aluminum shoes having a larger carpal angle than horses in steel shoes ($p<0.05$). An approximate 8-degree difference in carpal angle was noted between treatments. Therefore, the use of aluminum shoes to achieve a lesser degree of knee action may be desirable. Horses competing in subjectively judged events where the desired movement is one of sweeping shoulder movement with little action of the carpus could benefit from the use of aluminum shoes instead of steel. However, performance events where the action of the knee is not critical or needs to be accentuated, benefits of aluminum shoes may be negligible. This finding is of particular importance to performance horse disciplines for which ameliorated knee action is desirable.

The Establishment of a Mealworm Colony at UGA

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The University of Georgia's Department of Entomology maintains an Insect Zoo used for educational and outreach programs. The upkeep of the zoo requires live insects to feed the specimens. The Department of Entomology partners with the H.O. Lund Club to fund the purchases. Records indicate that $200-$300 a year is spent purchasing mealworms and crickets as food. The figures were compiled from records kept by the treasurers of the Lund Club. The Department of Entomology also sponsors events promoting Entomophagy, the science of using insects as a human food source. An estimated $100-$150 a year has been spent on Entomophagy related programs, from summer camps to the annual Insectival. The grant received from the CAES Undergraduate Research Initiative was originally for creating a cricket-colony. After a literature review, several attempts to establish a cricket colony, and personal conversations with experts in insect husbandry, it was determined that mealworms would be a much more viable and reliable insect. Funds were then allocated to establish a meal worm colony that can be harvested to fulfill the needs of the department while keeping enough of a population to produce subsequent generations. After the initial mealworm colony was established, a tiered structure was used to segregate the mealworms based on age and life stage. By cycling the life stages, cannibalism and disease are kept to a minimum. The environment and set up of the colony has promoted a high reproductive turnover and successfully allowed a sizeable amount of insects to mature. The original colony of 2000 mealworms has matured in 5 weeks, and the new generation has an estimated 10,000 meal worms. If this model is continued the department will be able to extract as many mealworms as it needs and continue the colony with sustainable numbers. The mealworms will cost the department roughly .001 cents each, making the grant back within 17 months, after, which the entire population will only cost as much as the upkeep requires.

Effects of a 90-Day Training Program on Gait Quality in 2 Year Old Horses

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The objective of training a horse under saddle is to create a mount capable of carrying a rider while performing certain tasks. With the proclivity towards futurity competition in the stock horse industry, demands on young horses of this type are becoming more strenuous. The exploration of effects on gait quality and self-carriage as well as effects on the structural integrity of the animals in these programs is important in order to maintain a high quality of stock within the industry. Few studies have examined the effect of basic under saddle training on gait quality in young stock horses. This study analyzes the effects of a 90-day period of under saddle training on gait quality in two-year-old stock type horses. Thirteen stock type horses bred and raised at the University of Georgia (age of 21-23 months) were used for this study in as part of an undergraduate equine behavior and training course. For the purpose of the course, each horse was assigned to an individual student for the class duration. Horse and rider pairs were filmed three times, at days 30, 62, and 95, in hand and under saddle, throughout the 90-day period. The videos were analyzed using On Track Equine software for changes in stride length, angle of the near knee mid-stride, protraction of the fore and hind leg, the heights of the head and hip relative to the withers, and the angles of the neck and head relative to the perpendicular of the ground. The results were statistically analyzed using SAS version 9.2 proc GLM with $P<0.05$ considered statistically significant. The results of this study suggest basic riding training encouraged horses to bear more weight in the hindquarters as evidenced by a progressively lower hip height. Knee angle became larger over time ($P<0.05$) indicating less knee action with progressive training, a feature desirable across several disciplines. The time interval between video tapings is indicative of generally accepted industry length training periods of 30, 60 and 90 days. Consequently, the effects seen in this study parallel those expected from similar training regimens found in performance-based programs. In conclusion, this study suggests gait quality can be positively affected in the first 90 days of under saddle training.

Comparing the Effects of the rAS Inhibitor Manumucin A with Novel Ras Converting Enzyme 1 Inhibitors

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Ras is a small GTPase protein involved in receptor mediated signal transduction pathways such as the Mitogen Activated Protein Kinase (MAPK) pathway that can elicit cell growth, differentiation and survival. The proper subcellular localization and biological activity of Ras is dependent on post translational lipid modification which occurs in four steps: isoprenylation, proteolysis, methylation and palmitoylation. Upregulation of Ras can lead to uncontrollable growth and cancer; therefore enzymes involved in lipid modification of Ras such as Farnesyltransferase (FTase) and Ras converting enzyme 1 (Rce1), are potential targets for chemotherapeutic agents. In this study, novel compounds (C1, C4, C9) previously screened for anti□Rce1 activity in yeast were compared to a validated FTase inhibitor, Manumycin A, in human cancer cells for their ability to inhibit Ras dependent MAPK phosphorylation. SKOV3 ovarian cancer cells were treated with Manumycin A in the presence and absence of serum while the novel Rce1 inhibitors were treated in the absence of serum. We used Western blot analysis to determine that Manumycin A inhibits MAPK phosphorylation in the absence of serum, while C4 had no apparent inhibitory activity, suggesting that Ras is fully functional. However, the compounds C1 and C9 were able to inhibit MAPK phosphorylation. Ongoing experiments will be done if the effects are specific, and to determine the effects of these compounds on overall cell viability and toxicity. In conclusion, these novel Rce1 inhibitors pave the way for developing novel chemotherapeutic agents targeting Ras.

Prevalence of mastitis and leukocyte counts in nonlactating mares

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The purpose of this study was to identify microbial pathogens in mammary secretion samples of nonlactating mares to establish prevalence of mastitis and total leukocyte and differential cell counts of infected and uninfected mammary glands. The presence of this disease in pregnant mares during the dry period may negatively impact milk yield for her foal during the subsequent lactation. Fresh mammary secretion samples of 21 mares (2 halves/udder = 42 samples) were cultured microbiologically for pathogen identification, processed through a direct cell counter for total leukocyte counts, and processed through a cytospin for differential leukocyte counts. Samples were also frozen and retested for total leukocyte counts and microbiological culture to determine if freezing negatively affected these processes. Data were analyzed for prevalence of infection among individual mammary glands (halves) of mares, as well as for mean total and differential leukocyte counts. Results demonstrated that fresh samples of individual mammary halves showed a 51% infection rate and frozen samples showed a 50% infection rate. Fresh samples of individual mammary halves exhibited average total leukocyte counts of 4.1 x 106/ml for infected halves and 3.0 x 106/ml for uninfected halves. Frozen samples of individual mammary halves exhibited average leukocyte counts of 3.0 x 106/ml for infected halves and 2.9 x 106/ml for uninfected halves. Mean differential leukocyte count for infected halves was 61% lymphocytes, 28% monocytes, and 11% neutrophils. Uninfected halves had a mean differential cell count of 42% lymphocytes, 34% monocytes, and 24% neutrophils. Results demonstrated a high level of mastitis (>50%) in nonlactating mares, which was associated with a slight elevation in SCC (over uninfected halves), primarily composed of mononuclear cells (lymphocytes, monocytes), suggesting chronic intramammary infection in this companion animal. Such infections may be detrimental to subsequent milk production and adversely influence foal health. Freezing of mammary samples did not affect the culture of pathogens; SCC tended to be slightly lower among frozen samples, but overall results suggest that mare mammary secretions may be frozen with little effect on sample quality.

Do aphid facultative symbionts confer protection against generalist predators

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Associations between insects and bacterial symbionts are common in nature, but in most cases the effects of infection on host biology are unknown. Aphids harbor a diverse group of heritable symbionts and have emerged as a model system for identifying effects of symbiont infection. In addition to their obligate nutrient-providing
symbiont, Buchnera, aphids may also harbor one or more facultative symbionts. The latter have been reported to provide aphids with a wide range of ecological benefits including providing protection against specialist natural enemies, including parasitic wasps and fungal pathogens. The goal of this project was to determine if facultative symbionts of pea aphids, Acyrthosiphon pisum, confer protection against a generalist predator, the ladybug beetle Hippodamia convergens. The experiment was carried out by providing several adult beetles with uninfected and infected pea aphids (twenty each per replicate) in a Petri dish to examine feeding preferences. The pea aphid comes in two color morphs, pink and green, which allowed us to use aphid color as a marker to determine infection status. We examined aphids infected with Hamiltonella defensa, Regiella insecticola, and H. defensa + X-type (A newly discovered pea aphid symbiont) compared to uninfected controls, but found that H. convergens consumed equal numbers of infected and uninfected aphid. Thus, despite conferring protection against specialist natural enemies, we found that several common pea aphid facultative symbionts did not confer protection against Hippodamia convergens, a generalist predator.

Development of Asexual Propagation Methods for Five Native Plant Genera

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This project's objective was to develop asexual propagation methods for five native plant genera: Baptisia, Eupatorium, Amsonia, Arisaema, and Thermopsis. Current propagation protocols for these plants do not include asexual methods. If plants could be propagated using asexual methods, the amount of time required to produce a plant of saleable size could be reduced. This would be of great benefit to nurseries and to native plant restoration projects by allowing greater production numbers with less cost. It would also allow for quicker propagation of endangered species within these genera, allowing quicker restoration of disturbed sites. Dormant stock material was obtained and placed in a greenhouse, under lights, to force early vegetative growth , needed to obtain propagation matetrial for this study. Once plants broke dormancy, they were fertilized with Harrell's 16-6-11 12 month controlled release to further stimulate growth. This was successful for all genera except the Arisaema. K-IBA solution at 0, 500, 1000 and 1500 ppm were used for Baptisia, Amsonia, and Thermopsis. K-IBA solution at 0 and 1000 ppm was used for Eupatorium due to a lack of cutting stock available. Three repetitions of six cuttings of each plant were used for each strength of KIBA. The rooting media was two-thirds Fafard Nursery Mix and one-third perlite. Cuttings for the Baptisia, Amsonia and Eupatorium were placed in 38 round--cell trays. Thermopsis cuttings were placed in one gallon pots. All cuttings were placed on a mist bench with mist applied 6 seconds every 10 minutes during daylight hours. An EZ-Clone 2000 hydroponics system, was also used to propagate an additional trial of the Baptisia. Genera that had started to root as of the writing of this abstract were the Eupatorium at 1000 ppm K-IBA; Baptisia alba at 1000 and 1500 ppm; and Baptisia australis at 500, 1000, and 1500 ppm. Percentage of cuttings which root at each strength of K-IBA will be determined. Length of the roots will be measured and the root volume will be determined by measuring water displacement.

Fluorescence intensity correction of rlatx bead absorption and scattering

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Introduction: In clear solutions of fluorescent dyes, with no scattering occurring, fluorescence and absorption can be easily predicted. Absorption follows Lambert-Beer's Law, and fluorescent emission is proportional to the absorbed light and the fluorophore's quantum yield. In practice, many solutions exhibit scattering properties that make these calculations ineffective predictors. Methods: Using a known fluorophore, samples with varying concentrations of known scattering agents (latex polymeric beads) were added to a solution. A spectrofluorometer was used to measure both fluorescence and 90° scattered intensity, and an absorption spectrophotometer to measure absorption of the samples at different wavelengths of visible light and different bead diameters. Results: At low bead concentrations, we found a linear relationship between the amount of scattering agent and the measured scattering intensity and a direct relationship between the amount of scattering agent and the absorption. At higher bead concentrations, the amount of scattered light started decreasing. This occurred once the turbidity reached a point where large path lengths of the scattered light lead to dominant absorption. This point was dependent on the bead size. In a similar fashion, fluorescence increased at low scatterer concentrations, but diminished at higher concentrations. Conclusions: The goal of this project is to identify the complex interrelation between absorption, fluorescence emission, and scattering to enable us to find corrective equations that complement Lambert Beer's law and the quantum yield equation. If the solvent itself absorbs light, the measured intensity is lower than the intensity measured in an idealized clear fluid. If the solvent scatters light, fluorescence intensity is correlated to scattered intensity. The measurement of 90° scattered intensity therefore provides the necessary information to obtain a corrected fluorescence intensity that would have been measured in an idealized, non-scattering fluid.

Expression of the P. falciparum DBL3x domain of VAR2CSA in E. coli

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Plasmodium falciparum, the parasite that causes the most virulent type of malaria, results in nearly one million deaths annually. Our research focuses on pregnancy-associated malaria (PAM), which accounts for 10,000 annual maternal deaths and 3% to 8% of infant mortality in Sub-Saharan Africa. PAM results from infected erythrocytes binding to chondroitin sulfate A (CSA), a receptor on the placenta, preventing nutrient exchange between the mother and fetus. Infected erythrocytes express the protein VAR2CSA, which mediates binding to the placenta. VAR2CSA is a large protein and consists of six different domains called DBL1-DBL6. We primarily focus on studying the DBL3x domain, which has been shown to mediate parasite binding within the placenta. Our goal is to characterize the binding of DBL3x in an effort to further understand the mechanisms of the parasite's adhesion to the placental CSA. In our study, we have isolated variants of the DBL3x domain from blood samples obtained from pregnant women in Kenya. Our goal is to understand how binding of the DBL3x domain differs between these samples. To achieve this goal, we use PCR based methods to amplify the DBL3x region from our samples and ligate them into a plasmid that allows expression of this protein in E.coli. The purified protein will be used in binding studies to placental CSA to analyze its binding properties. Understanding the binding properties is important as a disruption at this step could prevent infected erythrocytes from binding to the placenta and ultimately decrease the virulence of Plasmodium falciparum in PAM.

Characterization of Suspended Sediment Sources in the Warner Creek Watershed

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The quality of New York City's (NYC) water supply depends greatly on the water quality of the watersheds that drain into the reservoirs of the system. When identifying and monitoring the occurrence of activities or processes that may have an adverse effect on source water quality, the sources of erosion and their relative contribution should be considered. The objective of this study was to characterize and discriminate suspended sediment sources in order to determine the relative contribution from each potential source to the present load in a sub-watershed that drains into a major reservoir west of the Hudson River. Potential sediment sources of concern were glacial till sediments, glaciolacustrine sediments, non-glacial fluvial sediments, and channel bar sediments all due to channel erosion, and upland sediments due to surface erosion. Physical and chemical properties were used for characterizing sediment sources. Physical properties included the particle size distribution and the bulk density of each sediment source. Chemical properties included total C, total 13C, and total 15N of each sediment source. Physical analysis effectively characterized the potential sediment sources based on glacial or non-glacial parent material. Bulk density results discriminated the less dense non-glacial sources from the compacted glacial sources while particle size analysis discriminated the coarser non-glacial sediments from the finer glacial sediments. The particle size distribution of the suspended sediment collected at the stream outlet indicated a greater contribution of glacial sediments due to a large amount of silt-sized particles present in the sediment load. Chemical analysis showed a distinct separation of upland sources from channel sources using the soil properties. The total C and 13C effectively separated the upland sources from the channel sources, but did not discriminate within the channel sources. 15N was found to be the best tracer to discriminate between upland and channel sources as well as within the channel sources. This provided a unique fingerprint for each potential sediment source. Future studies on the physical and chemical properties of the suspended sediment will suggest the potential source of the sediment load in the stream. By having a better understanding of the source of the suspended sediment load in a stream, restoration projects and best management practices (BMP's) can be used more effectively to control suspended sediment in the watershed.

Expression of Heat Shock Proteins 27 & 72, E-Cadherin, and Ki-67 in Canine Intracranial Meningiomas

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Meningioma is the most common type of brain tumor in dogs and the most likely to be treated. Heat shock proteins (HSPs) are up-regulated during times of environmental stress and are associated with tumor maintenance via stabilization of tumor proteins. This makes HSPs a reasonable target for tumor therapy. One goal of this study was to see if HSPs 27 and/or 72 are expressed in canine intracranial meningiomas and potentially a therapeutic target. Another goal was to see if HSP expression correlated with E-Cadherin (EC)and/or Ki-67. This was a retrospective study of forty-one tumor samples from dogs. Immunohistochemistry (IHC) was performed using anti-HSP 27 or 72 antibodies to detect the presence of each HSP. These same samples were also stained for EC and Ki- 67. Control samples used in testing for HSPs were canine mammary carcinoma and squamous cell carcinoma, both which are known to express HSPs. Skin was used as a control for EC and Ki-67 staining. Staining intensities and percentages of tumor area were determined for each protein by semi-quantitative methods for HSPs. HSP 27 was expressed in 36% of cases with a mean % tumor area of 23.4% (range 1-58%) and a mean Integrated Optical Density (IOD) of 30665 (range 2722-80946). HSP 72 was expressed in 52% of cases with a mean % tumor area of 9.8% (range 1-26%) and a mean IOD of 11047 (range 1629-28968). Additionally, 21% of cases expressed both HSPs. A qualitative method was used in determining intensity and tumor area for EC. Thirteen meningiomas had MR images, which were evaluated, using T2FLAIR sequences, for peritumoral edema. This evaluation gives the edema index (EI) which was compared to HSPs 27 & 72, Ki-67, and E-Cadherin for an association. Statistical analyses using SAS V 9.2 (Cary, NC) and revealed no association between either HSP and Ki-67 or EC. Two-sided tests with significance level of $\alpha = .05$ showed a strong negative correlation between HSP 72 IOD ($p=0.03$) and tumor area ($p=0.04$) with EI. This shows that expression of HSPs 27 and 72 does occur in canine intracranial meningiomas. Their potential as a target for treatment is being evaluated further in association with markers of cell proliferation and dedifferentiation. HSP 72's potential involvement in the development of peritumoral edema in canine meningiomas is being investigated further.

Development of image analysis criteria for determining if cotton bolls are damaged by stink bugs

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Each year, stink bugs cause increased losses in cotton crops. The insects' feeding mechanism damages the cotton bolls when they puncture the outer carpal wall and inject digestive enzymes, causing the lint to break down over time, develop colorations, and become unusable. Presently, stink bug damage is controlled by manually examining cotton bolls, which is a labor-intensive process. Since cotton is an important industry, a new method of detection of infestation is needed that is more time efficient and accurate. We discovered that stink bug damage is associated with blue-green fluorescence under ultraviolet light. The focus of the current research is determining if this fluorescence has the capability to diagnose stink bug damage in cotton bolls at a high level of accuracy. We received greenhouse grown cotton bolls, half of which were exposed to stink bugs and half that were not. We subsequently imaged all sides of the bolls under LED lights (365nm UV and 440nm blue) using an SLR camera. Afterwards each cotton boll was opened, and the lint was examined for signs of staining, which indicates that a stink bug fed on the boll. By examining the correlation between external fluorescence and internal damage, we found that damaged cotton bolls exhibit a certain pattern of fluorescence on the outer carpal wall. The detection rate of the imaging method was 92% compared to a 75% detection rate of the conventional method. This information will now be used together with automated image analysis and computer vision methods to diagnose internal lint damage accurately and in a non-invasive manner.

Cross contaminaiton of coring utensils used for lettuce harvesting

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During 1995-2006, nine outbreaks were attributed to lettuce or spinach presumably contaminated in the fields. Pathogens survive for long periods of time in manure amended soils, thus lettuce contamination could occur when edible parts are in contact with soil or water during harvesting and coring in the fields. This project determined the efficacy of levulinic acid/ SDS for sanitation of coring blades during lettuce harvesting. Coring tools were contaminated by insertion into water (1 sec) containing low (LW), medium (MW) and high (HW) concentrations (3, 5, and 7 log CFU/ml respectively) of a 5-isolate mix of E. coli O157:H7. Blades were rinsed with water, 3% levulinic acid/SDS (LA/SDS), or chlorinated water (100 ug/ml). Lettuce core parts and coring tools were plated in McConkey agar/ 50ug/ml nalidixic acid. When coring tools were exposed to LW, all samples were positive by enrichment, 1.5-1.8 logs with MW, and 3-4 logs in HW. When the coring tool was rinsed with chlorine, 3 logs were found in HW, positive by enrichment when treated with MW, and LW. When rinsed with levulinic acid, <2 logs were identified with the HW, by enrichment in MW, and no growth was noted in LW. When the lettuce cores were examined, 2.3 logs were identified in the tools exposed to MW, and 4.7 logs in the HW. These results were comparable if the tools were rinsed with chlorinated water. When cores were rinsed with levulinic acid/SDS, only 2.6 logs were found in HW. Consecutive coring of lettuce heads mimicked potential contamination during harvest. When the coring tool was exposed to HW and rinsed with water prior to coring each consecutive head, 5 and 2 logs was identified in the first and 3rd lettuce head. If the coring tool was rinsed with bleach, 3.4 and < 0.8 logs in the 1st and 3rd head of lettuce respectively. If the coring tool was rinsed with LA/SDS, only the first head of lettuce was positive by enrichment. In conclusion, LA/SDS rinse of coring tools significantly reduced cross-contamination during lettuce coring. This process is more effective than using bleach, currently used during lettuce harvesting. This effective novel sanitation method needs to be further examined against other foodborne pathogens particularly Salmonella.

Common misinterpretations of individuals suffering from Ekbom Syndrome: ordinary materials often mistaken as "bugs" or "mites"

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Ekbom Syndrome (ES) is a psychological condition that causes individuals to mistake ordinary skin sensations as bugs crawling on or burrowing into their skin. This condition is usually accompanied by both visual and tactile hallucinations as well as pruritus and dermatitis which further convince these individuals that they have become infested by an insect. This research study was conducted to differentiate the delusions of people suffering from Ekbom Syndrome from actual arthropods. Initial contact was made with sufferers via telephone; during the ensuing interview the individual provided information that was entered into a standardized questionnaire form; data were condensed and transferred to an Excel spreadsheet. ES sufferers were encouraged to collect "tape samples" from their bodies and send them to the UGA Entomology Department where all submitted materials were examined microscopically. Materials were categorized and quantified for each submitter. For this study, 82 individuals suffering from ES were included (data from 2008-2011). Of these, 27 were male and 55 were female (male:female ratio 1:2). From this cohort, 100 samples were submitted. Results of sample examination demonstrated that 58% of material was lint, 46% skin, 39% scabs and 29% hair. Considering arthropod samples, this material contained 12 fungus gnats, 7 ants, and 4 springtails. All of these arthropods are very common and are not capable of causing the reported symptoms. Over 50% of submitted samples contained no insects or mites. The results indicate that these cases are delusory in nature and cannot be attributed to the presence of insects or mites. This information is important for health professionals and pest control operators, allowing them to differentiate psychological problems from valid pest infestations. Unnecessary insecticide applications can be harmful to both humans and the environment and can potentially lead to further health complications.

Comparison between rinse and crush-and-rub sampling for aerobic bacteria recovery from broiler hatching eggs after sanitization

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This study compared surface and deep eggshell aerobic bacteria recovered by rinse and crush-and-rub sampling methods for commercial hatching eggs after treatment with sanitizers. Eggs were arranged into 5 treatments consisting of No-treatment, Water, and three sanitizers. Sanitizers were hydrogen peroxide (H_2O_2), Phenol, and Q4B, (a compound chemical consisting of four quaternary ammoniums and one biguanide moiety). Eggs were sprayed according to treatment and allowed to dry for 1 h before sampling. To collect samples for the eggshell rinse, each egg was massaged in a plastic bag with 20 mL serological saline. Eggshells were then aseptically opened and their contents discarded before being individually crushed into 50 mL centrifuge tubes containing 20 mL of saline. Samples were plated onto Petrifilm™ and aerobic bacteria were enumerated after 48 h incubation at 37○C. Aerobic bacteria recovered (log_{10}cfu/mL) from the eggshell rinse were highest and similar for No-treatment (4.0) and Water (3.7), lower for Phenol (3.2) and H_2O_2 (3.1), and lowest for Q4B (2.4). Crush-and-rub aerobic bacteria levels were similar for No-treatment (2.5) and Water (2.3), lower for Phenol (1.6), intermediate for H_2O_2 (1.2), and lowest for Q4B (0.9). The overall correlation between the rinse and crush-and-rub sampling methods for individual egg aerobic bacteria counts was $r = 0.71$. The correlation within each treatment revealed the following r values: No-treatment 0.55, Water 0.72, H_2O_2 0.67, Phenol 0.73, and Q4B 0.38. A second experiment was designed to further examine the lower aerobic bacterial levels recovered by crush-and-rub (for previously rinsed eggs) than recovered in the initial eggshell rinse sample. Eggs were either rinsed and then crush-and-rubbed or only crush-and-rubbed without a prior rinse. Results confirmed a significant decrease (1.5 log_{10}cfu/mL) in bacteria levels between the initial rinse (4.4) and subsequent crush-and rub (2.9) for the same eggshell. For the crush-and-rub eggs with no previous rinsing, the bacteria recovery level (3.9) was not significantly different from rinse levels. Therefore, either rinse or crush-and-rub sample methods can be used to recover similar levels of eggshell aerobic bacteria.

Cuticular Pheromones and Fire Ant Queens: Smells Like Mom

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The Red Imported Fire Ant (RIFA), Solenopsis invicta, has been the subject of intense research because of its status as a serious invasive pest. One major emphasis of study in ant biology focuses on the question of how pheromones (chemical signals) are used for communication. This question applies especially to the polygyne (multiple-queen) and monogyne (single-queen) social forms of RIFA. Previous research has found strong genetic control for the social organization of a RIFA colony into polygyne or monogyne societies. These two social forms feature specific genotypes at a single Mendelian locus and phenotypic differences in behavior, physiology, and biochemistry. We studied the process by which colonies of each social form accept new queens. Workers in queenless colonies of both social forms will accept a new queen under certain circumstances, but polygyne workers only accept into their colonies polygyne queens and monogyne workers only accept into their colonies monogyne queens. Preliminary studies have indicated that this worker discrimination behavior may be influenced by chemicals found on the cuticle of queens. We first showed that fresh polygyne and monogyne queen corpses elicited the same worker responses as live queens, with acceptance and rejection based on queen social form; this result demonstrates that queen behavior does not influence worker acceptance. We then showed that chemically extracted queen pheromones, deposited onto inanimate surrogates (paper wicks), also elicited appropriate worker ant discrimination behavior. These results support the hypothesis that worker discrimination behavior is elicited by chemical differences between queens of the two social forms. The high-throughput assay we developed will facilitate future research on the chemical and genetic differences that mediate fire ant worker discrimination of queens on the basis of social form.

A comparison of the effectiveness of Matrigel coated plates versus pre-coated Synthemax surface plateswhen plating human neural progenitor cells

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The neural progenitor cells in this project are derivatives of human embryonic stem cells and are valuable in studying neurogenesis and finding potential therapies for neurodegenerative diseases and central nervous system traumas. The maintenance of neural progenitors requires animal basement membrane proteins to promote cellular attachment to culture dishes. The Food and Drug Administration may not approve these animal sources products for human use in cell therapies and they often produce variable results. Therefore, alternatives are needed. Currently, our lab uses Matrigel, an extract from mouse sarcoma cells consisting of laminin, collagen, entactin, and heparin sulfate. Beyond the animal sourcing issue, Matrigel must be used within three months of shipping and stored at -20 C. After thaw, Matrigel must be kept on ice to prevent gelling before coating and if not strictly monitored, disastrous results are often produced. We addressed these problems by investigating Synthemax, a product from Corning Life Sciences. Synthemax, a synthetic coating for tissue culture plates, is ready to use, can be stored at room temperature for two years, and is not an animal product. Synthemax is created from derived peptide sequences of bone sialoprotein and vitronectin. These sequences are then linked to a synthetic acrylate polymer surface, creating a binding matrix for cells. We determined how well our neural progenitor cells adhere to and proliferate on the Synthemax surface compared to Matrigel. Tissue culture plates with either Synthemax or Matrigel were seeded with neural progenitors. Adhesion was monitored daily and neural progenitors on both substrates reached confluency at the same rate. After three passages, the cells were immunostained for intracellular neural markers, Nestin and SOX2. A secondary antibody only control, Donkey Anti-Mouse 488, was used to monitor nonspecific binding. The neural progenitors on both Synthemax and Matrigel plates maintained neural progenitor morphological and phenotypic expression of SOX2 and Nestin. Synthemax coated plates are an effective alternative to Matrigel in the human neural progenitor proliferation process, further advancing potential human cell therapy clinical trials for stroke and Parkinson’s disease.

Case Report: Troubleshooting milk quality problems of a Georgia dairy herd in jeopardy of losing its market due to a high level of bovine mastitis

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Mastitis is the most costly disease of dairy cows, resulting in marked losses in milk production and quality. This report deals with troubleshooting a mastitis problem dairy herd in Oglethorpe, GA with a high bacteria and high somatic cell count (SCC) that was in jeopardy of losing its market due to poor milk quality. An initial bulk tank analysis in Aug 2010 showed a SCC of 800,000/ml and an elevated bacteria count (>10,000 colony-forming units/ml) composed mainly of streptococci including Streptococcus uberis, Streptococcus mutans, Streptococcus agalactiae, and Streptococcus dysgalactiae. A SCC of 800,000/ml is above the legal limit of 750,000 for the sale of milk for human consumption according to the Pasteurized Milk Ordinance. To determine which animals were contributing to the problem, the 40-cow milking herd was tested for the presence of mastitis by determining what type of bacteria infected each quarter of every cow. Quarter milk samples were processed by streaking milk samples onto trypticase soy blood agar plates and incubating at 37°C for 48 hr, performing Gram stains, and biochemical testing to determine the overall herd infection rate with streptococci and the specific species of streptococci causing the infections. Results demonstrated that the overall infection rate was 12%, and several infected animals were identified as contributing to the herd problem. Two cows were treated with nonlactating cow antibiotics and were dried off, and 4 cows were treated with lactating cow antibiotic preparations in attempts to cure infections and improve milk quality. The herd was then resampled in Oct 2010 to monitor the infection status and to determine cure rates of treated quarters. Culture results showed that 2 of the 4 cows treated with lactating cow therapy were cured following treatment, but that the other 2 cows were not cured of their streptococcal infections. However, the bulk milk analysis at this time showed that the herd SCC had decreased from 800,000 to 545,000/ml and that the bacteria count was reduced from >10,000 to 1,200 colony-forming units/ml, suggesting that the drying off of 2 cows and antibiotic therapy of 4 cows was successful in improving overall herd milk quality and maintaining the dairy's ability to market their product.

TurboGrow Chick Feeder fro Broilers

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Feed costs account for 60-75% of the live costs in broiler production. Traditionally chicks are started with extra feeder surface area to ensure they find feed in the first few days of placement in the growout house. With that in mind, management practices that improve feed utilization and reduce wastage would benefit the poultry industry. The objective of the current study was to compare the TurboGrow® chick feeder (TBC), a recent feeding option for the industry to traditional flat-rectangle trays (CON). The hypothesis of the current study was that the TBC would improve broiler performance. The hypothesis was tested by evaluating water consumption, uniformity and mortality on a commercial broiler farm. Two houses were utilized in this evaluation with one house being the control with CON and the second house having the TBC feeder. On 0, 3, 7 and 10 days of age 100 birds were weighed in each treatment. Five birds from each treatment were randomly selected and euthanized to obtain heart, liver and residual yolk weights. A second evaluation to determine actual feed consumption was conducted at the UGA Research Farm with the same treatments replicated 6 times each. Feeders were weighed daily through 10 days of age and body weights (BW) were obtained at 10 days of age. While differences in BW were observed throughout the first 10 days of age, no differences in relative organs weights were observed. In the field trial, the CON trays yielded higher body weights at 3 and 10 days of age. Birds in the CON treatment house consumed 17% more water than those in the TBC house which also suggests they consumed more feed. Mortality was 1% higher in the TBC treatment when compared to CON. Subjective evaluation of feed wastage suggested that more feed was spilled on the floor in the CON than the TBC house. More feed was consumed in the CON treatment than the TBC treatment in the pen trial. No differences in body weight were observed in the pen trial. Based on these results, birds consumed less feed with the TBC treatment and the hypothesis that the TBC improved broiler performance was rejected.