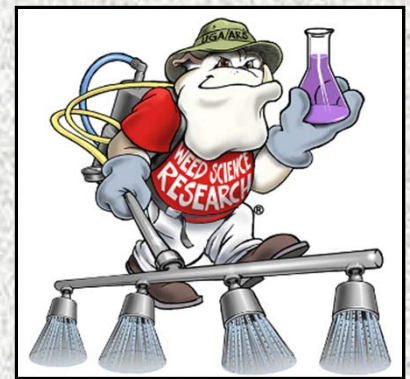


# Pecan Weed Control

2016 Beginner's Pecan Production Course  
April 11, 2016



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University of Georgia



# Herbicides

## PRE Herbicides

- control germinating & emerging
- rainfall for activation
- residual herbicides
- when to apply is always the key

## POST Herbicides

- controls actively growing emerged weeds
- Application timing and weed size are critical

**READ all labels and restrictions**

**Label is the LAW!!!**

**Not registered, do not use it!**



# Mode of Action - Terminology

## Mode of Action (MoA):

- How a particular herbicide acts on a plant
- Response plant to herbicide phytotoxic effects
- To avoid this, need to control these



# Description of MoA

<http://www.wssa.net/Weeds/Resistance/WSSA-Mechanism-of-Action.pdf>

## Summary of Herbicide Mechanism of Action According to the Weed Science Society of America (WSSA)

1

### Acetyl CoA Carboxylase (ACCase) Inhibitors

Aryloxyphenoxypropionate (FOPs) cyclohexanedione (DIMs) and phenylpyrazolin (DENs) herbicides inhibit the enzyme acetyl-CoA carboxylase (ACCase), the enzyme catalyzing the first committed step in *de novo* fatty acid synthesis (Burton 1989; Focke and Lichtenthaler 1987). Inhibition of fatty acid synthesis presumably blocks the production of phospholipids used in building new membranes required for cell growth. Broadleaf species are naturally resistant to cyclohexanedione and aryloxyphenoxy propionate herbicides because of an insensitive ACCase enzyme. Similarly, natural tolerance of some grasses appears to be due to a less sensitive ACCase (Stoltenberg 1989). An alternative mechanism of action has been proposed involving destruction of the electrochemical potential of the cell membrane, but the contribution of this hypothesis remains in question.

2

### Acetolactate Synthase (ALS) or Acetohydroxy Acid Synthase (AHAS) Inhibitors

# Why do PRE herbicides work?

Weed species are more susceptible to herbicides as seedlings or even prior to emergence

Often takes lower concentration for control

Continuous control

Extended over time

- Herbicide dependent

- Environment dependent

Need different MoAs



# Residual MoA's in GA pecan

Mode of Action	Chemical Family	Active Ingredient	WSSA Group
<b>Growth regulator inhibitor</b>	Sulfonylureas	Halosulfuron Flazasulfuron Rimsulfuron	<b>2</b>
<b>Photosynthesis inhibition</b>	Dinitroaniline	Pendimethalin	<b>3</b>
<b>Growth regulator inhibitor</b>	Triazines	Simazine	<b>5</b>
<b>Growth regulator inhibitor</b>	Ureas and Amides	Diuron	<b>7</b>
<b>Growth regulator inhibitor</b>	N-phenylphthalimide	Flumioxazin	<b>14</b>
<b>Photosynthesis inhibitor</b>	Alkylazine	Indaziflam	<b>29</b>

# What products for tree rows?

Product	Active Ingredient	WSSA Group
Indea Mission Matrix	Halosulfuron Flazasulfuron Rimsulfuron	2
Prowl, Prowl H2O, & Generics	Pendimethalin	3
Princep & others	Simazine	5
Diuron & others	Diuron	7
Alteau & Tuscany	Flumioxazin	14
Indaziflam	Indaziflam	29

## COMMERCIAL PECAN WEED CONTROL

Wayne Mitchem, Extension Associate, Weed Science  
A. Stanley Culpepper, Extension Agronomist, Weed Science

HERBICIDE	BROADCAST RATE/ACRE		REMARKS AND PRECAUTIONS
	AMOUNT OF FORMULATION	LBS ACTIVE INGREDIENT	
	<b>MoA</b>		<b>PREEMERGENCE</b>
Alin lan 4AS alin 4AS	<b>3</b>	2-6 qt	2-6 Use on non-bearing and bearing trees for control of annual grasses and small seeded broadleaf weeds. Use low rate for short-term control (2-4 months); high rate for long-term control (8-12 months). <b>DO NOT</b> apply to newly transplanted trees until soil has settled and no cracks are present. Apply before annual weeds emerge in the spring or add paraquat, Rely, or glyphosate for control of emerged weeds. Sequential applications may be used so long as total use rate does not exceed 12 qt/A/year and there are 2.5 months between applications.
on mex or Diuron 80DF x or Diuron 4L r brands	<b>7</b>	2-4 lb 1.6-3.2 qt	1.6-3.2 Use for control of annual broadleaf weeds and some annual grasses only under trees established in the orchard at least 3 years. Apply in spring before annual weeds emerge; if weeds are present, then include surfactant to improve contact activity. Make a single band or broadcast application as a directed spray. Use low rate on sandy loam soils. <b>DO NOT</b> use on sand, loamy sand, gravelly soils, or on exposed subsoils. <b>DO NOT</b> use on soils with less than 0.5% organic matter. <b>DO NOT</b> graze treated areas. Add paraquat, glufosinate, or glyphosate for enhanced control of emerged weeds.
zine cep, Simazine 90DF cep, Simazine 4F	<b>5</b>	2.2-4.4 lb 2-4 qt	2-4 Use for control of annual broadleaf weeds and some annual grasses only under trees established for at least 2 years. Provides good control of annual ryegrass. Use low rates on sandy soils. <b>DO NOT</b> apply to gravelly, sand, or loamy sand soils. <b>DO NOT</b> apply when nuts are on the ground. <b>DO NOT</b> graze treated areas. Add paraquat, glufosinate, or glyphosate for control of emerged weeds.
alin lan 4AS alin 4AS	<b>3+7</b>	2-4 qt  +	2-4  + Use for broad spectrum annual grass and broadleaf weed control. Provides good control of annual ryegrass. Paraquat, glufosinate, or glyphosate may be used with this tank mix to enhance control of emerged weeds. See remarks and precautions for each product.
zine cep, Simazine G		2.5-5 lb 2.2-4.4 lb 2-4 qt	2-4
urazon cam 80DF	<b>12+ 7</b>	2.5-5 lb +	2-4 + Use for broad spectrum annual grass and broad leaf weed control only under trees established in the orchard for at least 3 years. Apply in the spring before annual weeds emerge. See remarks and precautions for each product.
on mex 80DF x 4L		2-3.8 lb 1.6-3 qt	1.6-3
dimethalin l H <sub>2</sub> O 4EC		2-6 qt	2-6
l or Pendimethalin 3.3EC	<b>3</b>	2.4-7.3 qt	Control of annual grasses and broadleaf weeds such as pigweeds. Most effective when adequate rainfall or irrigation is received within 7 days after application. <b>DO NOT</b> apply to newly transplanted trees until ground has settled around roots. Sequential applications may be used as long as total use rate does not exceed 6 qt/A and there are 30 days between applications. Prowl H <sub>2</sub> O has a 60 day PHI for pecans; however, other pendimethalin formulations can only be used in non-bearing pecans.



COMMERCIAL PECAN WEED CONTROL

HERBICIDE	BROADCAST RATE/ACRE		REMARKS AND PRECAUTIONS
	AMOUNT OF FORMULATION	LBS ACTIVE INGREDIENT	
	<b>MoA</b>	<b>PREEMERGENCE</b>	
<p>diuron cam 80DF</p>	<b>12</b>	2.5-5 lb	2-4 Use for control of annual grasses, broadleaf weeds, and suppression of some perennials under bearing, non-bearing, or newly set trees. Apply to newly planted trees only after soil has settled around roots, at least 6 months after planting. Avoid contact with roots. Apply in the fall or early spring--fall applications control a broader weed spectrum than spring applications. <b>DO NOT</b> apply when nuts are on the ground at harvest. Use low rate on coarse-textured soils, higher rates on fine-textured soils. Make only 1 application per year. <b>DO NOT</b> graze treated areas. May tank mix with simazine or diuron for broader spectrum weed control. Add paraquat, glufosinate, or glyphosate for control of emerged weeds. <b>DO NOT</b> apply within 60 days of harvest. Sequential applications can be used so long as total use rate does not exceed maximum use rate for soil texture and crop.
<p>rimsulfuron mix 25WG da 25WG in 25WG</p>	<b>2</b>	4 oz	0.063 Provide PRE & POST control of broadleaf and annual grass weeds (see label for weed control POST). For broad spectrum residual control tank mix with diuron, oryzalin, or Prowl H <sub>2</sub> O. Use in orchards established at least 1 year. Rimsulfuron has a 14 day PHI for pecan. Sequential applications may be used so long as there is 30 days between applications and total use rate does not exceed 4 oz/A broadcast basis.
<p>fluroxypyr beau 51WDG any 51 WDG</p>	<b>14</b>	6-12 oz	0.19-0.38 <b>DO NOT</b> apply more than 6 oz/A/application to soils having a sand and/or gravel content > 80%. Tree established less than one year must be shielded with a grow tube or waxed container. <b>DO NOT</b> apply second application within 30 days of initial application. Applications after bud break can only be made with shielded application equipment. Once trees break dormancy apply with paraquat or glufosinate for non-selective postemergence control. Must use shielded application equipment if using in non-dormant pecan trees. Chateau has a 60 day PHI for pecans.
<p>aliflupr n 1.67SE</p>	<b>29</b>	3.5-6.5 oz	0.045-0.085 Use in orchards established 3 years or longer. Sequential applications may be used as long as there are 90 days between applications and total use rate does not exceed 10.3 oz/A/year. Use rate cannot exceed 3.5 fl oz/A/application on soils having less than 1% organic matter. On soils with an organic matter content from 1-3%, no more than 5 fl oz/A can be applied in a single application and the total use rate for the year cannot exceed 8.5 fl oz/A. In order to apply more than 5 fl oz/A in a single application soil organic matter must be >3%. Alion should be tank mixed with glyphosate, glufosinate, or paraquat for non-selective POST weed control. Alion has a 14 day PHI. Do not use on soils having a 20% or greater gravel content.

How do we use all this information?



## Residual PRE rates

### Diuron - 7

– Direx 4 L, Diuron 4 L, Karmex 1.6-3.2 qt/a



### Simazine - 5

– Princep 4 F, Simazine 4 F 2-4 qt

### Pendimethalin - 3

– Prowl H<sub>2</sub>O, EC 2-6 qt



### Norflurazon - 12

– Solicam 80 DF 2.5-5 lbs



### Flumioxazin - 14

– Chateau 51 WDG 6-12 oz



# Residual PRE rates



## Oryzalin - 3

- Surflan 4 AS, Oryzalin 4 AS 2-6 qt

## Indaziflam - 29

- Alion 1.67 SE **3.5 oz**



**POST**



ply  
est t  
road  
1"-

**Grasses – herbicide dependent**

**Grass herbicides – fops & dims: 2"-12"**

**SU herbicides – <4" tall**

# POST Herbicides w PRE activity

## Broadleaf and Sedge Control

### Halosulfuron - 2

– Sandea 75 WDG 0.67-1.3 oz



### Flazasulfuron - 2

– Mission 2.14-2.85 oz



### Rimsulfuron - 2

– Solida 25 WG, Matrix 25 WG,  
Pravin 25 WG 4 oz



# POST only MoA's in GA pecan

Mode of Action	Chemical Family	Active Ingredient	WSSA Group
<b>Photosynthesis inhibitor Herbicides</b>	Multiple	FOP's DIM's	<b>1</b>
<b>Photosynthesis inhibitor</b>	Bipyridylium	Paraquat	<b>22</b>
<b>Photosynthesis inhibitor</b>	Glycine	Glyphosate	<b>9</b>
<b>Photosynthesis inhibitor</b>	Phosphinic acid	Glufosinate	<b>10</b>
<b>Photosynthesis inhibitor</b>	Triazolinone	Carfentrazone	<b>14</b>
<b>Photosynthesis inhibitor</b>	Benzothiadiazinone	Bentazon	<b>6</b>
<b>Photosynthesis inhibitor</b>	Phenoxy	2,4-D	<b>4</b>

# What products for tree rows?

Product	Active Ingredient	WSSA Group
Amoxone Inteon & Generics	Paraquat	22
Ally	Glufosinate	10
Roundup WeatherMax & Generics	Glyphosate	9
Basagran	Bentazon	6
Alfentrazone	Aim	12



# POST only Herbicides – Group 1s

## Annual and Perennial Grass Control

### Fuazifop

– Fusilade DX 2 EC



### Sethoxydim

– Poast 1.5 EC

### Clethodim

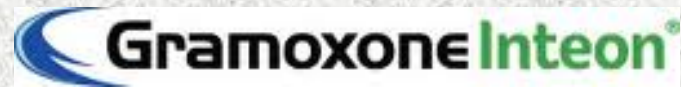
– Select 2 EC, Arrow 2 EC, Intensity 2 EC, Select Max, Intensity One



# POST Herbicides - contact Broad Spectrum Control

## Paraquat - 22

- Firestorm 3 SL, Parazone, Paraquat concentrate, Gramoxone Inteon



## Glufosinate - 10

- Rely 280



## Glyphosate -9

- Roundup Weather Max 5.5 SL, numerous brands

## Glyphosate + carfentrazone

- Rage



# POST Herbicides

## Broadleaf and Sedge Control

**2, 4-D amine - 4**

– Numerous generic formulation



**Bentazon - 6**

– Basagran 4 SL



**Carfentrazone - 14**

– Aim



## For all herbicides

# Know the recommendations

What is the rate of herbicide?

Application timing important?

✓ Time of year to apply?

✓ Late winter/early spring

Mixing instructions?

Rainfall or irrigation?

✓ Bare soil or apply with contact?

- Roundup?
- Rely?
- Gramoxone?



# Rotation of herbicide MoA

## Look for MoA information on labels

**GROUP 2 HERBICIDE**

# Sandaia

**Herbicide**

Sandaia® is a selective herbicide for control of listed broadleaf weeds and nutsedge

**% BY WT.**

Indaziflam (3-chloro-5-(4,6-dimethoxypyrimidin-2-yl)carbamoylsulfamoyl) oxylate	75.0%
Other ingredients	25.0%
<b>TOTAL</b>	<b>100.0%</b>

**KEEP OUT OF REACH OF CHILDREN  
CAUTION**

Si usted no entiende la etiqueta, busque a alguien para que se la explique a usted en detalle.  
(If you do not understand the label, find someone to explain it to you in detail.)

**FIRST AID**

Hold eye open and rinse slowly and gently with water for 15-20 minutes. Remove contact lenses, if present, after 5 minutes, then continue rinsing eye. Call poison control center or physician for treatment advice.

Call poison control center or physician immediately for treatment advice. Have person sip a glass of water if able to swallow. Do not induce vomiting unless told to do so by the poison control center or doctor. Do not give anything to an unconscious person.

**HOT LINE NUMBER**

Refer to label with you when calling poison control center, doctor or going for treatment. For emergency information concerning 1-888-478-0798.

**PRECAUTIONARY STATEMENTS**

**HAZARDS TO HUMANS AND DOMESTIC ANIMALS**  
**CAUTION**

Harmful if swallowed. Avoid contact with eyes or clothing.

**PERSONAL PROTECTIVE EQUIPMENT (PPE)**

Handlers must wear:  
Long sleeves and long pants

Instructions for cleaning/maintaining PPE. If no such instructions for washables, use detergent and hot water. Keep and wash all laundry.

**ADDITIONAL PRECAUTIONARY STATEMENTS:** When handlers use closed systems or enclosed cabs in a manner that meets the requirements listed in the Worker Protection Standard (WPS) for agricultural pesticides [40 CFR 170.240 (d) (4-6)], the handler PPE requirements may be reduced or modified as specified in the WPS.

**USER SAFETY RECOMMENDATIONS**

Do not eat, drink, or use tobacco, or use the toilet. Wash hands immediately if pesticide gets inside. Then wash thoroughly and put on clean clothing.

**ENVIRONMENTAL HAZARDS**

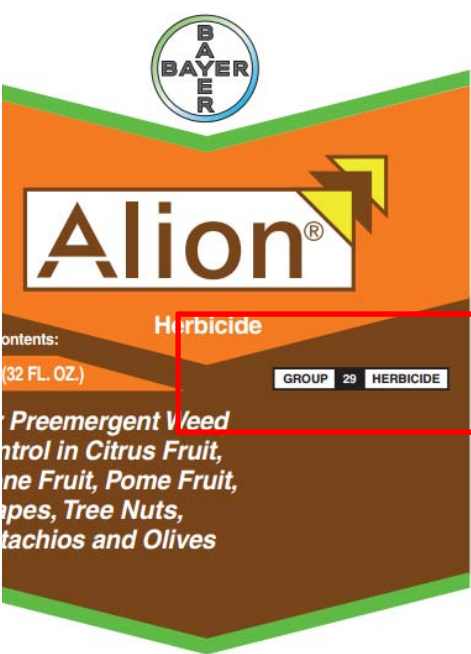
May be harmful to non-target vascular plants. Do not apply directly to water, to areas where surface water is present or to intertidal areas below the low water mark. Do not contaminate water when cleaning equipment or disposing of equipment washwaters.

May leach through soil into ground water under certain conditions as a result of label use. This chemical may leach into ground water where soils are permeable, particularly where the water table is shallow.

**DIRECTIONS FOR USE**

Use this product in a manner inconsistent with its labeling. Do not apply this product in a way that will contact workers or other persons, either directly or through drift. Only protected handlers may be in the area during application. For any requirements specific to your State or local jurisdiction, consult the applicable regulatory agency.

**GROUP 29 HERBICIDE**



**BAYER**

# Alion®

**Herbicide**

Contents: 32 FL. OZ.

**GROUP 29 HERBICIDE**

**Preemergent Weed Control in Citrus Fruit, Pineapple, Tree Nuts, and Olives**

**ACTIVE INGREDIENT:** Indaziflam\* ..... 19.05%  
**OTHER INGREDIENTS:** ..... 80.95%  
**TOTAL:** ..... 100.00%  
Contains 1.67 pounds of indaziflam per gallon.  
\*(CAS No: 730979-19-8)

**EPA Reg. No. 264-1106      EPA Est. No. 264-DEU-001**

**KEEP OUT OF REACH OF CHILDREN  
CAUTION**

*FOR ADDITIONAL PRECAUTIONARY STATEMENTS: See Inside Booklet.*

For **MEDICAL** And **TRANSPORTATION** Emergencies  
**ONLY** Call 24 Hours A Day 1-800-334-7577  
For **PRODUCT USE** Information Call 1-866-99BAYER  
(1-866-992-2937)

Produced for:  
Bayer CropScience LP  
P.O. Box 12014, 2 T.W. Alexander Drive  
Research Triangle Park, North Carolina 27709  
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Product of Germany      US80209568D      130226D 03/13

**FIRST AID**

- Take off contaminated clothing.
- Rinse skin immediately with plenty of water for 15-20 minutes.
- Call a poison control center or doctor for treatment advice.
- Move person to fresh air.
- If person is not breathing, call 911 or an ambulance, then give artificial respiration, preferably mouth-to-mouth if possible.

**ENGINEERING CONTROLS STATEMENTS:**

When handlers use closed systems or enclosed cabs in a manner that meets the requirements listed in the Worker Protection Standard (WPS) for agricultural pesticides [40 CFR 170.240 (d) (4-6)], the handler PPE requirements may be reduced or modified as specified in the WPS.

**USER SAFETY RECOMMENDATIONS:**

Users should wash hands before eating, drinking, chewing gum, using tobacco or using the toilet.

# Options for herbicide rotation?

Herbicides w PRE & POST

Use the SU herbicides

– 2 MoA

Bandera halosulfuron

Matrix rimsulfuron

Mission flazasulfuron

Consult label for

Weeds controlled

Restrictions



# Rotate the MoAs!

agronomic crops – rotate every year

perennial crops – may use same MoA every year

- NOT A GOOD PRACTICE!!!

increased potential for resistance development

do not want the same issues as our agronomic

friends



# Options for herbicide rotation?

**If you use Alion in 2016**

**Consider alternatives in 2017**

**– Tank mixes with Alion**

**Driven by your weed spectrum**

**Prowl H2O & others**

**Diuron/Direx/Karmex**

**Surflan/Oryzalin**

**Consider as many different MoA as possible**

**Both PRE and POST options**





# Resistant Weed Management

Issues – over reliance on 1 MOA

How to avoid

Keep rotating MoA's

tank mixing PRE herbicides

herbicide resistance in GA

Goosegrass

Prickly sida

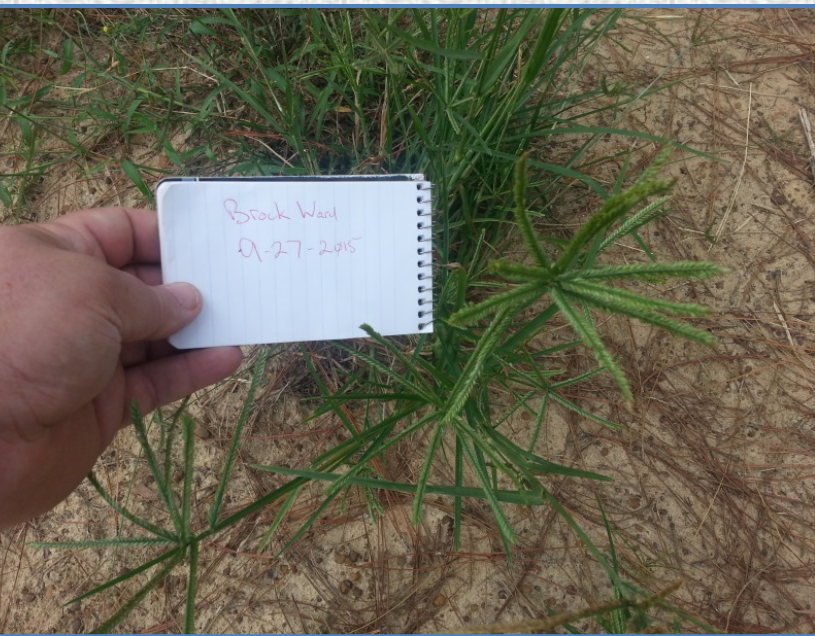
Italian ryegrass

Palmer amaranth

Large crabgrass



# Goosegrass



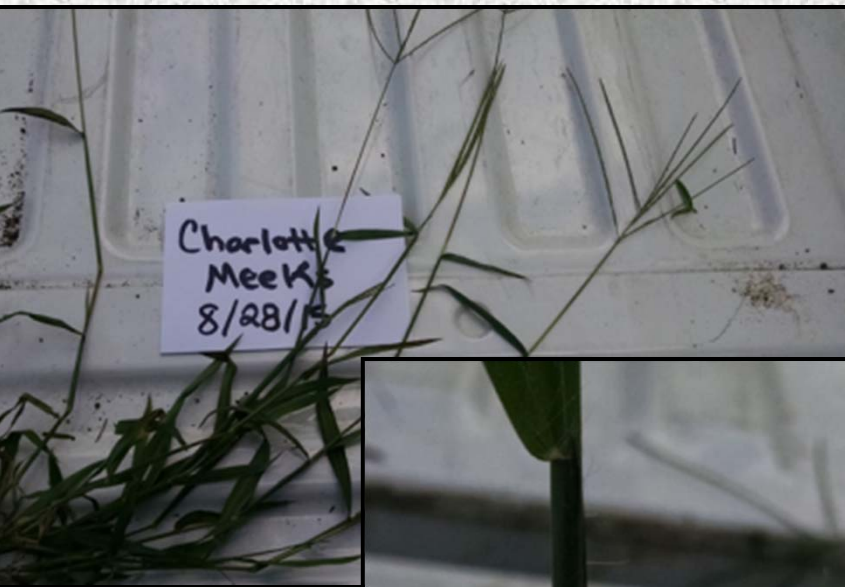
# ida species



**ilian  
grass**



# Large crabgrass



**On the look out  
Wild radish**



# FOR ALL HERBICIDES CONSIDER THE OPTIONS??

**What stage of trees?**

- Newly planted
- Established orchard

**Are trees bearing?**

**Nonbearing?**

**What weeds do I have?**

**How do I control them?**



# Yearly restrictions in new orchards

**Herbicides that can be use in orchards that are at least 1 year old or after soil has settled around roots (6 months)**

**Available only after Year 2**

– simazine

**Available only after Year 3**

– Diuron

– Indaziflam

**See label!!!!!!!**





# Establish Orchard Management

many options available

restrictions

- PHI

- Non-bearing vs. Bearing

- No grazing animals

after some applications



available in Non-bearing trees only

- bentazon (Basagran)

- clethodim (Select)



# Resistant Weed Management

## Causes

## How to avoid

- rotating MoA's
- tank mixing PRE herbicides



## Herbicide resistant Italian ryegrass

- ACCase resistant (grass herbicides)
- Glyphosate resistant
- ALS resistant

## Glyphosate resistant pigweed

# Thank you

**Support - 2016**

**- University of Georgia**

**- Georgia Pecan Commission**

**- Bayer Crop Sciences**

**- Dow Agro**

**- Summit Agro**

**Questions**



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The University of Georgia

