



A Guide to Corn Production in Georgia 2007

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CORN PRODUCTION IN GEORGIA

Corn production in Georgia has declined over the past two and half decades because of limited opportunities for profit and increased risks from higher production costs. Corn acreage in the 1970s averaged 1.64 million acres in Georgia. This declined almost 50 per cent in the 1980s to 0.86 million acres. Since then, acreage has declined to its lowest levels, averaging less than 300,000 acres in 2006. Due to significant price increases caused by increasing demand for ethanol and shorter carryover stock, acreage will significantly increase in Georgia and the U.S.

Dryland vs. Irrigated Corn

Estimates by the Georgia Agricultural Statistics Service and the Cooperative Extension Service indicate that approximately 55 per cent of Georgia's corn is irrigated (Table 1).

Table 1. Irrigated Corn Acreage in Georgia for Selected years

Year	Planted Acres	Irrigated Acres	% Irr. Acres
1998	265,000	175,000	66
1999	300,000	140,000	47
2000	240,000	140,000	58
2001	220,000	120,000	55
2002	290,000	160,000	55
2003	290,000	155,000	53
2004	280,000	155,000	55
2005	230,000	125,000	54
2006	280,000	155,000	55

Irrigation and other production technology, and good management have made 250 bushels/acre achievable throughout the state. These higher yields may not always be a practical goal for all producers. Your decision to irrigate changes the way a corn crop is managed to maximize a return on investment. Cultural practices such as hybrid selection, plant population, fertility level, and crop protection all change under irrigation.

Why irrigate? Surveys by the Georgia Agricultural Statistics Service show that yields of dryland production during the past decade on average were only 50% of irrigated yields (Table 2).

Table 2. Irrigated and Non-irrigated Corn Production in Georgia¹

Year	Acres Harvested for Grain -----1000 Acres-----		Yield per acre -----bushels-----		Dryland Yield as a % of Irr. Yield
	Non-Irr.	Irr.	Non-Irr.	Irr.	
1996	345	180	68	146	47
1997	300	150	85	145	59
1998	90	175	27	115	23
1999	160	140	66	145	46
2000	100	140	48	149	32
2001	100	120	92	169	54
2002	130	160	65	156	41
2003	135	150	102	153	67
2004	125	155	93	160	58
2005	105	125	104	150	69
Average	159	150	75	149	50

Of the many climatic and environmental factors that affect corn production, water is the most significant. Research at The University of Georgia Coastal Plain Experiment Station (Hook, 1991) show that severe, droughty conditions that were most damaging to corn yields since 1938 were clustered into two periods, the early 1950s and most of the 1980s. During the survey period, dryland production was predicted to be 38-64% of non-stress yields. Unfortunately, in corn production, yield reducing droughts should be considered the norm rather than the exception.

Irrigation can eliminate much of the moisture stress during these critical periods if correctly applied. Irrigation makes it possible for the crop to fully utilize fertilizer and other inputs to improve profitability. However, irrigation as with any other management tool must be used effectively and efficiently to achieve its maximum potential. See the irrigation management and scheduling section for details on efficient irrigation techniques.

AGRONOMIC PRACTICES FOR CORN

Dewey Lee

Soil Preparation

A good soil management program: (1) protects the soil from water and wind erosion, (2) provides a good, weed-free seedbed for planting, and (3) destroys hardpans or compacted layers that may limit root development. To conserve moisture and reduce compaction, work the land no more than necessary to achieve these objectives.

Water erosion is a significant problem on many Georgia soils during the high rainfall, winter months. Wind erosion can be a problem on sandy Coastal Plain soils in early spring when blowing sand can severely injure young corn plants. Crop residue left on the soil surface or a seeded cover crop effectively reduces water erosion problems. Using minimum-till planting practices such as strip-till or slit-till helps reduce soil losses and "sand blasting" from wind erosion.

Tillage

Compaction layers or traffic pans (dense areas) are present in many, if not most, of the sandy, Coastal Plain soils in Georgia. These traffic pans restrict root growth and thus affect water and nutrient uptake by the plant. Traffic pans or dense soils should be disrupted by deep turning, chisel plowing or by in-row subsoiling during planting. In-row subsoiling has increased corn yields over 50 per cent on soils where traffic pans were present (Table 3). It enables corn plants to develop deeper root systems which make better use of sub-soil moisture and improves chances of recovering nutrients as they move through the soil.

Table 3. Influence of Tillage and Water Management on Corn Yield (Bu/A)

Tillage	Irrigation	Year 1	Year 2	Year 3	Avg
Conventional	No	71	30	30	42
Conventional	Yes	114	137	138	130
Subsoil	No	159	130	78	122
Subsoil	Yes	155	162	149	155

¹Cassel and Edward, North Carolina.

Data in Tables 4 and 5 demonstrates that a full zone fracturing of sandy soils such as that which is achieved with a paraplow is equal in yield to in-row subsoiling of corn. Under current fuel and equipment cost it is more cost effective to perform some type of tillage that disrupts plow pans than to plant strictly no-till without in-row subsoiling.

Tillage	1999	2000	2002	3 yr av.
Paraplow	162	188	177	179
In-row subsoil	167	195	168	177
Notill	145	153	147	148
Lsd $p \leq 0.10$	7	16	8	

The results of several years of tillage studies conducted in Tifton, demonstrate that corn yields produced under conservation tillage methods are equal to or better than those with conventional tillage such as rip & bed (Table 5).

Tillage	2003	2004	2005	2006	Avg.
Strip	165	198	195	202	190
Slit	148	195	200	199	186
Rip & Bed	163	178	189	203	184
No-till	153	157	156	149	154
Lsd $p \leq 0.10$	NS	30	29	17	

Hybrid Selection

Many different hybrids are marketed in Georgia each year. Differences exist among hybrids in yield potential, maturity, standability, disease resistance, grain quality and adaptability to different geographic areas of the state. Keep the characteristics that best fit your farm in mind when you select hybrids for planting on your farm.

The right choice of hybrids for any production system is crucial since large genetic differences exist for the many traits of yield. Hybrids for irrigation should have the genetic potential to perform at high plant densities and respond to water and other inputs such as increased fertility. Hybrids with strong stalks and roots are needed under higher densities and yield levels to allow the corn crop to dry down with minimal harvest loss due to lodging. Higher populations suggest the need for a hybrid that can take the crowding and still maintain stalk quality and ear development. Dryland hybrids on the other hand require good stress tolerance with good grain quality. Each company that sell hybrids generally make distinctions between hybrids that perform better under one production system or another.

Leaf disease resistance is a necessary component of hybrid selection particularly in irrigated corn and corn behind corn situations. Higher humidity, fluctuating water availability and higher plant populations under irrigation will favor many diseases. Selection of hybrids with a higher degree of resistance to a variety of stresses is important. Hybrids should have very good resistance to the many organisms that cause diseases such as southern corn leaf blight, anthracnose, grey leaf spots, common rust, southern rust, maize chlorotic dwarf virus, etc.

Hybrids with high-grain quality at harvest are necessary to provide a better market for the crop. Grain quality depends on resistance to ear rots and other pests. Good husk cover to retard moisture and insect penetration minimizes damage from subsequent development of ear or kernel diseases. In addition, hybrids with higher grain quality typically weather better during dry down.

Hybrid maturity determines how well a hybrid will fit into a production program and maturity is another selection consideration. Hybrids are generally classified as early (short-seasoned), medium (mid-season) or late (full-season) maturity. Early and medium maturing hybrids are usually better adapted to irrigated corn production than dryland production because they, (1) mature 2 to 3 weeks earlier, (2) generally grow shorter and are less subject to lodging, (3) may need fewer irrigations because of their shorter season and (4) are more suitable for use where large acreages may require a harvest spread to improve harvest efficiency. If the farm work load normally prevents harvesting early to medium maturing hybrids within 30 days after physiological maturity (black layer) consider planting a later maturing hybrid.

Today, hybrid seed companies identify proprietary hybrids that are genetically similar but differ in one or more traits (Bt, Roundup resistance, Liberty Link, etc) which they distinguish from the conventional parent line. Care should be taken when examining these hybrids for possible use that other equally important characteristics have not unfortunately been altered, i.e. disease resistance, root strength, etc.

The results of annual hybrid evaluation tests at several locations throughout the state are available from your county Extension office. Information on most of the traits can be found in the Corn Performance Trial Bulletin. Consistent performance is most important and growers should evaluate hybrid performance data over at least three years at several locations. It is important however, to compare hybrids within maturity groups. Growers should test new hybrids on their farms but should not plant them initially to large acreages. Through continued evaluation of new hybrids, you should be able to select hybrids which will contribute to enhance production under irrigation on your farms.

Planting Dates

Plant corn as soon as temperature and moisture become favorable for seed germination and seedling growth. Soil temperature in the seed zone should be 55⁰F or greater before planting. Corn seed will sprout slowly at 55⁰F while germination is prompt at 60⁰F. Delay planting if a cold period that will drop soil temperatures below 55⁰F at the two-inch level is expected. However, if soil temperatures are near 55⁰F, and projections are for a warming trend, corn planting can proceed. Extremely early planting introduces a risk to frost or freeze damage and subsequent loss of stands. Usually, as long as the growing point is below ground level, corn can withstand a severe frost or freezing damage without yield reduction. It is best therefore to monitor soil conditions and weather if your desire is to plant as early as possible. Generally it takes corn seed 7 to 12 days to emerge when planted in soils there are 55⁰F.

Early planted corn out-yields late planted corn. Depending on your location, planting dates may range from early March in south Georgia to mid-May in north Georgia. Early planting helps avoid periods of low rainfall and excessive heat during pollination, both of which lead to internal water stress during critical periods of corn development. Early planting is essential when double cropping soybeans, grain sorghum, millet or vegetables following irrigated corn.

Plant Populations and Row Spacing

The optimum population for a given situation varies with soil type, hybrid, the ability to supply irrigation water and other management practices. Irrigated corn requires higher plant population than dryland corn to fully explore the potential of irrigation. Generally 26,000 to 32,000 plants/A are recommended for most intensively grown hybrids. Excessive populations increase seed costs and may reduce yield because of crowding and lodging. Plant 10% more seed/A than is necessary to produce the desired plant population for any particular hybrid. This over-planting will leave the harvest plant population at the desired level after a normal stand loss due to uncontrollable factors.

Optimum plant populations for dryland production range in general from 18,000 to 20,000. Though greater plant populations would provide higher yields in good rainfall years, the stress of higher plant populations above 20,000 in drier years would significantly increase the risk to yield loss due to plant competition. Conversely, lower plant populations reduce yield potential in years with adequate rainfall.

Most farm equipment in Georgia is set to plant in 36" rows. Wider rows, 38 to 40" rows usually result in little space between plants within a row. This creates in-row competition for water and nutrients. Studies conducted in corn reveal that yields increase as rows narrow at high plant populations (Table 6). This allows plants to exploit more moisture, nutrients and light due to greater space between plants. It also helps weed control by shading the lower canopy. Row widths of 30 to 36 inches are adequate for top yields in Georgia.

Table 6. Yield of corn in various row widths, Tifton GA

Row width	2003	2004	2005	2006	Avg
20"	255 a	263 a	230 a	267 b	254
30"	191 c	252 b	225 a	311 a	245
36"	232 b	250 b	202 b	257 b	235
Twin(36")	227 b	254 b	202 b	266 b	237

Lsd $p \leq .10$

Table 7 illustrates plant populations at various row widths and plant spacings. This table can be used to estimate plant populations. To check the calibration measure off the indicated distance found in Table 8, avoiding the first 40 to 50 feet seeded to allow the planter seed drop to become uniform. Count the number of kernels in one row for the indicated distance and multiply this number by 1,000 to get the population/A. Check several rows to be certain each planter unit is working properly. It is always best to double check the planter to ensure seed drop is providing the desired populations. Vacuum-type planters have excellent control in attaining a desired seed drop and plant populations. Whether old or new, well-maintained planters are necessary for evenly distributed plant population.

Table 7. Approximate Plant Populations at Various Row Widths and Plant Spacing within a row.

Within row Plant Spacing (inches)	Row width (inches)				
	20	30	36	38	40
4.5			38,700	36,700	34,800
4.7			37,100	35,100	33,400
5.0		41,800	34,800	33,000	31,400
5.3		39,400	32,900	31,100	29,600
5.5		38,000	31,700	30,000	28,500
5.7		36,700	30,600	29,000	27,500
6.0		34,800	29,000	27,500	26,100
6.2		33,700	28,100	26,600	25,300
6.5		32,200	26,800	25,400	24,100
6.8		30,700	25,600	24,300	23,100
7.0		29,900	24,900	23,600	22,400
7.3		28,600	23,900	22,600	21,500
7.5		27,900	23,200	22,000	20,900
7.8	40,200	26,800	22,300	21,200	20,100
8.0	39,200	26,200	21,800	20,600	19,600
8.3	37,800	25,200	21,000	19,900	18,900
8.5	36,900	24,600	20,500	19,400	18,400
8.8	35,600	23,800	19,800	18,800	17,800
9.0	34,800	23,200	19,400	18,300	17,400
9.3	33,700	22,500	18,700	17,800	16,900
9.5	33,000	22,000	18,300	17,400	
10.0	31,400	20,900	17,400	16,500	
10.3	30,500	20,300	16,500		
10.5	29,900	19,900			
10.7	29,300	19,500			
11.0	28,500	19,000			
11.5	27,300	18,200			
12.0	26,100	17,400			
12.5	25,000	16,500			
13.0	24,150				
13.5	23,200				
14.0	22,350				
14.5	21,600				
15.0	20,800				

Table 8. Length of Row Required for 1/1,000 Acre At Various Row Widths.

Row Widths inches	Length of row for 1/1,000 acre
20	26 ft. 2 in.
30	17 ft. 4 in.
32	16 ft. 3 in.
36	14 ft. 6 in.
38	13 ft. 9 in.
40	13 ft. 1 in.

FERTILIZATION

Glen Harris

By nature, soils of Georgia are acid and infertile; therefore, substantial quantities of limestone and fertilizer are required for optimum fertility levels. Fertilizer recommendations are based on yield goals and crop utilization. Corn harvested for silage requires more fertilizer than corn grown for grain because silage removes from the field all the nutrients in the above-ground plant parts. The removal of potassium is especially great in comparison to grain harvest. A comparison is given in Table 9 of the nutrients contained in grain and the stover.

Table 9. Pounds of Nutrients Removed by the Grain and Stover of a 180-Bushel Corn Crop.

Nutrient	Grain	Stover	Total
	-----lbs/acre-----		
Nitrogen	170	70	240
Phosphorus (as P ₂ O ₅)	70	30	100
Potassium (as K ₂ O)	48	192	240
Calcium	15	42	57
Magnesium	16	34	60
Sulfur	14	16	30
Zinc	0.15	0.54	0.69

Liming

Many Georgia corn fields are naturally acid. This acidity is primarily because of (1) increased use of nitrogen in acid forming sources, (2) leaching of calcium and magnesium, and (3) nutrient

removal by high-yielding crops. Liming such soils has certain advantages:

- Corrects soil acidity - Corn grows well in soil with a pH between 6.0 – 6.5 but is inhibited by a soil pH less than 5.7.
- Supplies plant nutrients - All plants need calcium and magnesium for growth. Dolomitic liming materials containing these elements will increase yield on soil low in either or both of these nutrients.
- Makes other plant nutrients more available - Acid soils fix plant nutrients, especially phosphorus, in forms unavailable to plants. Liming acid soils will release fixed nutrients, making them more available to the growing crop.
- Promotes bacterial activity - They break down soil organic matter to make soil nitrogen and other nutrients more available. Since most bacteria cannot live under very acid conditions, liming acid soils increases bacterial activity.

Magnesium is frequently a limiting nutrient in corn production, especially on the sandy soils of the Coastal Plain area. Dolomitic limestone will help eliminate this problem; however, to be effective as a source of magnesium, apply dolomitic lime several months prior to planting. If soil test results show that magnesium levels are low and dolomitic limestone cannot be applied several months before planting, apply a supplemental application of 25 to 50 pounds of elemental magnesium per acre before planting.

BASE FERTILIZATION

Fertilizer recommendations depend on the soil fertility level as determined by soil tests and the yield goal. Fertilization programs not based on soil tests may result in excessive and/or sub-optimum rates of nutrients being applied. Take soil samples each fall to monitor the current fertility level. Use the yield goal to determine the quantity of nitrogen, phosphate and potash to be used. At high yield levels, the balance of nutrients in relation to one another also is important.

Nitrogen: In sandy Coastal Plain soils, nitrogen is very mobile. If excessive rainfall occurs or excessive amounts of water are applied through the irrigation system, leaching losses of nitrogen can be quite drastic during the growing season. To increase the efficiency of nitrogen recovery during the season, split applications of nitrogen are recommended.

Apply 25 to 30 percent of the projected nitrogen needs before or at planting. The remaining nitrogen can be applied sidedress and/or injected through the center-pivot systems (fertigation). If all the nitrogen is applied with ground equipment, apply 50 to 75 pounds per acre at or before planting under irrigated conditions and 20 to 50 lbs per acre in dryland environments and the rest when the corn is 12 to 16 inches tall.

If nitrogen is to be injected through the irrigation system, apply 40 to 60 lbs at or before planting and begin ground or injected applications of 30 to 60 pounds of nitrogen per acre when the corn is 8 to 12 inches tall. Continue on a bi-weekly basis until the total required nitrogen is applied. Three to five applications of nitrogen will be needed during the growing season.

Applications of nitrogen after pollination **are not recommended unless a severe nitrogen deficiency is detected.**

Phosphate and potash: Apply all the phosphate and, on most soils, all the potash at or before planting. Some of the phosphate requirements may be obtained through the use of starter fertilizer. On deep sands, you should probably apply potash in split applications, half at planting and half at layby.

Secondary and micronutrients: Corn requires a relatively large amount of sulfur, generally 20 to 30 pounds per acre. On deep sands, apply sulfur in split applications. All sulfur should be applied in the sulfate ($\text{SO}_4^{=}$) form. Applications with nitrogen may prove efficient.

Base magnesium fertilization on soil tests. If the level is low, apply 25 to 50 pounds per acre of water-soluble magnesium by lay-by.

Zinc deficiency can be prevented by using three pounds per acre of actual zinc. Do not use zinc unless soil test levels are low. If needed, apply preplant or at planting.

Boron deficiencies can occur on sandy soil low in organic matter. Generally, use one to two pounds per acre of boron applied in split applications. It is best to apply boron with the nitrogen applications. The application of other essential nutrients should be based on plant analysis results.

FERTILIZER PLACEMENT

The main objectives in fertilizer placement are to avoid injury to the young seedling and to use fertilizer nutrients efficiently. Fertilizer applied too close to the germinating seed or emerging plant will cause severe salt injury to the plant. With low soil moisture, the fertilizer salts will draw water away from the plant roots causing the plants to wilt. It is important though to apply your nitrogen in a band near the row (4 to 6 inches next to the row) particularly in soils where N easily leaches and where traffic rows restrict root growth.

Broadcasting fertilizer will help reduce the risk of fertilizer injury. Research shows that broadcasting fertilizer is less expensive and just as efficient as banding on soils with medium fertility. If soil tests low in phosphorus and potassium, it is better to place one-half of the needed fertilizer in a band near the row and broadcast the rest.

STARTER FERTILIZER

Small amounts of nitrogen and phosphorus are often used as a starter or "pop-up" fertilizer. The main advantage of starter fertilizer is better early-season growth. Corn planted in February, March or early April is exposed to cool soil temperatures, which may reduce phosphate uptake. Banding a starter fertilizer two inches to the side and two inches below the seed increases the chances of roots penetrating the fertilizer band and taking up needed nitrogen and phosphorus.

Deduct the amount of nitrogen and phosphorus used in a starter fertilizer from the total nitrogen and phosphorus needed for the season. However, total phosphate requirements of the corn crop can often be supplied in the starter fertilizer. Since nutrients applied in starter fertilizers are a part of the total fertilizer program, using this recommended practice is not very costly.

Currently, the most popular starter fertilizer is ammonium polyphosphate (10-34-0). Monoammonium and diammonium phosphates are equally effective. There is generally no

advantage in using a complete fertilizer (NPK) as a starter since applying phosphate is the primary objective. There is an advantage to using additional N such as 28-0-0-5 particularly in sandy soils to encourage growth as soils warm. Depending on your needs, a typical popup application is 6 to 7 gallons each of 10-34-0 and 28-0-05.

ANIMAL MANURE

Animal manures such as poultry litter and lagoon water can be an excellent source of nutrients for corn. It is important though to know the amounts of nutrients contained in the manure prior to making a decision to use it as your main source of phosphorus and potassium. The majority of the nutrients contained in the manure are readily available in the season. If you are using poultry litter, in general, you should be able to use about 65% of the nitrogen and 80% of the phosphorus and potassium contained in the litter the first year. For example, if your analysis is 50-50-50 per ton, and you apply two tons per acre, then credit your fertility program 65 lbs of nitrogen, phosphorus and potassium the first year. At least 25% of the nitrogen should be available within the first two to three weeks after application and the remainder throughout the season.

PLANT ANALYSIS

Soil tests serve as a sound basis for determining fertilizer requirements for corn; however, many factors such as nutrient availability, leaching and crop management practices may require modification in a basic soil fertility program to maximize fertilizer use efficiency.

Plant analysis, a laboratory procedure used to determine the concentration of elements present in a plant, can be used to (1) monitor the nutrient status of the plant and evaluate the appropriateness of the fertilization program used, (2) confirm a suspected nutrient deficiency, or (3) detect low nutrient levels before growth is affected.

Plant analysis usually consists of determining the concentration of the following essential plant nutrients: nitrogen (N), phosphorus (P), potassium (K), magnesium (Mg), calcium (Ca), manganese (Mn), boron (B), copper (Cu), iron (Fe), zinc (Zn) and sulfur (S). The concentration found is a measure of the plant's nutrient status. The analysis is interpreted by comparing the concentration found to known standards for that plant part and stage of growth when sampled. When the concentration of an element falls outside the normally expected range, an evaluation and recommendation based upon the results and information with the sample, is made. Information such as soil test level, soil type, and fertilizer and lime applied is essential to properly evaluate a plant analysis and make a valid recommendation.

Do not substitute plant analysis for a soil test, but use it to determine (1) whether essential elements are present in low, adequate or excessive amounts in the plant and (2) whether the proper ratio of certain elements exists. It is advisable to take plant samples throughout the growing season to monitor nutrient status and detect any deficiencies or imbalances. What actually gets into the plant is really what counts most. If a deficiency or imbalance is detected early enough, it can usually be corrected in time to improve yield.

WEED CONTROL IN FIELD CORN

Eric Prostko

One of the most important aspects of field corn production is weed management. Uncontrolled weeds not only reduce corn yields through their competition for light, nutrients, and moisture, but they can also severely reduce harvest efficiency. Before implementing a weed management plan for field corn, several factors need to be considered including weed species, rotational crops, and cost/A.

Georgia's Field Corn Weed Problems

Recent surveys of county extension agents in Georgia indicated that the top 10 most troublesome weeds in field corn are as follows: 1) Texas panicum; 2) sicklepod; 3) morningglory species; 4) pigweed species; 5) nutsedge species; 6) common cocklebur; 7) Florida beggarweed; 8) large crabgrass; 9) johnsongrass; and 10) Pennsylvania smartweed.

Weed Competition in Field Corn

If a weed management program in field corn is going to be successful and economical, a thorough understanding of the competitive effects of weeds is important. In regards to this area, three things must be considered: 1) How many weeds are there and when did the weeds emerge in relationship to the crop?; 2) How much yield loss are they actually causing?; and 3) When do the weeds need to be controlled in order to prevent significant yield losses? Research has shown that weeds that emerge just prior to or at the same time as corn cause greater yield losses than later emerging weeds. Consequently, the use of effective weed control programs from 20 to 45 days after planting usually prevents yield losses due to weed competition. Weeds that emerge 45 days after planting will likely not cause competition-related yield losses but can have a negative influence on seed quality and harvest efficiency. Other research has shown that corn can tolerate a certain level of weed pressure and that control strategies should only be implemented when the potential yield losses caused by the weeds exceeds the cost of control (i.e. economic threshold concept). The following table illustrates the influence of various weed species on corn yield:

Table 10. Number of weeds/100 feet of row that cause yield reductions in field corn.

Weed	Corn Yield Loss (%)					
	1	2	4	6	8	10
Cocklebur or giant ragweed	4	8	16	28	34	40
Pigweed or lambsquarters	12	25	50	100	125	150
Morningglory or velvetleaf	6	12	25	50	75	100
Smartweed or jimsonweed	10	20	40	60	70	80
Yellow Nutsedge	400	800	800+	800+	800+	800+

Field Corn Weed Management Strategies

The most effective weed management programs in corn use a combination of cultural, mechanical, and chemical control strategies. Cultural practices include such factors as planting date, planting rate, and row spacing. Cultural practices improve weed control by enhancing the competitive ability of the field corn. Mechanical practices, such as cultivation, are a non-chemical method for controlling weeds between rows. A multitude of herbicides are labeled for use in field corn and can be applied preplant incorporated (PPI), preemergence (PRE), postemergence (POST), and post-directed (PDIR). A complete update on the herbicides recommended for use in Georgia can be found at the end of this section.

Atrazine

The foundation of weed management systems in all field corn production systems is atrazine. Atrazine provides broad-spectrum control of many weeds with excellent crop safety. Atrazine can be applied PPI, PRE, or POST (up to 12" tall). Numerous pre-mixtures are available that contain atrazine + a grass herbicide (Bicep, Bullet, Guardsman, Lexar, Lumax, etc). Generally, these pre-mixtures will provide broad spectrum weed control when applied PRE. However, they are usually not very effective for the control of Texas panicum. In order to protect both surface and groundwater, it is important to read and follow the label regarding the use of atrazine. When atrazine is applied PRE + POST, a total of 2.5 lb ai/A can be applied per year (2.5 qt/A of 4L or 44 oz/A of 90DF). When atrazine is applied only POST, a total of 2.0 lb ai/A can be applied per year (2 qt/A of 4L or 36 ozs/A of 90DF).

Herbicide Resistant Weed Management Systems

In 2006, it was estimated that 36% of the field corn acreage in the United States was planted using herbicide resistant corn hybrid technologies. Yield performance of herbicide resistant corn hybrids has improved to the point where yield drag is no longer a major concern. There are 3 types of herbicide resistant technologies that can be used by Georgia corn growers including Roundup Ready (RR), Liberty-Link (LL), and Clearfield (CL).

Roundup Ready Systems (RR): Numerous hybrids are available that are resistant to over-the-top applications of glyphosate. Glyphosate provides broad-spectrum control of many grass and broadleaf weeds. Research in Georgia has shown that 2 applications of glyphosate, applied approximately 21 and 35 days after planting, are more effective than single applications. It is also recommended that atrazine be included in the RR corn system. Atrazine can be applied either preemergence or in combination with the first postemergence application of glyphosate in the RR corn system. Technology fees associated with RR corn hybrids range between \$7-13/A depending upon the planted population. Glyphosate-resistant Palmer amaranth (pigweed) has been discovered in Georgia. Consecutive plantings of RR crops should be avoided. Refer to the section on herbicide resistant weeds later in this section for more information.

Liberty-Link Systems (LL): Liberty-link corn hybrids are tolerant of postemergence applications of Liberty (glufosinate). Liberty provides good control of many troublesome weeds including morningglory, Texas panicum, and sicklepod. Atrazine should always be included with Liberty to improve the spectrum of control and to provide residual weed control. There is no seed technology fee associated with the Liberty-Link corn system.

Clearfield Systems (CL): Clearfield corn hybrids are tolerant of postemergence applications of Pursuit (imazethapyr) or Lightning (imazethapyr + imazapyr). Lightning provides broad spectrum control of many troublesome corn weeds including crabgrass, annual morningglories, pigweed, and smartweed. However, Pursuit or Lightning would not be useful for the control of ALS-resistant Palmer amaranth (pigweed). Clearfield corn hybrids were developed using traditional breeding techniques and are not considered to be genetically modified organisms (GMO). Before using Pursuit or Lightning in the Clearfield system, pay close attention to rotational crop restrictions.

Herbicide/Insecticide Interactions

Growers who prefer or need to use organophosphate (OP) soil insecticides (Counter, Phorate, Thimet, Lorsban) should not apply certain postemergence herbicides if these insecticides are used or severe crop injury can occur. Herbicides that interact with OP soil insecticides include Accent, Basis Gold, Beacon, Callisto, Exceed, Option, and Steadfast. This interaction does not occur with other types of soil insecticides (Force, Furadan) or seed treatments (Poncho, Cruiser).

Herbicide/Disease Interactions

Growers who need to control johnsongrass should make sure that the planted corn hybrid has acceptable tolerance to maize dwarf mosaic virus (MDMV) and/or maize chlorotic dwarf virus (MCDV). Insect vectors (aphids, leafhoppers) will move from herbicide treated johnsongrass to the corn crop resulting in the increased incidence of these diseases.

Herbicide Resistant Weeds

Herbicide resistant weed species can become a serious problem in fields when a single herbicide or herbicides with similar modes of action are used repeatedly. This phenomenon has been documented in Georgia with Palmer amaranth (pigweed) and other weed species (Table 11). Populations of Palmer amaranth have been found in the state that are resistant to glyphosate and/or ALS-inhibiting herbicides. Check with your county extension agent for updated information about the distribution of herbicide resistant weeds in your area.

Table 11. Herbicide Resistant Weeds in Georgia

Weed	Year	Herbicide(s)	Site of Action
Goosegrass	1992	Treflan	Tubulin protein
Prickly sida	1993	Scepter	ALS enzyme
Italian ryegrass	1995	Hoelon	ACCcase enzyme
Palmer amaranth	2000	Cadre, Pursuit	ALS enzyme
Palmer amaranth	2005	glyphosate	EPSP synthase
Crabgrass	2007	Poast	ACCcase enzyme

Herbicide resistant weeds can be managed by using a combination of strategies including crop rotation, row patterns, mechanical cultivation, and utilizing herbicides with different modes of action.

Specific herbicide recommendations for the control of glyphosate-resistant Palmer amaranth and ALS-resistance management in field corn are presented in the following table:

Table 12. Herbicide programs for managing glyphosate and ALS-resistant Palmer amaranth in Georgia field corn.¹

Corn hybrid	Preemergence	Postemergence	Layby as needed
Conventional	Atrazine**	Prowl ² + Atrazine + Crop Oil	2,4-D ⁵ or Evik
Conventional	Bicep II Magnum ³ , or Bullet, or Guardsman, or Lariat, or Lexar	Atrazine or Banvel/Clarity ^{4,5} , or 2,4-D ⁵ , or Aim, or Callisto	2,4-D ⁵ or Evik
Liberty Link	Atrazine** or Dual II Magnum ⁶ or Outlook	Liberty + atrazine ⁷	2,4-D ⁵ or Evik
Roundup Ready	Atrazine**	glyphosate + atrazine or Expert ⁸ or Sequence ⁹	2,4-D ⁵ or Evik
Roundup Ready	Bicep II Magnum ³ , or Bullet, or Guardsman, or Lariat, or Lexar at 66% normal rate	glyphosate + atrazine or Expert ⁸ or Sequence ⁹	2,4-D ⁵ or Evik

¹Glyphosate- and ALS-resistant Palmer amaranth are very serious concerns. An aggressive management program is necessary to slow spread of resistant biotypes and to reduce selection pressure in areas currently not infested with resistant biotypes.

²Generic brands of Prowl (pendimethalin) are available and perform similarly.

³Bicep II Magnum is a pre-mixture of *S*-metolachlor and atrazine. Less expensive, generic brands containing metolachlor and atrazine are available (Parallel Plus, Stalwart Xtra). These generic brands may not provide the same length of residual control as Bicep II Magnum (which contains *S*-metolachlor).

⁴Generic brands of Banvel (dicamba dimethylamine salt) are available and perform similarly.

⁵Use extreme caution to avoid drift to sensitive crops, such as cotton, tobacco, soybeans, and vegetables. Use only amine formulations of 2,4-D. Follow all label directions for drift management.

⁶Generic brands containing metolachlor are available (Me-Too-Lachlor-II, Parallel, Stalwart-C). However, these generic brands may not provide the same length of residual control as Dual II Magnum (*S*-metolachlor).

⁷Also available in a pre-mixture sold under the trade name of Liberty ATZ.

⁸Expert is a pre-mixture of glyphosate, *S*-metolachlor and atrazine.

⁹Sequence is a pre-mixture of glyphosate + *S*-metolachlor.

** When atrazine is applied PRE + POST, a total of 2.5 lbs ai/A can be applied per year (2.5 qt/A of 4L or 44 oz/A of 90DF). When atrazine is applied only POST, then a total of 2.0 lb ai/A can be applied per year (2 qt/A of 4L or 36 oz/A of 90DF).

Rotational Crop Concerns

Advances in herbicide chemistry have led to the development of some exceptional families including the sulfonlyureas (Accent, Beacon, Permit), imidazolinones (Lightning, Pursuit), sulfonanilides (Python), and others. Many herbicides in these families are used in field corn. However, some of these herbicides have the potential to injure rotational crops if the appropriate replanting interval is not observed. Atrazine also has the potential to cause carryover problems to sensitive crops particularly when used in late plantings. Because of the diversity of crops that are grown in Georgia, producers must consider the potential effects that herbicides could have on a rotational crop the next year. This information is readily available on nearly all herbicide labels.

Conservation Tillage Systems

Weed control in conservation tillage systems begins with an effective burndown herbicide program. The following table presents the various burndown herbicide programs that can be used in field corn:

Table13. Weed and Cover Crop Response to Burndown Herbicides Used in Conservation Tillage Field Corn Productions Systems in Georgia.

Weed	Glyphosate	Glyphosate + 2,4-D	Glyphosate + Atrazine	Paraquat	Paraquat + 2,4-D	Paraquat + Atrazine	glufosinate
Carolina geranium	P	F-G	G-E	G-E	G-E	G-E	G-E
Chickweed	E	E	G-E	E	E	E	G-E
corn spurry	G-E	G-E	G-E	F-G			
Crimson clover	P-F	F	F	G	G-E	G-E	
cutleaf evening primrose	P-F	E	G-E	F	E	G-E	G-E (mature plant)
Henbit	F-G	E	G-E	G	E	G-E	G-E
Horseweed	G	E	G-E	F	G	G-E	G-E
ryegrass**	G	G	G-E	P-F	P-F	F	P
small grains	E	E	G-E	F-G	F-G	G	P-F
Swinecress	F-G	G	G	P-F	F-G	F-G	G-E
volunteer peanut	F	F	F	P	P-F	F	G-E
wild radish	F-G	G-E	G-E	F	G-E	G-E	G-E (mature plant)
corn plant-back restriction	0 days	7-14 days	0 days	0 days	7-14 days	0 days	0 days

Burndown rates are the following: Glyphosate at 0.75 lb ae/A (22 ozs/A of 4.5 lb ae/gal or 32 ozs/A of 3 lb ae/gal); paraquat at 0.75 lb ai/A (3 pts/A of Gramoxone Inteon or 2 pts/A of Gramoxone Max/Firestorm); glufosinate at 0.42 lb ai/A (23 ozs/A of Ignite 280SL or 32 ozs/A of Liberty 1.67SL); atrazine at 1.0 lb ai/A (1 qt/A of Atrazine 4L), and 2,4-D amine at 0.48 lb ai/A (1 pt/A of 2,4-D Amine 3.8SL).

** Ryegrass can be very difficult to control. The following programs are suggested: **Option 1** - Glyphosate at 1.125 lb ae/A (2 pts/A of 4.5 lb ae/gal or 3 pts/A of 3 lb ae/gal) + 3 pts/A of Atrazine 4L at-planting; or **Option 2** - Gramoxone Inteon at 30 oz/A or Gramoxone Max/Firestorm at 20 ozs/A applied 2 weeks before planting followed by Gramoxone Inteon at 30 oz/A or Gramoxone Max/Firestorm at 20 ozs/A + Atrazine 4L at 3 pts/A at-planting.

WEED RESPONSE TO HERBICIDES USED IN FIELD CORN

Eric P. Prostko, Extension Agronomist - Weed Science

	Sutan	Eradicane	Lasso	Axiom	Frontier Outlook	AAtrax Atrazine	Pursuit ¹	Dual ² Cinch	Harness Surpass TopNotch Degree	simazine	Python
	PPI		PRE								
PERENNIAL WEEDS											
johnsongrass (rhizome)	F	F-G	P		P	P	P	P	P	P	P
nutsedge, purple	G-E	G-E	P	P	P	P	G	P	P	P	P
nutsedge, yellow	G-E	G-E	F	P	F-G	P	F-G	F-G	F	P	P
ANNUAL GRASSES											
broadleaf signalgrass	G	G	F-G		F-G	P	P	F-G	G	P	P
crabgrass	E	E	E	G-E	E	G	F	E	E	G	P
crowfootgrass	E	E	E	G	E	G	P	E	E	G	P
fall panicum	E	E	E		E	P	P-F	E	E	G	P
goosegrass	E	E	E		E	G	F	E	E	G	P
johnsongrass (seedling)	E	E	P		P	P	G	P	P	P	P
sandbur	E	E	F-G		F-G			F-G	F-G	G	P
Texas panicum	G-E	G-E	P-F	F	F	P	P-F	P	P	P	P
annual ryegrasses						G				E	P
BROADLEAF WEEDS											
bristly starbur			P		P	G	F	P	P	G	E
citronmelon			P		P	G	G	P	P	F	
cocklebur			P	P	P	G-E	E	P	P	G	E
cowpea			P		P	E	P	P	P	G	
crotalaria			P		P	G-E		P	P	G	
croton, tropic			P		P	G	P	P	P	G	
Florida beggarweed			F		P	E	P	F	F	G	F-G
Florida pusley	G-E	G-E	G-E	G	G-E	E	P	G-E	G-E	G	G
jimsonweed			P		P	E	G	P	P	E	P
lambsquarters, common	G	G	F-G	F-G	F	E	F	F	F	E	E
morningglories			P	P	P	G	G	P	P	G	F-G
pigweeds	G-E	G-E	E	F-G ³	E	E	E	G-E	G-E	E	E
prickly sida	G	G	F-G		F	E	G-E	F	F	E	E
purslane	G	G	G		G	E		G	G	E	
ragweed, common			P	F	P	E	P	P	P	E	G
sesbania, hemp											
sicklepod	F	F	P	P	P	G	P	P	P	G	F-G
smartweed	P	P	P	P-F	P	G-E	G-E	P	P	G	G
tropical spiderwort					F	F	F-G	G-E			
volunteer peanuts	P	P	P		P	G	P	P	P	F	
wild poinsettia											G
wild radish	P	P	P		P	G	E	P	P	F	

PPI = Preplant soil incorporated PRE = Preemergence (surface applied)

¹Weed response for Pursuit is similar for PPI and PRE applications. **Pursuit can only be used on Clearfield corn hybrids (IR/IT).**

²Includes all metolachlor products (Cinch, Dual, Dual II, Dual Magnum, Dual II Magnum). The generic formulations of metolachlor (**Parallel, Stalwart, Me-Too-Lachlor**) have not provided the same length of residual control of certain weeds as similar rates of Dual Magnum formulations in some UGA field trials.

³Palmer Amaranth control is poor.

Key to response symbols: E = Excellent control, weed kill 90 percent or above.; G = Good control, weed kill 80 percent or above; F = Fair control, weed kill less than 80%, usually unacceptable unless supplemental chemical or cultivation practices are used; P = Poor control. If no symbol is given, weed response is unknown.

WEED RESPONSE TO HERBICIDES USED IN FIELD CORN (continued)

	Evik	Attrex, Atrazine	Accent	Basis Gold	Option	Beacon	Exceed	Basagran	Callisto
PO (Postemergence/Postemergence Directed)									
PERENNIAL WEEDS									
johnsongrass (rhizome)	P	P	G-E	P	G-E	F-G	P-F	P	P
nutsedge, purple	G	P	P-F				P	P	P-F
nutsedge, yellow	G	P					P	G	P-F
ANNUAL GRASSES									
broadleaf signalgrass	G	P-F	G	G	G	P		P	P
crabgrass	E	G	P-F	F	P-F	P	P	P	P-F
crowfootgrass	E	G	E	F-G			P	P	P
fall panicum	E	G	G-E	F-G	G-E	F	P	P	P
goosegrass	E	G	E		G-E		P	P	P
johnsongrass (seedling)	E	F	G-E	G	G-E	G-E	F-G	P	P
sandbur	E	F	E		G-E		P	P	P
Texas panicum	G-E	P-F	G-E	F-G	G-E	P	P	P	P
annual ryegrass	F-G	F	G					P	P
BROADLEAF WEEDS									
bristly starbur	E	E						E	
citronmelon	G	G					F	P	
cocklebur	F	E	P-F	G	P-F		G	E	G
cowpea	G	G						P	
crotalaria	E	G						P	
croton, tropic	G	G						P	
Florida beggarweed	E	G	G	F		G-E		P	
Florida pusley	E	G	P-F	F-G		G-E		P	
jimsonweed	E	E	F-G		F-G		G	E	G-E
lambquarters, common	E	E	F-G	G	G		G	P	G-E
morningglories	G	E	G-E	F-G	F-G	F	F-G	F-G	F-G
pigweeds	E	E	G-E	G	G	G-E	G	P	G-E
prickly sida	E	E	P	F-G			F-G	G	P
purslane	E	E						P	
ragweed, common	E	E	P-F	F-G	G		G	F	G
sesbania, hemp									
sicklepod	E	E	P-F	F-G		G	G	P	P
smartweed		G-E	G	E	P	G		G-E	G-E
tropical spiderwort	G-E	P						F-G	
volunteer peanuts	G-E	F-G	F	F-G		F	P	P	P
wild poinsettia									
wild radish	G-E	F-G	G			G	G	F	

Key to response symbols: E = Excellent control, weed kill 90 percent or above; G = Good control, weed kill 80 percent or above; F = Fair control, weed kill less than 80%, usually unacceptable unless supplemental chemical or cultivation practices are used; P = Poor control

If no symbol is given, weed response is unknown.

WEED RESPONSE TO HERBICIDES USED IN FIELD CORN (continued)

	Pursuit ¹	Lightning ¹	Liberty ²	Glyphosate ³	Banvel, Clarity	Lorox, Linex
	PO (Postemergence/Postemergence Directed)					
PERENNIAL WEEDS						
johnsongrass (rhizome)	P	F	P-F	E	P	P
nutsedge, purple	G		P-F	P-G	P	F
nutsedge, yellow	F	P	P-F	P-G	P	F
ANNUAL GRASSES						
broadleaf signalgrass	P		G	G-E	P	G
crabgrass	P-F	G	G	G-E	P	G
crowfootgrass	P-F	G	G	G-E	P	E
fall panicum	P		G-E	G-E	P	E
goosegrass	P		P	G-E	P	E
johnsongrass (seedling)	F		G	G-E	P	E
sandbur				G-E	P	E
Texas panicum	P-F	P-F	G-E	G-E	P	G-E
annual ryegrass			G	F-G	P	
BROADLEAF WEEDS						
bristly starbur	P-F		G	G	E	G
citronmelon	F		G	G	E	E
cocklebur	E	G	E	G	E	E
cowpea	P		G	G	E	G
crotalaria				G	G	E
croton, tropic	P		G	G	G	G
Florida beggarweed	P		G	G	G	E
Florida pusley	F-G	F-G	F-G	P-F	G	G
jimsonweed	F-G		G	G	E	E
lambsquarters, common	P	F	E	G	E	E
morningglories	F-G	G-E	G	F-G	E	G
pigweeds	G-E	G-E	P-F	G	E	G
prickly sida	P-F		P-F	G	E	G
purslane			G	G	E	G
ragweed, common	P	G	G	G	E	E
sesbania, hemp						
sicklepod	P	F	G	G	E	E
smartweed	E	G-E	G-E	G-E	E	
tropical spiderwort	F	F-G	P-F	P-F	P	F
volunteer peanuts	P	P	F-G	F	F-G	G
wild poinsettia				G-E		
wild radish	G-E		F	G	G-E	G

¹Pursuit and Lightning are **only** for use on Clearfield corn hybrids (IR/IT).

²Liberty is **only** for use on Liberty-Link corn hybrids.

³Glyphosate is **only** for use on Roundup Ready corn hybrids. Ratings also reflect weed control in minimum tillage applications prior to crop emergence/planting.

Key to response symbols: E = Excellent control, weed kill 90 percent or above; G = Good control, weed kill 80 percent or above; F = Fair control, weed kill less than 80%, usually unacceptable unless supplemental chemical or cultivation practices are used; P = Poor control

If no symbol is given, weed response is unknown.

WEED RESPONSE TO HERBICIDES USED IN FIELD CORN (continued)

	Gramoxone (paraquat)	Prowl⁺	Trifluralin⁺	Stinger	2,4-D	Permit	Buctril	Aim
	PO (Postemergence/Postemergence Directed)							
PERENNIAL WEEDS								
johnsongrass (rhizomes)	P	P	P	P	P	P	P	P
nutsedge, purple	F	P	P	P	P	G	P	P
nutsedge, yellow	F	P	P	P	P-F	G	P	P
ANNUAL GRASSES								
broadleaf signalgrass	G	G	G	P	P	P	P	P
crabgrass	G	G-E	G-E	P	P	P	P	P
crowfootgrass	G	G-E	G-E	P	P	P	P	P
fall panicum	G	G-E	G-E	P	P	P	P	P
goosegrass	G	G-E	G-E	P	P	P	P	P
johnsongrass (seedling)	G	G	G	P	P	P	P	P
sandbur	G	G	G	P	P	P	P	P
Texas panicum	E	G	G	P	P	P	P	P
annual ryegrass		F	F	P		P		P
BROADLEAF WEEDS								
bristly starbur	G	*	*	F-G		G	G	P
citronmelon	F	*	*	F-G	E	P-F		
cocklebur	G	*	*	G-E	E	G	E	G
cowpea	G	*	*	G-E	E			
crotalaria	G	*	*	G-E	G	P		F
croton, tropic	G	*	*	G	G			G
Florida beggarweed	E	*	*	G-E	G	P	G	F
Florida pusley	F-G	G	G	F-G	G		E	F-G
jimsonweed	G	*	*	G	E			G
lambquarters, common	F-G	G*	G*	P	E	P-F	G	G-E
morningglories	G	*	*	P	G	P-F	G	E**
pigweeds	G	G*	G*	P	E	F-G	G	G-E
prickly sida	F-G	*	*		G			F
purslane	G	G*	G*		G			G
ragweed, common	G	*	*	G	E	G	G	F
sesbania, hemp								
sicklepod	G	*	*	F-G	E	P	P	P
smartweed				F	P-F	F-G		G
tropical spiderwort	G-E	P	P		G-E	P		G-E
volunteer peanuts	P	P	P	F-G	P	P	P	P
wild poinsettia	F-G	P	P					
wild radish	G	P	P		G	G	G	

Key to response symbols: E = Excellent control, weed kill 90 percent or above; G = Good control, weed kill 80 percent or above; F = Fair control, weed kill less than 80%, usually unacceptable unless supplemental chemical or cultivation practices are used; P = Poor control. If no symbol is given, weed response is unknown.

Ratings are based on average to good soil and weather conditions for herbicide performance.

*Must be tank mixed with atrazine or glyphosate for postemergence control of seedling grasses and broadleaf weeds.

†For control of grasses and selected broadleaf weeds, these herbicides must be applied prior to weed emergence.

**Aim will not effectively control smallflower morningglory.

Corn Weed Control Guidelines -General Comments

- Several package mixes are available containing herbicides approved for use in Georgia. Refer to manufacturer's label to ensure that the herbicide rates contained in the mix are adequate for the weeds to be controlled.
- Some herbicides cause crop injury when used on light textured soils. Refer to manufacturer's label and use lower rates where applicable for the soil texture encountered.
- Application of postemergence herbicide treatments to moisture stressed weeds will usually result in poor control.
- The total atrazine rate should not exceed 2.5 lbs/ai/A per year.

INSECT CONTROL IN FIELD CORN

David Buntin

Field corn in Georgia is subject to attack by many different kinds of insect pests. Some of these insects are capable of completely destroying a corn crop. However, there is no key insect pest of corn in Georgia causing serious damage in most fields every year. Indeed, in many years most corn fields may completely escape serious insect damage.

Corn is sensitive to plant population. As little as a 10% loss in stand will reduce yield potential. Consequently, insect management in corn focuses more on seedling insect pests causing stand loss than in other crops. Once corn plants are established and past the seedling stage (6+ leaf stage), corn is quite tolerant of insect injury. Corn can tolerate considerable leaf defoliation and some ear and kernel damage before significant yield loss occurs. Therefore, insecticide use in field corn in Georgia historically has been limited and aimed mostly at soil and seedling pests.

A good insect control program is essential to protect the crop from damage and to ensure judicious and economical usage of insecticides. Insect pest management in field corn consists of two approaches: **(1) prevention** of insect damage by crop management and preventive insecticide use in high-risk situations and **(2) regular monitoring** of the insect-pest infestations and treatment on a field by field basis as needed after plants have emerged. Historically low commodity prices for corn made routine preventive use of insecticides in Georgia a questionable practice. However the recent increase in grain prices and availability of low cost seed treatments make active pest management with insecticides more beneficial.

Certain crop management practices can help minimize or prevent damage by some insect in field corn.

Good Soil Conditions: Good fertility, optimum soil pH, good field drainage, irrigation and other agronomic practices that promote rapid stand establishment and vigorous plant growth are important in minimizing losses from insect injury.

Crop Rotation: In general, rotation of corn with other summer crops helps prevent the buildup of corn pests from year to year. Most corn insect pests are highly mobile and therefore are not affected by rotation. However, billbug and western corn rootworm, which is now established in the northern half of Georgia, can be controlled by crop rotation.

Plant at the recommended time: Plantings of field corn at the recommended time often escape serious damage by most insects.

Make Uniform Plantings: Making uniform plantings over as large an area as possible (a farm or community) can help to “dilute” insects thereby minimizing infestations of certain insects such as European corn borer.

Control Certain Weeds: Damage from the southern corn billbug is usually associated with fields where nutsedge is a problem. Sugarcane beetle builds up to especially high levels on

bahiagrass. Leafhoppers and aphids serve as vectors of corn viruses from johnsongrass to field corn.

Tillage: Under conventional-tillage production, previous-crop residue, sod, winter cover crop and/or heavy weed populations increases the risk of damage by soil insects. Conventionally-tilled fields should be fallowed for at least 2 weeks before planting. Soil insects attacking seedlings usually are worse in reduced, strip-till and no-tillage production, where residue from previous crops, cover crops or weeds remain on the soil surface.

Hybrid Selection. Since 1998, hybrids containing the toxin from *Bacillus thuringiensis* (Bt) have been available. Until recently all Bt corn hybrids targeted larvae of certain moth species. Bt hybrids for control of mid-season corn rootworms now are available.

1) YieldGard Corn borer (YGCB) can contain same gene (Cry1Ab) with either the MON810 event or the Bt11 event. YGCB targets caterpillar pests including European and southwestern corn borers, fall armyworm, corn earworm and other lepidopterans. The toxin is expressed season-long throughout the plant although expression in seedlings may be limited.

2) Herculex I contains the gene Cry1F. It also targets caterpillar pests including European and southwestern corn borers, fall armyworm, corn earworm and other lepidopterans. The toxin is expressed season-long throughout the plant. Activity in seedling and whorl-stage plants is greater than YGCB. Conversely Herculex activity in ears and kernels is more limited than YGCB.

The following table shows a comparison of activity of YGCB and Herculex I against major caterpillar pests in Georgia:

Bt corn type	Corn borers in stalk	Cutworm on Seedling	LCSB*: Seedling	Fall armyworm in whorl	Corn earworm in ears
YieldGard - Corn Borer	Excellent	Poor	Poor-Fair	Good	Fair-Good
Herculex I	Excellent	Good	Good-Excellent	Excellent	Poor-Fair

*Lesser cornstalk borer is not specifically listed as a target pest on the Bt label.

When to Use Bt hybrids: Planting corn early or during the recommended planting time in your area usually avoids most damage by fall armyworm, corn earworm and corn borers. Therefore, when planting during the recommended planting time, plant the best high-yield adapted hybrid regardless of Bt resistance. Carefully compare the agronomic performance of adapted susceptible hybrids and hybrids with Bt-resistance. Some Bt-resistance hybrids may not have the yield potential of adapted, susceptible hybrids in the absence of serious insect pressure. Hybrids with Bt technology should be considered for planting when the planting time is 1 month or more after the recommended planting time when risk of caterpillar damage is greatest. Planting of Bt corn permits planting of corn as a double-crop and at times later than previously recommended for susceptible corn.

Bt Hybrid refuge requirements: Refuge requirements for Bt corn in cotton growing areas such as Georgia are as follows:

- Bt corn can only represent up to 50% of corn on a farm.
- A non-Bt corn refuge should be planted within ¼ to ½ mile of the Bt corn.
- YieldGard-CB cannot serve as a refuge for Herculex I corn and visa versa.
- Bt corn can be treated with insecticide except for sprayable Bt products.
- Do not mix Bt and non-Bt corn seed.
- Bt and non-Bt corn can be planted in strips of 4 or more consecutive rows. Alternate row strips are not allowed.
- Check with seed dealers for complete Bt corn refuge requirements.

Bt hybrids for Rootworm Control: Recently YieldGard-rootworm and Herculex-RW have been released for control of mid-season corn rootworms. Each product contains a different Bt gene. Mid-season rootworms do not occur in Georgia except for western corn rootworm which is present in the northwest portion of the state. Rootworm Bt products are not effective against wireworms, white grubs or southern corn rootworm in the seedling stage. Therefore Bt for rootworm control is NOT needed and not recommended throughout most of Georgia. In northwestern Georgia, hybrids with rootworm Bt should be considered for continuous corn. It is not needed where corn is rotated with other crops.

INSECT MANAGEMENT DURING KEY CROP STAGES

Before and At Planting

Insects that live in the soil, including wireworms, white grubs, rootworms, seedcorn maggots, whitefringed beetle larvae, lesser cornstalk borer and other, can damage corn seeds and seedlings. These insects cannot be controlled once corn seed has been planted.

Rotated, conventionally tilled corn with good weed control generally has the least risk of serious early-season insect damage, although insect damage can still occur under these conditions. Several factors increase the risk of damage by soil insects and the need for an at-planting insecticide to prevent damage.

1. Planting continuous corn in the same field.
2. Planting in no-till or minimum-till situations (such as strip till) where residue of the previous crop remains on the soil surface.
3. Planting behind small grains, winter cover crops or sod of any type especially in reduced tillage situations.
4. Late-planting (more than 1 month after the recommended planting time).
5. Planting on light soils following periods of drought (lesser cornstalk borer).
6. When planting on heavier soils following extended wet periods (corn rootworms and seedcorn maggot).
7. Planting in fields with certain weeds; nutsedges enhance billbugs, bahiagrass and sugarcane beetle and johnsongrass and aphids and leafhoppers transmit corn virus diseases.

Insecticides for Use At-Planting:

Granular Insecticides: Granular insecticides require the use of specialized application equipment.

Counter 15G: Only available in a Lock'n Load closed handling system. Apply as in-furrow, T-band or band. Most effective against beetle type insects; not a good choice for cutworms and lesser cornstalk borer. Counter also provide fair to good nematode control. Interactions with ALS herbicides such as Accent and Option may cause severe injury. Check herbicide product label for restrictions.

Lorsban 15G: Apply as a T-band or band for control of cutworms and lesser cornstalk borer. Less effective against beetle type insects, wireworms and grubs. Lorsban also may interact with ALS herbicide to cause injury; see herbicide labels for restrictions.

Phorate / Thimet 20G: Do not apply in-furrow due to risk of seed injury. Apply as T-band or band application. Mainly use is for mid-season rootworm control. If wireworms are the target pest, use another insecticide that can be applied in-furrow or as a seed treatment. Interactions with ALS herbicides may cause injury; see herbicide labels for restrictions.

Force 3G: Apply in-furrow or band. Force is a pyrethroid insecticide and is effective against most soil insects. No systemic activity, no nematode activity and no herbicide interactions. Force tends to breakdown quickly in warm, sandy soils.

Liquid injected insecticides: Several liquid insecticides are labeled for at-planting use in corn. They should be applied in-furrow using specialized application equipment or applied in the open seed furrow using flat-fan nozzles oriented with the row. See product dealer to obtain equipment. Injection spray equipment may be difficult to use if not properly installed or under certain soil conditions.

Capture 2EC: Fair to good control of soil insects. No systemic activity or activity against nematodes.

Furadan 4F: Apply in-furrow. Good to very good control of soil insects. Also has systemic activity against aphids, leafhoppers, thrips and moderate infestations of chinch bugs. Furadan also provides suppression of nematodes. Availability may be limited.

Regent 4SC: Provides fair control of most soil insects. Regent has some systemic activity for control of thrips, aphids, and chinch bugs on seedlings.

Seed Treatments: Systemic seed treatments are only available as commercial seed dealer application and must be ordered with the seed. Cost varies per acre between irrigated and dryland corn based on differences in seed planting rate.

Poncho 250: Provides good control of most soil insects, but has variable control or not effective against corn billbug and cutworms. Also provides systemic control for 2-3 weeks after planting

of aphids, thrips, leafhoppers and moderate infestations of chinch bug.

Cruiser 250: Provides fair to good control of most soil insects, but is not effective against corn billbug and cutworms. Also provides systemic control for 2-3 weeks after planting of aphids, thrips, leafhoppers and moderate infestations of chinch bug.

Poncho 1250 / Cruiser 1250: Consider use for control of billbug and cutworms and in fields with a history of severe infestations of soil insects.

Table 14. Relative efficacy insecticides for at-planting use in corn.

Product	Seed-corn maggot	S. Corn root-worm	Wire-worm	Grubs	Lesser corn-stalk borer	Cutworm	Bill-bug	Sugar-cane beetle
Counter 15G	++	++	++	++	-	-	+	-/+
Lorsban 15G	++	++	-/+	-/+	++	++	-	-
Force 3G	++	++	++	+	+	+	-	-/+
Capture 2EC LQ	++	++	++	+	+	+	-	-
Furadan 4F LQ	++	++	++	+	++	+	+	+
Regent 4SC LQ	++	++	+	+	+	+	-	?
Poncho 250 ST	++	++	+	-/+	+	-	-	-/+
Cruiser 250 ST	++	++	+	-/+	+	-	-	-/+
Poncho/Cruiser 1250 ST	++	++	++	++	++	+	+	+

Rating: - indicates poor activity; + indicates fair activity; ++ indicates good activity.

LQ = Products require specialized equipment for liquid injection in-furrow.

ST = seed treatments, applied by seed dealers.

Application of granular insecticides: Probably the best way to apply an at-planting insecticide (where the label allows) on field corn (including conventional, minimum and no-till plantings) is to apply it in a T-band or a narrow band (6 to 7 inches) behind the planter shoe and in front of the press wheel. This method of application incorporates some of the material in a band near the surface of the soil and insects which feed at or near the soil surface (lesser cornstalk borer, cutworms, billbugs, sugarcane beetle) will be more likely to come in contact with it. However, the best method where **only** wireworms, seedcorn maggots and southern corn rootworms are a problem is an in-furrow application where the label allows. **Note:** In no-till plantings, make sure **some** incorporation with the press wheel is obtained since labels of most at-planting insecticides specify a covered-band application. **Organophosphate soil insecticides can interact with ALS and other herbicides to cause serious plant injury. Check insecticide labels carefully to avoid herbicide interactions.**

Seedling Stage Corn

Corn fields should be checked about 2 weeks after planting verify that plants are emerging and to determine the kinds and numbers of insects present and initiate controls based

on this information. Inspect at least 10 whole plants at each of 10 different locations for average sized fields. Sample the entire field. Yield loss occurs when as few as 10% of plants are destroyed or damage so severely as to prevent normal stalk and ear development.

Scout corn to detect infestations of the lesser cornstalk borer, billbugs, sugarcane beetle, cutworms, armyworm, fall armyworm, stink bug and chinch bug which may reduce stands. These insects may inflict heavy damage on seedlings less than 12 inches high (sugarcane beetle may damage much larger corn also). Look for insects around the plants, on the plants, and in the soil around the stem and roots; look for dead, dying and lodged plants. Look for small and large larvae (usually in a silken tube) boring into the plant just at the soil line. Even the young larvae of this insect can cause heavy damage to the young seedlings (2 to 5 leaf stage) in 2 to 3 days if not controlled. Check late-planted corn very carefully for the lesser cornstalk borer.

Billbugs are reddish-brown or black weevil type beetles with long curved snouts. Billbug feed at the base of the stalk just below the soil surface where they chew holes through the stem killing the growing point. The insect has one generation per year and moves by crawling. Billbugs mostly cause damage in non-rotated corn following corn, in fields next to last year's corn or in fields with heavy infestations of nutsedge. Early detection of infestations is important to prevent serious loss. At-planting banded insecticide treatments such as Counter 15G may aid in controlling billbugs. Systemic seed treatments, Poncho or Cruiser, are not effective at the low (250) rate but are effective at the higher (1250) rate. Foliar application of an insecticide directed at the stalk and base of the plant are most effective.

Sugarcane beetles are black and about ½ inch long. Like billbugs they gouge holes in the stalk just below the soil surface. Damage usually occurs over a short period of time when beetles are active. This insect can build up on bahiagrass and other grassy weeds in or near corn fields. Notes on insecticide use for billbugs also apply to sugarcane beetle.

Cutworms are larvae of various moth species. They cut leaves and entire corn seedling off near the soil line. They typically spend the day under soil or plant residue in the field. Infestations often are associated with reduced tillage with plant residue on the soil surface and/or fields with serious weed infestations the previous year or before planting. Environmental conditions causing slow seedling growth also increase enhance damage by cutworms. Treat when 10% of plants are cut and worms are present. Lorsban 4E or various pyrethroid insecticides applied broadcast or as a band over the row at planting can control cutworms. Low rate of systemic seed treatments, Poncho and Cruiser, are not reliably effective; the high (1250) rate is effective. Herculex 1 Bt technology also will suppress cutworms, but YieldGard - Corn borer type Bt is not effective against cutworms.

Lesser cornstalk borer is a larva of a moth. It prefers hot, dry conditions and conventional tillage. Late planted corn is at more risk from attack. Moths are highly attracted to burnt stubble. Larvae bore into the side of seedling plants. They live in a silken tube that will be covered with soil particles. This tube is characteristic of lesser cornstalk borer. Control comments for cutworms also apply, except lesser cornstalk borer is very difficult to control after plant emergence.

Chinch bugs are small true bugs with black and white X-patterned wings as adults. Nymphs are reddish gray with a white band across their back. Chinch bugs suck sap from roots, leaves and stems causing stunting wilting and deformation of seedling plants. Chinch bugs are favored by hot dry conditions and by reduced tillage following grassy winter crops or weeds. Vigorous corn may outgrow severe seedling injury. Treat chinch bugs when 3 to 5 bugs per plant occur on 20% of plants. Systemic seed treatments Poncho and Cruiser at the low rate will control low to moderate infestations. Large infestations may require spraying seedlings. Lorsban 4E and Warrior 1CS applied as directed spray at the base of plants using plenty of water are recommended for chinch bug control after planting.

Stink bugs overwinter as adults and will feed by piercing and sucking sap from corn seedlings. Common species in Georgia are the Southern Green, Brown, and Rice stink bugs. Feeding in the seedling stage stunts and deforms developing whorls. New leaves do not expand properly and are trapped in the previous leaf causing a "buggy-whip" type damage. Stink bugs are very difficult to scout in the seedling stage. About 10% seedling damage is economically important. Most at-planting insecticides are not effective in preventing stink bug damage. Furadan 4F injected in-furrow at planting is effective and systemic seed treatments, Poncho and Cruiser at the low rate, will suppress damage at the low (250) rate.

Thrips are tiny black or yellow insects. They feed on leaves where they can cause discoloration of leaves of seedling plants. Unless damage is severe, plants usually grow out of this damage the 6 leaf stage with no measurable yield loss. Systemic seed treatments, Poncho and Cruiser, are effective and some foliar insecticides effectively control thrips on seedling corn.

Whorl Stage Corn

Once corn plants reach the 5 - 7 leaf stage they are large enough to escape damage by most seedling pests. Most insects of importance during the whorl stage defoliate the whorl and leaves. These include grasshoppers, armyworms, corn earworm, cereal leaf beetles and others. Whorl stage corn is very tolerant to defoliation. Almost 50% leaf loss can occur at 5 - 7 leaf stage before any yield loss is expected. The following table may be helpful in assessing the yield loss potential from defoliation at different stages whorl development.

Table 15. Yield loss Potential in Bushels Per Acre from Defoliation.

Leaf stage	Percent leaf Area Destroyed				
	20	40	60	80	100
5	0	0	1	4	6
7	0	1	4	6	9
9	0	2	6	9	13
11	1	5	9	14	22
13	1	6	13	22	34
15	2	9	20	34	51
17	4	12	27	45	70

Source: J. van Duyn, North Carolina State University.

Whorlworms (Fall armyworm, corn earworm, true armyworm, other armyworms) infest whorls where they chew large holes in expanded and unfurling leaves. These caterpillars as a group are sometimes called ‘budworms’. Armyworms lay masses of eggs on the leaves whereas corn earworm lays single eggs. Small larvae cause window-pane or shot-hole type injury before moving to infest the whorl. As they feed and grow, they tunnel in the whorl causing large wholes to develop as the leaves unfold and expand. Armyworm and earworm infestations during the boot stage often may cut all or part of the tassel before it emerges. Controls should be initiated when 30% of the plants in a field are infested. Use ground equipment and apply **at least** 20 gallons of finished spray per acre directed down into the whorls. Cone type nozzles producing large sized droplets will aid in control. Bt corn, both YieldGard corn borer and Herculex will prevent damage by whorlworms, but Herculex is more effective than YieldGard-CB under heavy infestations.

Cereal leaf beetle is a pest of winter small grains, where larvae defoliate leaves in the spring. Newly emerged adults leave small grain crops as they mature and move to adjacent grass crops such as corn. Adults chew long irregular lines in leaves of seedling and whorl-stage corn. Adult beetles are dark blue with reddish legs and neck. Corn fields immediately next to small grain fields are most heavily infested. Beetles occur along the field edge initially and often can be controlled by treating the first 50 - 100 ft of the corn field edge.

Grasshoppers feed on many different plants and usually are a problem in dry years. Adults are very mobile and hard to control. Nymphs should be controlled if they are causing excessive defoliation and are numerous. Reduced tillage situations tend to have greater grasshopper infestations than clean tillage fields. Grasshoppers typically occur along the field edge initially and often can be controlled by treating the first 50 - 100 ft of the corn field edge.

Mid-Season Stalk-Boring and Root-Feeding Insects

European corn borer, Southwestern corn borer and Southern cornstalk borer are caterpillars that tunnel inside corn stalks during the whorl and ear fill stages. Eggs are laid in masses on leaves. Small larvae feed in foliage before tunneling into the stalk. Once in the stalk, they cannot be controlled using insecticides. Stalk borers usually are not serious insect pests of corn in most of Georgia. The southwestern corn borer only occurs in the northwestern part of the state and usually causes significant stalk damage in later plantings. Bt-resistant hybrids are very effective in controlling these insects.

Western corn rootworm is present only in northern Georgia, but the insect continues to spread southward. Larvae feed on root tips causing root pruning reducing root activity and yield potential. In severe cases most of the roots are destroyed causing the plants to lodge or fall over in a ‘gooseneck’ appearance. Western corn rootworm only feeds on corn. Adults are attracted to silks where they feed and lay eggs in the soil in corn fields. Eggs over winter and hatch the next year to damage the following corn crop. Therefore, crop rotation is very effective in controlling this insect. At-planting insecticides are recommended for preventive control in continuous corn fields with a history of rootworm damage. Hybrids with Bt rootworm technology also effectively control western corn rootworm (Note: the other major rootworm pest species in the Midwest, the northern corn rootworm, does not occur in Georgia).

Ear Formation, Tasseling/Silking, and Kernel-fill Stages

Stink bugs also can cause feeding damage to small developing ears before silking. This type of feeding injury can deform ears into a C or boomerang shape that usually curves away from the stalk. These ears fail to develop properly and are more susceptible to infection by corn smut fungus. Treat during the ear elongation stage (before silking and pollen shed) if 1 stink bug per 20 plants is present. After ear elongation and seed set stink bugs only damage individual kernels and control is not warranted unless populations reach 1 bug per 10 ears. Brown stink bug are less susceptible to pyrethroid insecticides than Southern green stink bugs. Use pyrethroid insecticides such as Capture, Warrior, Decis, Baythroid or Mustang MAX, if green stink bugs are prevalent. If brown stink bugs are prevalent use methyl parathion (Methyl 4E or PennCap M) but do not apply methyl parathion during pollen shed.

Corn rootworm adults, Japanese beetles, corn earworm larvae, and grasshoppers can clip corn silks thereby interfering with pollination. Silk damage or removal by insect feeding can cause poor seed set and partially filled ears. Damage must be severe to justify control with insecticides. Later plantings also tend to suffer more silk clipping than early plantings. Insecticidal control may be needed if: (1) most ears are infested AND (2) silks are being clipped to within ½ inch of the ear tip AND (3) 5 or more rootworm beetles or 2 or more Japanese beetles are present per ear or corn earworm larvae are present on most ears.

Aphids seldom require control on field corn in Georgia. Corn leaf aphid is the most common aphid occurring on field corn in Georgia. Natural enemies such as ladybugs and parasites are usually effective in regulating them at non-damaging levels. Consider control if heavy aphid infestations occur and leaves appear to be drying and dying over large areas of the field, or aphids on the tassels and silks appear likely to interfere with pollination.

Corn earworm and Fall armyworm larvae feed on developing kernels on corn ears.

Corn earworm feeding damage usually is confined to the tips of the ears. Several small larvae may infest an ear, but because larvae are cannibalistic, usually only one larva completes development per ear. Corn earworm feeding activity tends to open up the husks to provide points of entry for kernel diseases and secondary insects such as sap beetles. Later plantings have greater infestations than earlier planting. Infestations of 60 to 100% of ears can occur in some years and in later plantings in most years, but yield loss generally is less than 5%.

Fall armyworm damage is similar to corn earworm but several fall armyworms may complete development in a single ear. Therefore damage during armyworm outbreaks can be much more severe than by corn earworm. Early-planted corn often escapes ear infestation by fall armyworm.

Because larvae are protected within the husk, **using insecticides to control corn earworm and fall armyworm in the ear is not feasible in field corn.** Bt-corn is helpful in partly preventing ear damage by corn earworm but do not expect more than 50 – 75 % control.

Specific insecticide recommendations are updated annually and are available in the Georgia Pest Management Handbook, commercial edition at: http://www.ent.uga.edu/pmh/Agronomic/Agronomic_Crops.htm. (There is a (_) before Crops. Click on corn for current pesticide recommendations and restrictions).

CORN DISEASE AND NEMATODE MANAGEMENT

Bob Kemerait

Corn grown in Georgia is susceptible to a number of diseases that are caused by fungi, bacteria, viruses, and nematodes. Although rarely resulting in total crop loss, diseases such as seed rots, seedling blights, leaf spots, leaf blights, root rots, stalk rots, nematode damage, and ear rots are important because they can lead to yield reductions and quality losses. Mycotoxins that are produced by fungi that infect the kernels may result in feed that is unsafe for consumption by humans or livestock. Although fungicides are often too expensive to use on field corn, future losses can be minimized by implementing sound disease management practices and utilizing approved fungicides at the proper time when warranted by the presence of disease. Efficient management practices integrate the use of resistant varieties and cultural practices.

SEED ROTS AND SEEDLING BLIGHTS

As the seed germinates and seedlings develop, corn is susceptible to rot and disease that may kill the young plant or leave it stunted and nonproductive. Seed rot and seedling blight are caused by fungal pathogens, some of which may be present on the seed even before it is planted. Once these fungal pathogens infect the seed or seedling, decay, lesions, stunting, and chlorosis are likely to occur. Common seedling pathogens include species of *Pythium*, *Fusarium*, *Penicillium*, and *Rhizoctonia*. An important tactic to control seed rot and seedling blight is to plant only high quality seed that has been treated with a labeled fungicide. Poor quality seed, such as that produced under drought conditions or which has mechanical damage, is more likely to be susceptible to these problems. Poor seed is likely to produce seedlings with less vigor and greater fungal infection than healthy, undamaged seed. Additional steps to protect against seedling blight include rotation with non-grass crops, planting in warm soils that promote rapid germination and seedling growth, and the avoidance of deep planting. Also, it is important to bury crop residues that act as a nutrition source and that allow pathogens to survive between crops.

ROOT ROTS

Species of the soilborne fungi *Pythium*, *Rhizoctonia*, and *Fusarium*, that are factors in seedling blights, can also cause root rot in corn. Root rot results from the interaction of a complex of soilborne fungi, bacteria, nematodes, and root feeding insects and thus may require use of integrated pest management. Symptoms of root rot include visible lesions, discoloration and degradation of the root system, cankers on the adventitious crown and brace roots of large plants, and yellowing and stunting of the whole plant. The severity of root rot can be reduced by improving drainage in a field, rotation with non-host crops, good weed control, and control of parasitic nematodes.

STALK ROT

The stalk rot-lodging complex is the most costly corn disease in Georgia. This disease is caused by several different fungal pathogens as well as a bacterial pathogen. "Stalk rot" describes such maladies as stalk breakage, stalk lodging, and premature death of the plant. In the

most general sense, this rot is an internal decay of the pith tissue of the stalk, though plants with rotted stalks often have root rot as well. Losses result from poor grain fill associated with premature plant death, difficulty in the mechanical harvest of lodged plants, and rot that occurs when ears come in contact with the soil.

The incidence and severity of stalk rot is related to fertility and growing conditions during the season. If conditions are favorable for growth early in the season, corn plants will produce a large number of kernels. These kernels later become a sink for the carbohydrates produced through photosynthesis. If a plant is unable to produce all of the carbohydrates needed for optimal health and development because of environmental stresses or poor fertility, the grain sink (ear) has priority over other tissues. Without adequate carbohydrates, cells in the root and lower stem senesce and are more easily colonized by opportunistic stalk-rotting organisms.

Stalk rots are differentiated based upon the pathogen and symptoms that are associated with the disease. Fungal pathogens cause Gibberella, Diplodia, Anthracnose, Fusarium, and Pythium stalk rots and Charcoal rot. General symptoms of fungal stalk rot include wilt and disintegration of internal pith tissue. Bacterial stalk rot is caused by *Erwinia chrysanthemi* pv. *zeae*. Bacterial stalk rot is easily identified by plants that suddenly lodge in midseason with one to several internodes above the soil line dark brown, water soaked, soft or slimy, with a foul odor.

Although no direct controls are available, losses can be reduced by (1) planting early and harvesting before lodging occurs, (2) planting good-standing hybrids, (3) maintaining a balanced fertility level, (4) avoiding extremely high plant populations, and (5) preventing moisture stress. A balanced and continuous supply of nitrogen is needed throughout the season to maintain the health of the pith tissue. Adequate potassium is needed to maintain normal photosynthesis and the cell walls of pith tissue. High plant populations have been associated with an increase in the severity of stalk rot.

FOLIAR DISEASE MANAGEMENT

Foliar diseases are common in Georgia and include southern and northern corn leaf blights, brown spot, common rust, southern rust and bacterial leaf blight. Grey leaf spot occurs occasionally in northern Georgia. Bacterial leaf blight is observed frequently in southern Georgia during rainy periods in mid-season. The other foliar diseases are caused by fungi and typically develop in late-season.

Most corn hybrids have tolerance or resistance to leaf blights and rusts under normal conditions. Leaf diseases that occur late in the growing season are usually avoided by early planting. Many of the fungal pathogens that cause foliar diseases in corn survive between crops on debris from the previous crop. For better disease control, this debris should be buried and the field rotated with a non-host crop. Leaf diseases should not cause widespread losses unless unique factors, such as the development of a new race of a virulent pathogen, occur. Such was the case in 1970 when a new race of *Bipolaris maydis* caused severe outbreaks of southern corn leaf blight.

COMMON SMUT

Common smut, caused by the fungus *Ustilago maydis*, is perhaps the most visually dramatic disease to affect field corn in Georgia. As its name implies, this disease is abundant around the state, though it rarely causes severe losses. The disease is recognized by the large, dark, tumor-like galls that form on the ears, leaves, stalks, and tassels that fill with fungal spores. Common smut has been found to be most severe when corn is planted next to wheat fields and when stink bugs have moved from wheat fields into corn. The primary management tactic is to plant varieties which have resistance to this disease.

NEMATODES

Nematode damage to corn can be reduced by (1) rotating with crops not susceptible to nematodes that damage corn, (2) using cultural practices which reduce plant stress, (3) subsoiling under-the-row to promote root growth, and (4) using nematicides in fields diagnosed by field observation and/or soil sample assay to have nematode populations that cannot be controlled well enough by other recommended practices. Problem nematodes in corn include sting, stubby roots and root knot.

VIRAL DISEASES

Viral diseases that affect corn in Georgia include maize dwarf mosaic virus (MDMV) and maize chlorotic dwarf virus (MCDV). Symptoms of MDMV include leaf mottling and stunting. Symptoms of MCDV include severely stunted plants, chlorotic striping in the young leaves, and infected leaves that turn red or yellow. These diseases are usually more prevalent in areas of northern Georgia that are infested with Johnsongrass, which is a host for the viruses. Maize dwarf mosaic virus is transmitted to corn from infected Johnsongrass by aphids; maize chlorotic dwarf virus is vectored by leaf hoppers.

Prevention is the best means of virus disease control. Eradicating Johnson grass from the field and adjacent areas, planting adapted, virus-resistant hybrids, and planting early aid in reducing the occurrence of virus diseases in corn.

EAR AND KERNEL ROTS and MYCOTOXIN PRODUCTION

Many different types of fungi attack corn kernels and may cause losses in yield and grain quality; however species of *Aspergillus*, *Fusarium*, and *Penicillium* produce toxins (mycotoxins) that make corn unsafe for animal or human consumption. Mycotoxins are a normal byproduct of the growth and development of these fungi. Toxins may be produced by the fungi while the crop is in the field or after harvest and during storage. The presence of mycotoxins in the field is related to environmental conditions and other factors, such as damage caused by birds and insects. Insects that invade and damage the ear of corn carry the spores of fungi such as *Aspergillus* and *Fusarium* from the environment into the ear of corn, or create wounds that are readily colonized by these fungi. Also, spores from these fungi may be deposited on the silks and grow down the silk tissue to infect the kernels. Infected kernels are often easily identified

because of the fungal growth that is associated with them. For example, kernels infected with *Aspergillus* may show masses of yellow and green spores while those infected with *Fusarium* have whitish-pink-red growth on the kernels. Mycotoxin contamination in storage results from improper drying or storage conditions that support the growth of the fungi. To help prevent the formation of mycotoxins, corn must be dry and free of insects and air movement regulated to avoid the accumulation of moisture.

Consumption of mycotoxins by animals can lead to feed refusal, reduced weight gain, liver tumors, kidney necrosis, and increased susceptibility to other diseases. Feed samples must be analyzed in the laboratory to insure that levels of mycotoxins are below levels approved to be safe by the Food and Drug Administration. Aflatoxins, produced by two species of *Aspergillus*, are probably the most important mycotoxins found in corn from Georgia. Toxin production is favored by (1) drought and temperature stress of the plants in the field, (2) nitrogen deficiency, (3) insect damage to ears, (4) physical damage during harvest, (5) inadequate drying before storage, (6) holding wet corn on trailers too long without adequate cooling and ventilation before drying, (7) moisture build-up in bins during storage, (8) insect damage in storage and (9) poor sanitation. Avoiding these situations will help reduce the risk of mycotoxin contaminated corn. Corn varieties with adequate husk cover over the kernels will be less damaged by insects such as weevils, worms, and thrips, and thus less likely to be contaminated by aflatoxin. Corn is most susceptible to contamination by aflatoxins during periods of sustained drought, water stress, and high temperature. Contamination can be reduced using irrigation and minimizing fertilizer stress.

GENERAL DISEASE MANAGEMENT

1. Plant seed treated with a fungicide to reduce seed rots.
2. Rotate to non-cereal crops to prevent a build-up of certain disease organisms, including fungi, bacteria and nematodes.
3. Plant hybrids that are resistant to problem diseases.
4. Plant early to help reduce stalk and ear rot problems. (Field molding and aflatoxin contamination also appear to be worse on later plantings where insect damage is usually greater).
5. Destroy old crop residues to help reduce problems from disease organisms that overwinter in crop residue.
6. Follow good fertilization practices, include starter fertilizers, and a good liming program to promote vigorous seedling growth (Healthy plants are less susceptible to many diseases.)
7. Subsoil under-the-row to reduce compaction and promote root growth.
8. Use approved fungicides on susceptible hybrids when the disease is present prior to the tassel stage.

SCHEDULING AND MANAGING CORN IRRIGATION

Kerry Harrison and Dewey Lee

Irrigation requires a relatively high investment in equipment, fuel, maintenance and labor, but offers a significant potential for increasing net farm income. Frequency and timing of water application have a major impact on yields and operating costs. To schedule irrigation for most efficient use of water and to optimize production, it is desirable to frequently determine the soil water conditions throughout the root zone of the crop being grown. A number of methods for doing this have been developed and used with varying degrees of success. In comparison to investment in irrigation equipment, these scheduling methods are relatively inexpensive. When properly used and coupled with grower experience, a scheduling method can improve the grower's chances of success.

Any plan typically is better than no plan or method at all, particularly with corn. A good plan pays dividends in terms of yield, water-use efficiency and net returns. Growers who take a "wait for the crop to tell me" never get the greatest benefits for their irrigation. In corn, irrigating too late causes yield loss while irrigating too much wastes energy, water, money and can leach nutrients beyond the root zone.

The most simple and practical way of scheduling corn irrigation is to use the moisture balance or check-book method. This helps a grower keep up with an estimated amount of available water in the field as the crop grows. The objective is to maintain a record of incoming and outgoing water so that an adequate balance amount is maintained for crop growth. Growers will need certain basic information to use a check-book method. The soil type of the field, expected daily water use of corn, water holding capacity of the soil and a rain gauge or access to nearby rainfall information are the basic starting point items. An example of a check-method book calculation is presented at the end of Table 16

Check-book type methods can be enhanced with other different tools or methods such as the EASY pan method. The UGA EASY (Evaporation based Accumulator for Sprinkler enhanced Yield) Pan is designed to be easy to operate, economical, and representative of the water used by the crop in humid areas. A couple of the unique operating characteristics is the ability to read the unit from a distance and the fact that no record keeping is required. This makes the Easy Pan a simple tool for scheduling irrigation. The float based mechanism is designed to represent both the effective root depth of a crop and the soil water holding capacity. The covering screen on the pan unit is designed to limit evaporation to a level similar to the evapotranspiration rate (water use) of a crop.

Also expert systems such as Irrigator Pro (software by USDA), or other scheduling software are available to help you make decisions regarding when to irrigate. Soil moisture measuring devices such as Echo[®] and Watermark[®] can be used in conjunction with corn growth curves to enhance irrigation scheduling as well. These devices provide instant readings of either soil moisture content or tension in the root zone and can identify exactly when water is needed to replenish the root zone.

Tables 16 and 17 are provided to help you determine when to schedule irrigation by the check book method. The expected daily water use of corn is shown in Table 16. This table also provides growth stage, days after planting and estimated water use in inches per day for hybrids with a relative maturity of 115-119 days. Table 17 provides examples of available water holding capacities of soils in Georgia.

Table 16. Estimated Water Use of Corn in Georgia

Growth Stage	Days After Planting	Inches Per Day
Emergence and primary root developing.	0-7	.03
	8-12	.05
Two leaves expanded and nodal roots forming.	13-17	.07
	18-22	.09
Four to six leaves expanding. Growing point near surface. Other leaves and roots developing.	23-27	.12
	28-32	.14
	33-36	.17
Six to eight leaves. Tassel developing. Growing point above ground.	37-41	.19
	42-45	.21
Ten to twelve leaves expanded. Bottom 2-3 leaves lost. Stalks growing rapidly. Ear shoots developing. Potential kernel row number determined.	46-50	.23
	51-54	.25
Twelve to sixteen leaves. Kernels per row and size of ear determined. Tassel not visible but about full size. Top two ear shoots developing rapidly.	55-59	.27
	60-64	.29
Tassel emerging, ear shoots elongating.	65-69	.31
Pollination and silks emerging.	70-74	.32
	75-79	.33
Blister stage.	80-84	.33
Milk stage, rapid starch accumulation.	85-89	.34
Early dough stage, kernels rapidly increasing in weight.	90-94	.34
Dough stage.	95-99	.33
Early dent.	100-104	.30
Dent.	105-109	.27
Beginning black layer.	110-114	.24
Black layer (physiological maturity).	115-119	.21

The following example of the water balance or check-book method demonstrates how to determine how much and how frequent to irrigate.

Example:

Step 1. The soil type of the corn field is a Tifton soil series. In Table 17, Look at the average available water capacity in in/ft increments. Assuming a rooting depth of 24 inches, the total available water is 2.2 inches (2 feet x 1.1 in/ft)

Step 2. The corn crop is 65 days old. From Table 16, the daily water use is about .31 inches/day

Step 3. Determine the irrigation by setting a lower limit of available water due to soil tension.

For this example use 50%. In other words, only half of the water in the root zone will be allowed to be depleted. Therefore, 1.1 inches of water will be needed to replace the soil water used or lost.

Step 4. Determine the amount of irrigation to apply by dividing the amount replaced by an irrigation efficiency. Using 75% as the irrigation efficiency, the amount of irrigation to apply is $1.1/.75 = 1.47$ or 1.5 inches.

Step 5. Determine the frequency of irrigation by dividing the amount of water replaced by water use per day. An example of frequency of water (either rainfall or irrigation) need: $1.1 \text{ in} / .31 \text{ in per day} = 3.5 \text{ days}$.

Step 6. It is necessary then to apply 1.5 inches every 3.5 days to maintain 50% available water for corn that is 65 days old.

Table 17. Examples of Available Water Holding Capacities of Soils in the Coastal Plain of Georgia

Soil Series	Description	Intake In/Hr for Bare Soil*	Available Water Holding Capacity In: In/Ft. Increments
Faceville	Sandy Loam, 6-12"	1.0	1.3
Greenville			1.4
Marlboro			1.2 - 1.5
Cahaba	Loamy sand, 6-12"	1.2	1.0 - 1.5
Orangeburg			1.0 - 1.3
Red Bay			1.2 - 1.4
Americus	Loamy Sand , 40 to 60 inches	2.0	1.0
Lakeland			0.8
Troup			0.9 - 1.2
Norfolk	Loamy sand, 12-18" rapid permeability	1.3	1.0 - 1.5
Ochlocknee			1.4 - 1.8
Dothan	Loamy sand and sandy loam 6-12", moderate intake	1.0	1.0 - 1.3
Tifton			0.8 - 1.0
Fuquay			0.6 - 8
Lucy	Rapid permeability in first zone, moderate in second	1.5	1.0
Stilson			0.9
Wagram			0.6 - 0.8

* Increase soil infiltration rate in field where conservation tillage methods are used.

IRRIGATION SCHEDULING

Probably the most important management decision about irrigation scheduling is your yield expectation and water availability. For growers targeting yields of less than 150 bushels per acre or with less than 5 inches of water available, watch for visual signs of stress that occur just prior to tasseling. This will be "leaf curling" that occurs before noon. In this case a thorough application of water (up to 2.5 inches depending on soil type) should be made as tassels begin to emerge and another application made two weeks later. Do not change this timing unless very heavy rainfall occurs. If water is still available a third application of the same amount could be made two weeks after the second application.

In short, if you are targeting a yield of less than 150 bushels per acre or if you have a limited amount of water to apply you should not irrigate until you see "leaf curl" at the tassel stage. At this point apply 2-2.5 inches of water every 14 days (1-1.25 inches back-to-back may be necessary) until you receive a heavy rainfall or run out of water.

Corn growers who are targeting yields of greater than 150 bushels per acre and have adequate amounts of water available may want to consider other methods to schedule irrigation that will help eliminate ALL periods of drought stress. To effectively schedule irrigation, determine soil moisture conditions in the rooting zone frequently and keep a record of your findings. Irrigate whenever soil moisture falls below the desired level. This system allows efficient water use and top yield potential. Make soil moisture determinations daily during peak moisture use periods. During other periods, make readings frequently enough to detect irrigation needs before stress occurs. Usually three times weekly will be often enough for the first 50 to 60 days after planting.

HARVESTING AND DRYING CORN

Paul Sumner

When to Harvest

One general principle applies to all of the available options: the grain should be dried or delivered quickly, preferably within 24 to 48 hours of harvest. Equipment and operations that have worked well when corn was harvested at 22% moisture content may not work so well when the corn is wetter. Combines often have much greater capacity than driers when the corn is very wet. The options available for handling high moisture grain fall into three general categories:

1. ***Dry on the farm.*** - Where adequate drying equipment is available, this option may be chosen. Drying capacity, economics, and convenience are major factors in this decision. Higher moisture contents can substantially reduce drying capacities so that factor should be carefully considered when evaluating the choices.
2. ***Deliver to Elevator or other Buyer.*** - Buyers may or may not be able to handle wet grain. If they accept wet grain their capacity will be limited. The major factor in choosing this

option is usually one of economics although delivery may also be important. Various combinations of price discounts, weight shrinkage and drying charges are used to compensate the buyers for their drying cost and for the weight lost during drying. These discounts and charges will vary from one buyer to another and may change with time. Good decisions cannot be made if current and accurate information about wet grain discounts is not available.

3. **Custom Drying.** - In some places there may be limited access to a custom drying arrangement. This would most likely involve a neighbor who may not have started or has already finished his harvest or a peanut buying point. Costs for such a service would be a drying charge and handling fee. Custom services could be used to boost drying capacity or as a supplement for systems that were not designed to handle high moisture corn.

The length of the harvest period is highly dependent on the size of the operation, combine speed and capacity, efficiency of the harvesting-hauling-handling-drying-storage system, and weather.

Drying

Drying is one of the oldest methods of preserving food and feedstock. It is simply the removal of moisture from a product, usually by forcing dry air through the material.

Air serves two basic functions in grain drying. First, the air supplies the necessary heat for moisture evaporation; second, the air serves as a carrier of the evaporated moisture. The amount of moisture which can be removed from corn depends on the moisture content of the corn, and the drying air relative humidity and temperature.

Air temperature determines to a large extent the total water-carrying capacity of the drying air. Hot air can hold more moisture than cold air. For example, a pound of air at 40°F can hold only 40 grains of moisture (7000 grains = 1 pound) while a pound of 80°F air can hold 155 grains - almost a four fold increase.

Relative humidity also plays an important part in the drying process. Air at 100°F and 50 percent relative humidity can absorb 60 more grains of moisture per pound of air than it can at 75 percent humidity.

When grain is placed in a drier and air is forced through the grain, a drying zone is established at the point where the air enters the facility (Figure 1). The drying zone moves uniformly through the grain in the direction of air flow at a rate depending on the volume, temperature and relative humidity of the air and the moisture content of the grain.

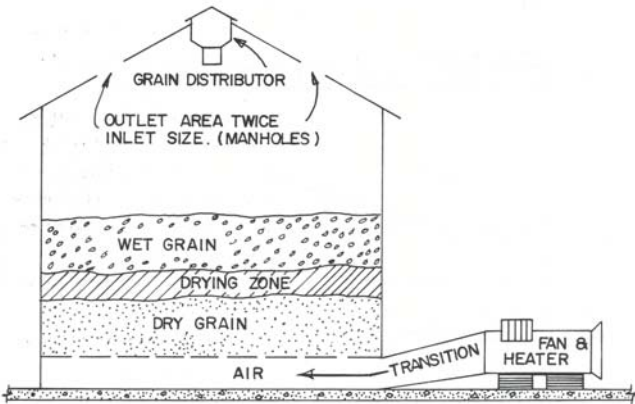


Figure 1. Grain is dried from the point of air entry with the drying front moving in the direction of air flow. The wetter grain occurs where the air leaves the grain layer.

Batch-in-Bin Drying

In this method a two to four foot layer of grain is placed in a drying bin. The layer (batch) is rapidly dried then cooled and removed. A new batch is then placed in the bin and the process repeated. Fan requirements: medium to high (40 CFM/sq. ft. @ 3 inches static pressure). Heat requirements: medium (120 – 140°F.).

Batch Drying

Batch drying involves special drying equipment which holds a relatively thin layer of grain (1-2 feet).

Some models recirculate the grain during drying for uniform moisture removal. Grain is normally dried, cooled and then removed. Fan requirements: very high (50 - 100 CFM/sq. ft.). Heat requirements: medium high (160 - 180°F.).

Continuous Flow Drying

A thin layer of grain ($\frac{2}{3}$ - 1½ ft.) moves continuously through the drier; first through a drying section then through a cooling section. Continuous loading and unloading is required. Fan requirements: very high (75 - 125 CFM/sq. ft.). Heat requirements: very high (180 - 200°F.).

Peanut Wagons (Batch Drying)

Peanut wagons/trailers have been used extensively in Georgia for many years to dry high moisture peanuts. Peanuts have a different density and drying characteristics than grain products. Grain (corn) can be dried in the units. The main difference between drying peanuts and corn is the drying temperatures and resistance to air flow. The drying air temperatures for peanuts should not exceed 95°F. Most peanut dryer thermostats have a set point range between

70 and 140°F. The LP burners used have the capability of increasing air temperature by 50 to 70°F. Therefore maximum drying temperature that could be obtained with an 85°F ambient air temperature is 135 to 155°F. The resistance to air flow is approximately 2.5 to 3 inches static pressure for 2 feet of corn depth compared to peanuts of 0.5 inches static pressure for 4 feet depth of peanuts. Peanut wagons can be 14, 21, 28 or 45 feet in length. The CFM/Bushel of corn ranges from 25-60 CFM/bushel (50-100 CFM/ft²) at a depth of 2 feet.

Suggestions for Drying Corn in Peanut Wagons

- Only fill peanut wagons to a maximum of 2 feet or grain fill line.
- Set thermostat to highest setting - 140°F. (If the burner is capable of a higher temperature rise replace thermostat for a higher range setting – 160-180°F)
- Drying time will depend on air conditions and drying temperature. Figure 2 and 3.

The amount of LP required to dry corn can be estimated by the graph in figures 4 and 5. Graphs 2 and 4 are based on 85°F and 85 percent relative humidity ambient air being forced through the grain at a rate of 50 CFM/ft² of floor area. Graphs 3 and 5 are based on 85°F and 85 percent relative humidity air being forced through the grain at a rate of 100 CFM/ft². When the air flow rate is increased drying time is reduced but fuel usage per bushel will increase because of removing the moisture faster.

Corn dryers range in capacity from a few hundred to several thousand bushels per day. Producers should size their dryer(s) to match daily combine capacity and harvest moisture target levels.

**Drying Corn In Peanut Wagons
85°F, 85% RH, 50 CFM/ft², 30 CFM/Bushel**

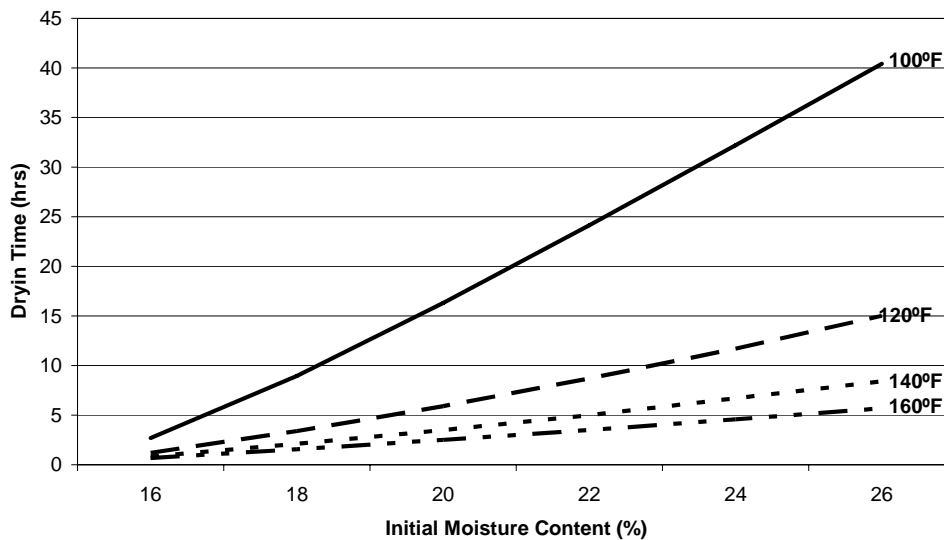


Figure 2. Estimated total drying time for corn with air at 85°F and 85 percent relative humidity, 30 CFM/Bushel, 50 CFM/ft² of floor area.

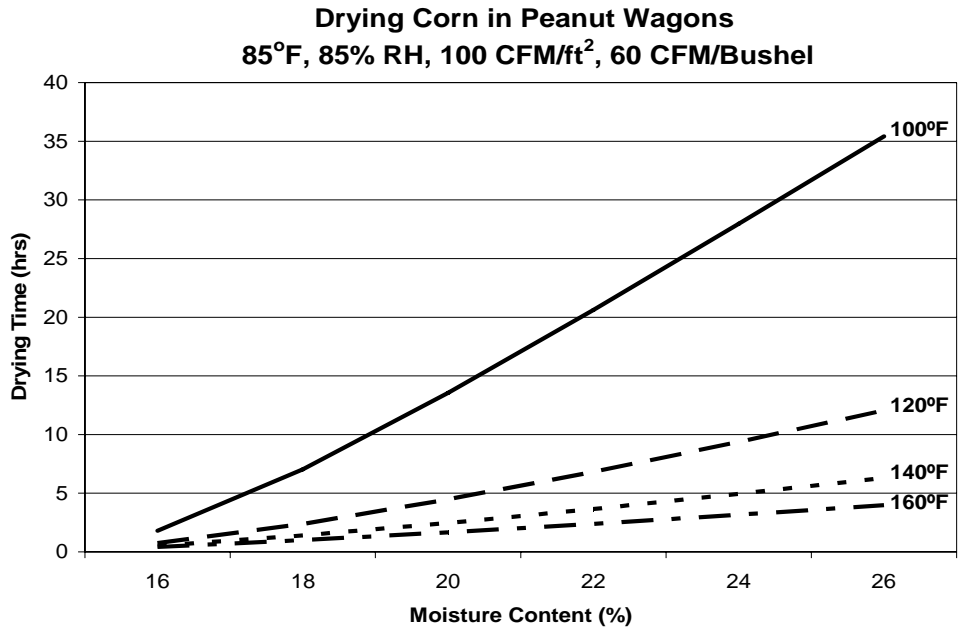


Figure 3. Estimated total drying time for corn with air at 85°F and 85 percent relative humidity, 60 CFM/Bushel, 100 CFM/ft² of floor area.

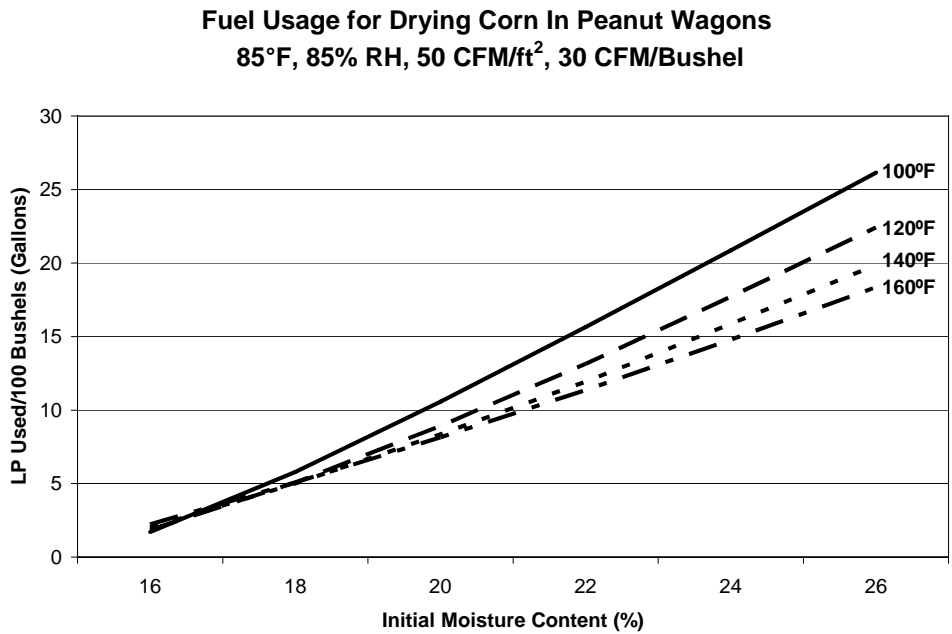


Figure 4. Estimated LP fuel use for corn with air at 85°F and 85 percent relative humidity, 30 CFM/Bushel, 50 CFM/ft² of floor area.

**Fuel Usage for Drying Corn In Peanut Wagons
85°F, 85% RH, 100 CFM/ft², 60 CFM/Bushel**

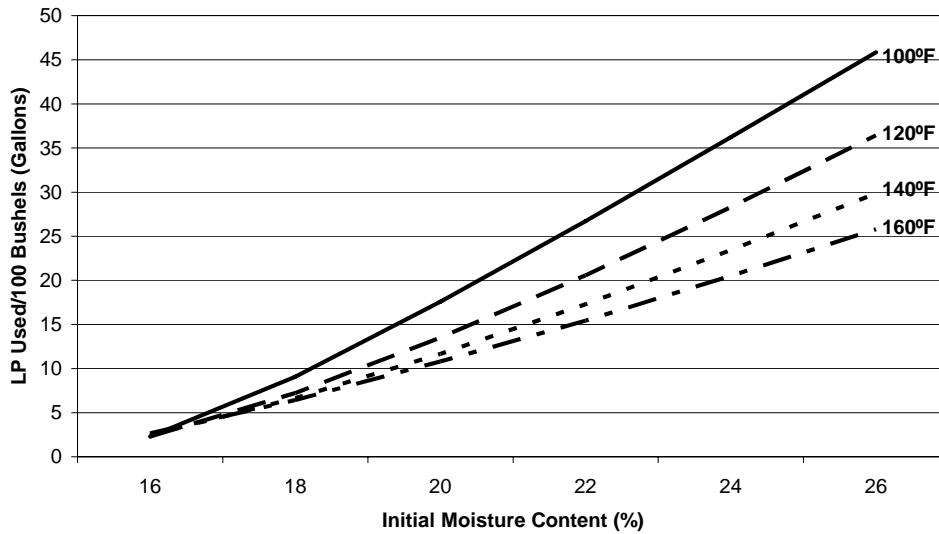


Figure 5. Estimated LP fuel use for corn with air at 85°F and 85 percent relative humidity, 60 CFM/Bushel, 100 CFM/ft² of floor area.

BUDGETING DRYLAND AND IRRIGATED CORN FOR PROFIT

Nathan Smith

Carefully review your budget as you anticipate your cost and adjust each item as they occur during the season to remain knowledgeable of your cost. The following budgets can you plan as you consider marketing opportunities for 2007 and beyond.

**CORN, NON-IRRIGATED
SOUTH GEORGIA, 2007**

ESTIMATED COSTS AND RETURNS

Expected Yield	<u>85</u>	Bushels	YIELD: YOUR FARM			
VARIABLE COSTS	Unit	Number of Units	\$/Unit	Cost/Acre	\$/Bushels	Your Farm
Seed	Thous.	20.00	\$ 1.50	\$ 30.00	\$ 0.35	_____
Lime	Tons	0.25	\$ 28.00	\$ 7.00	\$ 0.08	_____
Fertilizer						
Nitrogen	Lbs	100.00	\$ 0.43	\$ 43.00	\$ 0.51	_____
Phospate (P2O5)	Lbs	40.00	\$ 0.31	\$ 12.40	\$ 0.15	_____
Potash (K2O)	Lbs	60.00	\$ 0.23	\$ 13.80	\$ 0.16	_____
Weed Control	Acre	1.00	\$ 14.50	\$ 14.50	\$ 0.17	_____
Insect Control	Acre	1.00	\$ -	\$ -	\$ -	_____
<i>Machinery: Preharvest</i>						
Fuel	Gallon	3.98	\$ 2.25	\$ 8.95	\$ 0.11	_____
Repairs & Maintenance	Acre	1.00	\$ 6.59	\$ 6.59	\$ 0.08	_____
<i>Machinery: Harvest</i>						
Fuel	Gallon	2.65	\$ 2.25	\$ 5.96	\$ 0.07	_____
Repairs & Maintenance	Acre	1.00	\$ 3.66	\$ 3.66	\$ 0.04	_____
Labor	Hrs	0.93	\$ 10.00	\$ 9.26	\$ 0.11	_____
Crop Insurance	Acre	1.00	\$ 10.10	\$ 10.10	\$ 0.12	_____
Land Rental	Acre	1.00	\$ -	\$ -	\$ -	_____
Interest on Operating capital	Percent	\$ 82.61	8.00%	\$ 6.61	\$ 0.08	_____
Drying - 8 points	Bushel	93.47	\$ 0.28	\$ 26.17	\$ 0.31	_____
Total Variable Costs				\$ 198.01	\$ 2.33	
Fixed Costs:						
<i>Machinery: Depreciation, Taxes, Insurance, and Housing</i>						
Preharvest	Acre	1.00	\$ 17.93	\$ 17.93	\$ 0.21	_____
Harvest	Acre	1.00	\$ 23.66	\$ 23.66	\$ 0.28	_____
General Overhead	% of VC	\$ 198.01	5.00%	\$ 9.90	\$ 0.12	_____
Management	% of VC	\$ 198.01	5.00%	\$ 9.90	\$ 0.12	_____
Owned Land Costs; Taxes, Cash Payment, Etc.	Acre	1.00	\$ -	\$ -	\$ -	_____
Other _____						_____
Total Fixed Costs				\$ 61.40	\$ 0.72	
TOTAL COSTS & PROFIT GOAL						
Total Costs Excluding Land				\$ 259.40	\$ 3.05	
****-YOUR PROFIT GOAL-****				\$ _____/Bu.		
\$-PRICE NEEDED FOR PROFIT-\$				\$ _____/Bu.		

A&AE 1/2007

SENSITIVITY ANALYSIS OF CORN, NON-IRRIGATED

NET RETURNS ABOVE VARIABLE COSTS PER ACRE					
Varying Prices and Yield (Bushels)					
	-25%	-10%	Average	+10%	+25%
	63.75	76.5	85	93.5	106.25
\$3.00	\$ (6.76)	\$ 31.49	\$ 56.99	\$ 82.49	\$ 120.74
\$3.25	\$ 9.18	\$ 50.62	\$ 78.24	\$ 105.87	\$ 147.31
\$3.50	\$ 25.12	\$ 69.74	\$ 99.49	\$ 129.24	\$ 173.87
\$3.75	\$ 41.06	\$ 88.87	\$ 120.74	\$ 152.62	\$ 200.43
\$4.00	\$ 56.99	\$ 107.99	\$ 141.99	\$ 175.99	\$ 226.99

ESTIMATED LABOR AND MACHINERY COSTS PER ACRE OF CORN, NON-IRRIGATED

PREHARVEST OPERATIONS							
Operation	Acres/Hour	Number Times Over	Labor Use (Hr.)	Fuel Use (Gal./Ac)	Machinery Repairs (\$/Ac)	Fixed Costs (\$/Ac)	
Heavy Disk 27' with Tractor (180-199 hp)-MFWD 190	13.214	1.00	0.08	0.74	1.41	4.08	
Disk Harrow 32' with Tractor (180-199 hp)-MFWD 190	16.291	1.00	0.06	0.60	1.08	3.14	
Disk Bed (Hipper) 6R-36 with Tractor (180-199 hp)-MFWD 190	9.600	1.00	0.10	1.02	1.17	3.61	
Plant – Rigid 6R-36 with Tractor (120-139 hp)-2WD 130	9.573	1.00	0.10	0.70	1.25	3.51	
Fert Appl (Liquid) 6R-36 with Tractor (120-139 hp)-2WD 130	9.164	1.00	0.11	0.73	1.44	3.01	
Spray (Band) 60' with Tractor (120-139 hp)-2WD 130	35.455	1.00	0.03	0.19	0.24	0.59	
Total Preharvest Fuel, Repairs, Fixed Costs, and Labor			0.483	\$ 3.98	\$ 6.59	\$ 17.93	

HARVEST OPERATIONS							
Operation	Acres/Hour	Number Times Over	Labor Use (Hr.)	Fuel Use (Gal./Ac)	Machinery Repairs (\$/Ac)	Fixed Costs (\$/Ac)	
Header – Corn 6R 36 with Combine (200-249 hp) 240	6.109	1.000	0.164	2.02	\$ 3.10	\$ 21.32	
Corn Grain Cart 8R36 500 bu with Tractor (120-139 hp)-2WD 130	10.642	1.000	0.094	0.63	\$ 0.56	\$ 2.34	
Total Harvest Fuel, Repairs, Fixed Costs, and Labor			0.258	\$ 2.65	\$ 3.66	\$ 23.66	

A&AE 1/2007

**CORN, IRRIGATED
SOUTH GEORGIA, 2007**

ESTIMATED COSTS AND RETURNS

Expected Yield	<u>185</u> Bushels		YIELD: YOUR FARM			
Variable Costs:	Unit	Number of Units	\$/Unit	Cost/Acre	\$/Bushels	Your Farm
Seed	Thous.	30.00	\$ 1.40	\$ 42.00	\$ 0.23	_____
Lime	Tons	0.50	\$ 28.00	\$ 14.00	\$ 0.08	_____
<i>Fertilizer</i>						
Nitrogen	Lbs	225.00	\$ 0.43	\$ 96.75	\$ 0.52	_____
Phospate (P2O5)	Lbs	90.00	\$ 0.31	\$ 27.90	\$ 0.15	_____
Potash (K2O)	Lbs	125.00	\$ 0.23	\$ 28.75	\$ 0.16	_____
Weed Control	Acre	1.00	\$ 24.82	\$ 24.82	\$ 0.13	_____
Insect Control	Acre	1.00	\$ 7.00	\$ 7.00	\$ 0.04	_____
<i>Machinery: Preharvest</i>						
Fuel	Gallon	3.98	\$ 2.25	\$ 8.95	\$ 0.05	_____
Repairs & Maintenance	Acre	1.00	\$ 6.59	\$ 6.59	\$ 0.04	_____
<i>Machinery: Harvest</i>						
Fuel	Gallon	2.65	\$ 2.25	\$ 5.96	\$ 0.03	_____
Repairs & Maintenance	Acre	1.00	\$ 3.66	\$ 3.66	\$ 0.02	_____
Irrigation*	Inch	8.00	\$ 10.50	\$ 84.00	\$ 0.45	_____
Labor	Hrs	0.93	\$ 10.00	\$ 9.26	\$ 0.05	_____
Crop Insurance	Acre	1.00	\$ 9.00	\$ 9.00	\$ 0.05	_____
Land Rental	Acre	1.00	\$ -	\$ -	\$ -	_____
Interest on Operating capital	Percent	\$ 184.32	8.00%	\$ 14.75	\$ 0.08	_____
Drying - 8 points	Bushel	203.44	\$ 0.28	\$ 56.96	\$ 0.31	_____
Total Variable Costs				\$ 440.35	\$ 2.38	
Fixed Costs:						
<i>Machinery: Depreciation, Taxes, Insurance, and Housing</i>						
Preharvest	Acre	1.00	\$ 17.93	\$ 17.93	\$ 0.10	_____
Harvest	Acre	1.00	\$ 23.66	\$ 23.66	\$ 0.13	_____
General Overhead	% of VC	\$ 440.35	5.00%	\$ 22.02	\$ 0.12	_____
Management	% of VC	\$ 440.35	5.00%	\$ 22.02	\$ 0.12	_____
Irrigation	Acre	1.00	90.00	\$ 90.00	\$ 0.49	_____
<i>Owned Land Costs; Taxes, Cash Payment, Etc.</i>						
Other _____	Acre	1.00	\$ -	\$ -	\$ -	_____
Total Fixed Costs				\$ 175.63	\$ 0.95	
TOTAL COSTS & PROFIT GOAL						
Total Costs Excluding Land				\$ 615.98	\$ 3.33	
****-YOUR PROFIT GOAL-****				\$ _____/Bu.		
\$-PRICE NEEDED FOR PROFIT-\$				\$ _____/Bu.		

*Irrigation application assumes use of diesel power unit. Electric power unit is estimated to be 60% of the cost of \$2.25 per gal diesel.

SENSITIVITY ANALYSIS OF CORN, IRRIGATED

NET RETURNS ABOVE VARIABLE COSTS PER ACRE					
Varying Prices and Yield (Bushels)					
	-25%	-10%	Average	+10%	+25%
	138.75	166.5	185	203.5	231.25
\$3.00	\$ (24.10)	\$ 59.15	\$ 114.65	\$ 170.15	\$ 253.40
\$3.25	\$ 10.59	\$ 100.77	\$ 160.90	\$ 221.02	\$ 311.21
\$3.50	\$ 45.27	\$ 142.40	\$ 207.15	\$ 271.90	\$ 369.02
\$3.75	\$ 79.96	\$ 184.02	\$ 253.40	\$ 322.77	\$ 426.84
\$4.00	\$ 114.65	\$ 225.65	\$ 299.65	\$ 373.65	\$ 484.65

ESTIMATED LABOR AND MACHINERY COSTS PER ACRE FOR CORN, IRRIGATED

PREHARVEST OPERATIONS						
Operation	Acres/Hour	Number Times Over	Labor Use (Hr.)	Fuel Use (Gal./Ac)	Machinery Repairs (\$/Ac)	Fixed Costs (\$/Ac)
Heavy Disk 27' with Tractor (180-199 hp)-MFWD 190	13.214	1.00	0.08	0.74	1.41	4.08
Disk Harrow 32' with Tractor (180-199 hp)-MFWD 190	16.291	1.00	0.06	0.60	1.08	3.14
Disk Bed (Hipper) 6R-36 with Tractor (180-199 hp)-MFWD 190	9.600	1.00	0.10	1.02	1.17	3.61
Plant – Rigid 6R-36 with Tractor (120-139 hp)-2WD 130	9.573	1.00	0.10	0.70	1.25	3.51
Fert Appl (Liquid) 6R-36 with Tractor (120-139 hp)-2WD 130	9.164	1.00	0.11	0.73	1.44	3.01
Spray (Broadcast) 60' with Tractor (120-139 hp)-2WD 130	35.455	1.00	0.03	0.19	0.24	0.59
Total Preharvest Fuel, Repairs, Fixed Costs, and Labor			0.483	\$ 3.98	\$ 6.59	\$ 17.93

HARVEST OPERATIONS						
Operation	Acres/Hour	Number Times Over	Labor Use (Hr.)	Fuel Use (Gal./Ac)	Machinery Repairs (\$/Ac)	Fixed Costs (\$/Ac)
Header – Corn 6R 36" with Combine (200-249 hp)-240hp	6.109	1.000	0.164	2.022	\$ 3.10	\$ 21.32
Corn Grain Cart 8R36 500 bu with Tractor (120-139 hp)-2WD 130	10.642	1.000	0.094	0.629	\$ 0.56	\$ 2.34
Total Harvest Fuel, Repairs, Fixed Costs, and Labor			0.258	\$ 2.65	\$ 3.66	\$ 23.66

A&AE 1/2007

**CORN, STRIP TILLAGE, NON-IRRIGATED
SOUTH GEORGIA, 2007**

ESTIMATED COSTS AND RETURNS

Expected Yield	<u>85</u>	Bushels	YIELD: YOUR FARM			
Variable Costs:	Unit	Number of Units	\$/Unit	Cost/Acre	\$/Bushels	Your Farm
Seed	Thous.	20.00	\$ 1.50	\$ 30.00	\$ 0.35	_____
Cover Crop Seed	Bushel	5.00	\$ 2.00	\$ 10.00	\$ 0.12	_____
Lime	Tons	0.25	\$ 28.00	\$ 7.00	\$ 0.08	_____
Fertilizer						
Nitrogen	Lbs	100.00	\$ 0.43	\$ 43.00	\$ 0.51	_____
Phospate (P2O5)	Lbs	40.00	\$ 0.31	\$ 12.40	\$ 0.15	_____
Potash (K2O)	Lbs	60.00	\$ 0.23	\$ 13.80	\$ 0.16	_____
Weed Control	Acre	1.00	\$ 14.50	\$ 14.50	\$ 0.17	_____
Insect Control	Acre	1.00	\$ -	\$ -	\$ -	_____
<i>Machinery: Preharvest</i>						
Fuel	Gallon	3.83	\$ 2.25	\$ 8.61	\$ 0.10	_____
Repairs & Maintenance	Acre	1.00	\$ 6.42	\$ 6.42	\$ 0.08	_____
<i>Machinery: Harvest</i>						
Fuel	Gallon	2.65	\$ 2.25	\$ 5.96	\$ 0.07	_____
Repairs & Maintenance	Acre	1.00	\$ 3.69	\$ 3.69	\$ 0.04	_____
Labor	Hrs	0.94	\$ 10.00	\$ 9.36	\$ 0.11	_____
Crop Insurance	Acre	1.00	\$ 10.10	\$ 10.10	\$ 0.12	_____
Land Rental	Acre	1.00	\$ -	\$ -	\$ -	_____
Interest on Operating capital	Percent	\$ 87.42	8.00%	\$ 6.99	\$ 0.08	_____
Drying - 8 points	Bushel	93.47	\$ 0.28	\$ 26.17	\$ 0.31	_____
Total Variable Costs				\$ 208.00	\$ 2.45	
Fixed Costs:						
<i>Machinery: Depreciation, Taxes, Insurance, and Housing</i>						
Preharvest	Acre	1.00	\$ 17.36	\$ 17.36	\$ 0.20	_____
Harvest	Acre	1.00	\$ 23.98	\$ 23.98	\$ 0.28	_____
General Overhead	% of VC	\$ 208.00	5.00%	\$ 10.40	\$ 0.12	_____
Management	% of VC	\$ 208.00	5.00%	\$ 10.40	\$ 0.12	_____
Owned Land Costs; Taxes, Cash Payment, Etc.	Acre	1.00	\$ -	\$ -	\$ -	_____
Other _____	Acre	1.00	\$ -	\$ -	\$ -	_____
Total Fixed Costs				\$ 62.13	\$ 0.73	
TOTAL COSTS & PROFIT GOAL						
Total Costs Excluding Land				\$ 270.14	\$ 3.18	
****-YOUR PROFIT GOAL-****				\$ _____/Bu.		
\$-PRICE NEEDED FOR PROFIT-\$				\$ _____/Bu.		

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SENSITIVITY ANALYSIS OF CORN, STRIP TILLAGE, NON-IRRIGATED

NET RETURNS ABOVE VARIABLE COSTS PER ACRE					
Varying Prices and Yield (Bushels)					
	-25%	-10%	Average	+10%	+25%
	63.75	76.5	85	93.5	106.25
\$3.00	\$ (16.75)	\$ 21.50	\$ 47.00	\$ 72.50	\$ 110.75
\$3.25	\$ (0.82)	\$ 40.62	\$ 68.25	\$ 95.87	\$ 137.31
\$3.50	\$ 15.12	\$ 59.75	\$ 89.50	\$ 119.25	\$ 163.87
\$3.75	\$ 31.06	\$ 78.87	\$ 110.75	\$ 142.62	\$ 190.43
\$4.00	\$ 47.00	\$ 98.00	\$ 132.00	\$ 166.00	\$ 217.00

ESTIMATED LABOR AND MACHINERY COSTS PER ACRE CORN, STRIP TILLAGE, NON-IRRIGATED

PREHARVEST OPERATIONS						
Operation	Acres/Hour	Number Times Over	Labor Use (Hr.)	Fuel Use (Gal./Ac)	Machinery Repairs (\$/Ac)	Fixed Costs (\$/Ac)
Spin Spreader 5 ton with Tractor (120-139 hp)-2WD 130	23.758	1.0	0.04	0.28	0.47	1.34
Disk Harrow 32' with Tractor (180-199 hp)-MFWD 190	16.291	1.0	0.06	0.60	1.08	3.14
Spray (Broadcast) 60' with Tractor (120-139 hp)-2WD 130	35.455	1.0	0.03	0.19	0.24	0.59
Subsoiler low-till 6 shank with Tractor (180-199 hp)-MFWD 190	8.809	1.0	0.11	1.11	1.42	4.46
Plant & Pre Rigid 6R-36 with Tractor (120-139 hp)-2WD 130	9.218	1.0	0.11	0.73	1.52	4.23
Fert Appl (Liquid) 6R-36 with Tractor (120-139 hp)-2WD 130	9.164	1.0	0.11	0.73	1.44	3.01
Spray (Band) 60' with Tractor (120-139 hp)-2WD 130	35.455	1.0	0.03	0.19	0.24	0.59
Total Preharvest Fuel, Repairs, Fixed Costs, and Labor			0.491	\$ 3.83	\$ 6.42	\$ 17.36

HARVEST OPERATIONS						
Operation	Acres/Hour	Number Times Over	Labor Use (Hr.)	Fuel Use (Gal./Ac)	Machinery Repairs (\$/Ac)	Fixed Costs (\$/Ac)
Header – Corn 6R 36 with Combine (200-249 hp) 240	6.109	1.0	0.164	2.02	\$ 3.10	\$ 21.32
Corn Grain Cart 8R36 500 bu with Tractor (120-139 hp)-2WD 130	10.642	1.0	0.094	0.63	\$ 0.59	\$ 2.65
Total Harvest Fuel, Repairs, Fixed Costs, and Labor			0.258	\$ 2.65	\$ 3.69	\$ 23.98

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**CORN, STRIP TILLAGE, IRRIGATED
SOUTH GEORGIA, 2007**

ESTIMATED COSTS AND RETURNS

Expected Yield	<u>185</u>	Bushels	YIELD: YOUR FARM			
Variable Costs:	Unit	Number of Units	\$/Unit	Cost/Acre	\$/Bushels	Your Farm
Seed	Thous.	30.00	\$ 1.40	\$ 42.00	\$ 0.23	_____
Cover Crop Seed	Bushel	5.00	\$ 2.00	\$ 10.00	\$ 0.05	_____
Lime	Tons	0.50	\$ 28.00	\$ 14.00	\$ 0.08	_____
Fertilizer						
Nitrogen	Lbs	225.00	\$ 0.43	\$ 96.75	\$ 0.52	_____
Phospate (P2O5)	Lbs	90.00	\$ 0.31	\$ 27.90	\$ 0.15	_____
Potash (K2O)	Lbs	125.00	\$ 0.23	\$ 28.75	\$ 0.16	_____
Weed Control	Acre	1.00	\$ 24.82	\$ 24.82	\$ 0.13	_____
Insect Control	Acre	1.00	\$ 7.00	\$ 7.00	\$ 0.04	_____
<i>Machinery: Preharvest</i>						
Fuel	Gallon	3.83	\$ 2.25	\$ 8.61	\$ 0.05	_____
Repairs & Maintenance	Acre	1.00	\$ 6.42	\$ 6.42	\$ 0.03	_____
<i>Machinery: Harvest</i>						
Fuel	Gallon	2.65	\$ 2.25	\$ 5.96	\$ 0.03	_____
Repairs & Maintenance	Acre	1.00	\$ 3.66	\$ 3.66	\$ 0.02	_____
Irrigation*	Inch	8.00	\$ 10.50	\$ 84.00	\$ 0.45	_____
Labor	Hrs	0.94	\$ 10.00	\$ 9.36	\$ 0.05	_____
Crop Insurance	Acre	1.00	\$ 9.00	\$ 9.00	\$ 0.05	_____
Land Rental	Acre	1.00	\$ -	\$ -	\$ -	_____
Interest on Operating capital	Percent	\$ 189.11	8.00%	\$ 15.13	\$ 0.08	_____
Drying - 8 points	Bushel	203.44	\$ 0.28	\$ 56.96	\$ 0.31	_____
Total Variable Costs				\$ 450.32	\$ 2.43	
Fixed Costs:						
Machinery: Depreciation, Taxes, Insurance, and Housing						
Preharvest	Acre	1.00	\$ 17.36	\$ 17.36	\$ 0.09	_____
Harvest	Acre	1.00	\$ 23.66	\$ 23.66	\$ 0.13	_____
General Overhead	% of VC	\$ 450.32	5.00%	\$ 22.52	\$ 0.12	_____
Management	% of VC	\$ 450.32	5.00%	\$ 22.52	\$ 0.12	_____
Irrigation	Acre	1.00	90.00	\$ 90.00	\$ 0.49	_____
Owned Land Costs; Taxes, Cash Payment, Etc.	Acre	1.00	\$ -	\$ -	\$ -	_____
Other _____	Acre	1.00	\$ -	\$ -	\$ -	_____
Total Fixed Costs				\$ 176.05	\$ 0.95	
TOTAL COSTS & PROFIT GOAL						
Total Costs Excluding Land				\$ 626.37	\$ 3.39	
****-YOUR PROFIT GOAL-****				\$ _____/Bu.		
\$-PRICE NEEDED FOR PROFIT-\$				\$ _____/Bu.		

*Irrigation application assumes use of diesel power unit. Electric power unit is estimated to be 60% of the cost of \$2.25 per gal diesel.

SENSITIVITY ANALYSIS OF CORN, STRIP TILLAGE, IRRIGATED

NET RETURNS ABOVE VARIABLE COSTS PER ACRE					
Varying Prices and Yield (Bushels)					
	-25%	-10%	Average	+10%	+25%
	138.75	166.5	185	203.5	231.25
\$3.00	\$ (34.07)	\$ 49.18	\$ 104.68	\$ 160.18	\$ 243.43
\$3.25	\$ 0.62	\$ 90.80	\$ 150.93	\$ 211.05	\$ 301.24
\$3.50	\$ 35.30	\$ 132.43	\$ 197.18	\$ 261.93	\$ 359.05
\$3.75	\$ 69.99	\$ 174.05	\$ 243.43	\$ 312.80	\$ 416.87
\$4.00	\$ 104.68	\$ 215.68	\$ 289.68	\$ 363.68	\$ 474.68

ESTIMATED LABOR AND MACHINERY COSTS PER ACRE FOR CORN, STRIP TILLAGE, IRRIGATED

PREHARVEST OPERATIONS						
Operation	Acres/Hour	Number Times Over	Labor Use (Hr.)	Fuel Use (Gal./Ac)	Machinery Repairs (\$/Ac)	Fixed Costs (\$/Ac)
Spin Spreader 5 ton with Tractor (120-139 hp)-2WD 130	23.758	1.0	0.04	0.28	0.47	1.34
Disk Harrow 32' with Tractor (180-199 hp)-MFWD 190	16.291	1.0	0.06	0.60	1.08	3.14
Spray (Broadcast) 60' with Tractor (120-139 hp)-2WD 130	35.455	1.0	0.03	0.19	0.24	0.59
Subsoiler low-till 6 shank with Tractor (180-199 hp)-MFWD 190	8.809	1.0	0.11	1.11	1.42	4.46
Fert Appl (Liquid) 6R-36 with Tractor (120-139 hp)-2WD 130	9.164	1.0	0.11	0.73	1.44	3.01
Plant & Pre Rigid 6R-36 with Tractor (120-139 hp)-2WD 130	9.218	1.0	0.11	0.73	1.52	4.23
Spray (Broadcast) 60' with Tractor (120-139 hp)-2WD 130	35.455	1.0	0.03	0.19	0.24	0.59
Total Preharvest Fuel, Repairs, Fixed Costs, and Labor			0.491	\$ 3.83	\$ 6.42	\$ 17.36

HARVEST OPERATIONS						
Operation	Acres/Hour	Number Times Over	Labor Use (Hr.)	Fuel Use (Gal./Ac)	Machinery Repairs (\$/Ac)	Fixed Costs (\$/Ac)
Header – Corn 6R 36" with Combine (200-249 hp)-240hp	6.109	1.0	0.164	2.022	\$ 3.10	\$ 21.32
Corn Grain Cart 8R36 500 bu with Tractor (120-139 hp)-2WD 130	10.642	1.0	0.094	0.629	\$ 0.56	\$ 2.34
Total Harvest Fuel, Repairs, Fixed Costs, and Labor			0.258	\$ 2.65	\$ 3.66	\$ 23.66

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BT CORN, STRIP TILLAGE, ONE PASS, IRRIGATED

SOUTH GEORGIA, 2007

ESTIMATED COSTS AND RETURNS

Expected Yield	<u>185</u>	Bushels	YIELD: YOUR FARM			
Variable Costs:	Unit	Number of Units	\$/Unit	Cost/Acre	\$/Bushel	Your Farm
Seed	Thous.	30.00	\$ 1.50	\$ 45.00	\$ 0.24	_____
Cover Crop Seed	Bushel	5.00	\$ 2.00	\$ 10.00	\$ 0.05	_____
Lime	Tons	0.50	\$ 28.00	\$ 14.00	\$ 0.08	_____
Fertilizer						
Nitrogen	Lbs	225.00	\$ 0.43	\$ 96.75	\$ 0.52	_____
Phospate (P2O5)	Lbs	90.00	\$ 0.31	\$ 27.90	\$ 0.15	_____
Potash (K2O)	Lbs	125.00	\$ 0.23	\$ 28.75	\$ 0.16	_____
Weed Control	Acre	1.00	\$ 24.82	\$ 24.82	\$ 0.13	_____
Insect Control	Acre	1.00	\$ 7.00	\$ 7.00	\$ 0.04	_____
Disease Control	Acre	1.00	\$ -	\$ -	\$ -	_____
<i>Machinery: Preharvest</i>						
Fuel	Gallon	3.19	\$ 2.25	\$ 7.18	\$ 0.04	_____
Repairs & Maintenance	Acre	1.00	\$ 4.71	\$ 4.71	\$ 0.03	_____
<i>Machinery: Harvest</i>						
Fuel	Gallon	2.65	\$ 2.25	\$ 5.96	\$ 0.03	_____
Repairs & Maintenance	Acre	1.00	\$ 3.66	\$ 3.66	\$ 0.02	_____
Irrigation*	Inch	8.00	\$ 10.50	\$ 84.00	\$ 0.45	_____
Labor	Hrs	0.81	\$ 10.00	\$ 8.12	\$ 0.04	_____
Crop Insurance	Acre	1.00	\$ 9.00	\$ 9.00	\$ 0.05	_____
Land Rental	Acre	1.00	\$ -	\$ -	\$ -	_____
Interest on Operating capital	Percent	\$ 188.43	8.00%	\$ 15.07	\$ 0.08	_____
Drying - 8 points	Bushel	203.44	\$ 0.28	\$ 56.96	\$ 0.31	_____
Total Variable Costs				\$ 448.89	\$ 2.43	_____
Fixed Costs:						
Machinery: Depreciation, Taxes, Insurance and Housing						
Preharvest	Acre	1.00	\$ 12.22	\$ 12.22	\$ 0.07	_____
Harvest	Acre	1.00	\$ 23.66	\$ 23.66	\$ 0.13	_____
General Overhead	% of VC	\$ 448.89	5.00%	\$ 22.44	\$ 0.12	_____
Management	% of VC	\$ 448.89	5.00%	\$ 22.44	\$ 0.12	_____
Irrigation	Acre	1.00	90.00	\$ 90.00	\$ 0.49	_____
Owned Land Costs; Taxes, Cash Payment, Etc.	Acre	1.00	\$ -	\$ -	\$ -	_____
Other _____	Acre	1.00	\$ -	\$ -	\$ -	_____
Total Fixed Costs				\$ 170.77	\$ 0.92	_____
TOTAL COSTS & PROFIT GOAL						
Total Costs Excluding Land				\$ 619.66	\$ 3.35	_____
****-YOUR PROFIT GOAL-****				\$ _____	/Bu.	_____
\$-PRICE NEEDED FOR PROFIT-\$				\$ _____	/Bu.	_____

*Irrigation application assumes use of diesel power unit. Electric power unit is estimated to be 60% of the cost of \$2.25 per gal diesel.

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SENSITIVITY ANALYSIS OF BT CORN, STRIP TILLAGE, ONE PASS, IRRIGATED

NET RETURNS ABOVE VARIABLE COSTS PER ACRE					
Varying Prices and Yield (Bushels)					
	-25%	-10%	Average	+10%	+25%
	138.75	166.5	185	203.5	231.25
\$3.00	\$ (32.64)	\$ 50.61	\$ 106.11	\$ 161.61	\$ 244.86
\$3.25	\$ 2.04	\$ 92.23	\$ 152.36	\$ 212.48	\$ 302.67
\$3.50	\$ 36.73	\$ 133.86	\$ 198.61	\$ 263.36	\$ 360.48
\$3.75	\$ 71.42	\$ 175.48	\$ 244.86	\$ 314.23	\$ 418.29
\$4.00	\$ 106.11	\$ 217.11	\$ 291.11	\$ 365.11	\$ 476.11

ESTIMATED LABOR AND MACHINERY COSTS PER ACRE BT CORN, STRIP TILLAGE, ONE PASS, IRRIGATED

PREHARVEST OPERATIONS							
Operation	Acres/Hour	Number Times Over	Labor Use (Hr.)	Fuel Use (Gal./Ac)	Machinery Repairs (\$/Ac)	Fixed Costs (\$/Ac)	
Spin Spreader 5 ton with Tractor (120-139 hp)-2WD 130	23.758	1.0	0.04	0.28	0.83	2.31	
Harrow40' with Tractor (180-199 hp)-MFWD 190	25.758	1.0	0.04	0.38	0.48	1.28	
Spray (Broadcast) 60' with Tractor (120-139 hp)-2WD 130	35.455	1.0	0.03	0.19	0.22	0.55	
ST Plant-Rigid 6R-36 with Tractor (180-199 hp)-MFWD 190	6.873	1.0	0.15	1.42	1.53	4.53	
Fert Appl (Liquid) 6R-36 with Tractor (120-139 hp)-2WD 130	9.164	1.0	0.11	0.73	1.44	3.01	
Spray (Band) 60' with Tractor (120-139 hp)-2WD 130	35.455	1.0	0.03	0.19	0.22	0.55	
Total Preharvest Fuel, Repairs, Fixed Costs, and Labor			0.392	\$ 3.19	\$ 4.71	\$ 12.22	

HARVEST OPERATIONS							
Operation	Acres/Hour	Number Times Over	Labor Use (Hr.)	Fuel Use (Gal./Ac)	Machinery Repairs (\$/Ac)	Fixed Costs (\$/Ac)	
Header – Corn 6R 36" with Combine (200-249 hp)-240hp	6.109	1.0	0.164	2.022	\$ 3.10	\$ 21.32	
Corn Grain Cart 8R36 500 bu with Tractor (120-139 hp)-2WD 130	10.642	1.0	0.094	0.629	\$ 0.56	\$ 2.34	
Total Harvest Fuel, Repairs, Fixed Costs, and Labor			0.258	\$ 2.65	\$ 3.66	\$ 23.66	

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Scott Angle, Dean and Director