

Pecan Weed Control

2019 Beginner's Pecan Production Course
April 16, 2019



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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!



Mechanism of Action - Terminology

- Mechanism 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

Mechanism of Action	Chemical Family	Active Ingredient	WSSA Group
ALS Inhibitor	Sulfonylureas	Halosulfuron Flazasulfuron Rimsulfuron	2
Microtubule inhibition	Dinitroaniline	Pendimethalin	3
PSII Inhibitor	Triazines	Simazine	5
PSII Inhibitor	Ureas and Amides	Diuron	7
PPO Inhibitor	N-phenylphtlalimide	Flumioxazin	14
Cellulose-biosythesis inhibitor	Alkylazine	Indaziflam	29

What products for tree rows?

Product	Active Ingredient	WSSA Group
Sandea Mission Matrix	Halosulfuron Flazasulfuron Rimsulfuron	2
Prowl, Prowl H2O, & Generics	Pendimethalin	3
Princep & others	Simazine	5
Karmex & others	Diuron	7
Chateau & Tuscany	Flumioxazin	14
Alion	Indaziflam	29
Pindar	Penoxsulam + oxyfluorfen	2 14

COMMERCIAL PECAN WEED CONTROL

Wayne Mitchem, Extension Associate – Weed Science
Timothy Grey, Research Weed Scientist

HERBICIDE	MOA	BROADCAST RATE/ACRE		REI/PHI (Hours or Days)	REMARKS AND PRECAUTIONS
		AMOUNT OF FORMULATION	LBS ACTIVE INGREDIENT		
PRE-EMERGENCE					
<i>oryzalin</i> Surflan 4AS Oryzalin 4AS	3	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). DO NOT apply to newly transplanted trees until soil has settled and no cracks are present. Apply before annual weeds emerge in the spring or add <i>paraquat</i> or <i>glyphosate</i> 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.
<i>diuron</i> Karmex XP or Diuron 80DF Direx or Diuron 4L other brands	7	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, include surfactant to improve contact activity. Make a single band or broadcast application as a directed spray. Use low rate on sandy loam soils. DO NOT use on sand, loamy sand, gravelly soils, or on exposed subsoils. DO NOT use on soils with less than 0.5% organic matter. DO NOT graze treated areas. Add <i>paraquat</i> , <i>glufosinate</i> , or <i>glyphosate</i> for enhanced control of emerged weeds.
<i>simazine</i> Princep, Simazine 90DF Princep, Simazine 4F	5	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. DO NOT apply to gravelly, sand, or loamy sand soils. DO NOT apply when nuts are on the ground. DO NOT graze treated areas. Add <i>paraquat</i> , <i>glufosinate</i> , or <i>glyphosate</i> for control of emerged weeds.
<i>oryzalin</i> Surflan 4AS Oryzalin 4AS + <i>simazine</i> Princep, Simazine 80W 90DG 4L		2-4 qt + 2.5-5 lb 2.2-4.4 lb 2-4 qt	2-4 + 2-4		Use for broad spectrum annual grass and broadleaf weed control. Provides good control of annual ryegrass. <i>Paraquat</i> , <i>glufosinate</i> , or <i>glyphosate</i> may be used with this tank mix to enhance control of emerged weeds. See remarks and precautions for each product.
<i>norflurazon</i> Solicam 80DF + <i>diuron</i> Karmex 80DF Direx 4L		2.5-5 lb + 2-3.8 lb 1.6-3 qt	2-4 + 1.6-3		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.
<i>pendimethalin</i> Prowl H ₂ O 4EC Prowl or Pendimethalin 3.3EC	3	2-6 qt 2.4-7.3 qt	2-6		Control of annual grasses and broadleaf weeds such as pigweed. Most effective when adequate rainfall or irrigation is received within 7 days after application. DO NOT 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 ₂ O has a 60 day PHI for pecans; however, other <i>pendimethalin</i> formulations can only be used in non-bearing pecans.

COMMERCIAL PECAN WEED CONTROL

HERBICIDE	MOA	BROADCAST RATE/ACRE		REI/PHI (Hours or Days)	REMARKS AND PRECAUTIONS
		AMOUNT OF FORMULATION	LBS ACTIVE INGREDIENT		
PRE-EMERGENCE					
<i>norflurazon</i> Solicam 80DF	12	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. DO NOT 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. DO NOT graze treated areas. May tank mix with <i>simazine</i> or <i>diuron</i> for broader spectrum weed control. Add <i>paraquat</i> , <i>glufosinate</i> , or <i>glyphosate</i> for control of emerged weeds. DO NOT 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.
<i>rimsulfuron</i> Matrix 25WG Solida 25WG Pravin 25WG	2	4 oz	0.063		Provide pre- and post- control of broadleaf and annual grass weeds (see label for weed control POST). For broad spectrum residual control tank mix with <i>diuron</i> , <i>oryzalin</i> , or Prowl H ₂ O. Use in orchards established at least 1 year. <i>Rimsulfuron</i> has a 14-day PHI for pecan. Sequential applications may be used so long as there are 30 days between applications and total use rate does not exceed 4 oz/A broadcast basis.
<i>flumioxazin</i> Chateau 51WDG Tuscany 51 WDG Tuscany 4 SC	14	6-12 oz	0.19-0.38		DO NOT apply more than 6 oz/A/application to soils having a sand and/or gravel content > 80%. Trees established less than 1 year must be shielded with a grow tube or waxed container. DO NOT 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 <i>paraquat</i> or <i>glufosinate</i> for non-selective post-emergence control. Must use shielded application equipment if using in non-dormant pecan trees. <i>Flumioxazin</i> has a 60-day PHI for pecans.
<i>indaziflam</i> Alion 1.67SE	29	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 <i>glyphosate</i> , <i>glufosinate</i> , or <i>paraquat</i> for non-selective post-weed control. Alion has a 14-day PHI. Do not use on soils having a 20% or greater gravel content.
POST-EMERGENCE					
<i>2,4-D amine</i> Various generic formulations 3.8SL	4	2-3 pt	1-1.4		DO NOT apply more than twice a year or within 60 days of harvest. Trees must be at least 1 year old. DO NOT allow spray to drift onto or contact foliage, fruit, stems, or trunks of trees. DO NOT apply to bare ground. DO NOT apply on light, sandy soils. Past research has shown concerns of injury when applying <i>2,4-D</i> on sandy soils, immediately before a large rain and during early bud or leaf break. Extreme caution must be taken to avoid off target movement of <i>2,4-D</i> . Certain crops, like cotton and vegetables, can be severely injured by <i>2,4-D</i> drift. Some formulations may limit use rate 2 pt/A. Sequential applications may be used as long as there are at least 30 days between applications. See product label for details.

<i>penoxsulam</i> +	2	2-3 pt	1.0 -	
<i>oxyfluorfen</i> Pindar GT	14		1.50	<p>Apply Pindar GT to pecan trees that have been planted at least 9 months and longer. Use trunk guards to protect plants until adequate mature bark has developed. Can be used as a bearing and non-bearing dormant application. Non-bearing are those trees which will not bear a crop within one year after treatment. Applications can be made beginning after pecan harvest up to emergence of green leaf tissue the following season. For best results, apply prior to weed emergence of broadleaf and grass species. If susceptible weeds are emerged, apply with an approved adjuvant for burndown of existing weeds. Apply to the soil and base of dormant trees. <i>Do not apply over the top of dormant crop plantings.</i> Applying as a tank mix with glyphosate, glufosinate, paraquat, or other approved pecan postemergence herbicides will provide broadspectrum control. See label for use rate restrictions.</p>

COMMERCIAL PECAN WEED CONTROL

HERBICIDE	MOA	BROADCAST RATE/ACRE		REI/PHI (Hours or Days)	REMARKS AND PRECAUTIONS
		AMOUNT OF FORMULATION	LBS ACTIVE INGREDIENT		
POST-EMERGENCE (continued)					
<i>fluzifop</i> Fusilade DX 2EC 2 lb/gal	1	8-24 fl oz	0.125-0.38		Use for control of annual and perennial grasses under bearing or non-bearing trees. Sequential applications will be necessary for control of perennial grass weeds like bermudagrass and johnsongrass. Low spray volumes (10 GPA) generally improve control. Add crop oil concentrate (1 qt/A). Make application to johnsongrass: 12-18" tall; bermudagrass: 3" tall or with 4-8" runners; annual grasses: 2-8" tall. Does not control nutsedge(s). DO NOT apply when harvestable nuts are on the ground. DO NOT graze treated area. DO NOT apply within 30 days of harvest.
<i>sethoxydim</i> Poast 1.5EC 1.5 lb/gal	1	1-2.5 pt	0.3-0.5		Use for control of annual and perennial grasses. Sequential applications will be necessary for control of perennial grass weeds like bermudagrass and johnsongrass. Low spray volumes (10 GPA) generally improve control. Add crop oil concentrate (1 qt/A). Use low rate on annual grasses up to 6" tall; higher rates on larger annual grasses and perennial grasses. Does not control nutsedge. DO NOT harvest within 15 days of application.
<i>clethodim</i> Select 2.0EC	1	6-8 fl oz			Use for control of annual and perennial grasses in NON-BEARING trees that will not be harvested within 1 year of application. Use higher rates and sequential applications for perennial grasses. Add a non-ionic surfactant containing at least 80% ai at a rate of 1 qt/100 gal of spray solution (0.25% v/v). Make application to johnsongrass: 12-18" tall; bermudagrass: 3" tall or with 4-8" runners; annual grasses: 2-8" tall. Does not control nutsedge.
Select Max 1 lb/gal					
Intensity One 1 lb/gal		12-1.6 oz			
<i>halosulfuron</i> Sandea 75WDG	2	0.67-1.33 oz	0.032-0.063		For control of nutsedge, pigweed, radish, and cocklebur. Apply as directed spray under trees established for at least 1 year. Avoid contact of spray with trunk, stem, roots, or tree foliage. May apply up to 2 applications. DO NOT apply within 1 day of harvest. See label for rate restrictions related to soil texture. Tank mix with <i>glyphosate</i> for broad spectrum control.
<i>paraquat</i> Firestorm 3SL Parazone Paraquat Concentrate 3 lb/gal	22	1.75-2.7 pt	0.65-1		Use for broad spectrum, contact control of emerged weeds. Apply as a directed spray in at least 20 gal of water with 1-2 pt surfactant/100 gal of spray mix or 1% crop oil concentrate (1 gal/100 gal spray mix). Apply when annual weeds are succulent and 1-6" tall. DO NOT allow spray drift to contact foliage or green bark of trees since severe damage may occur. DO NOT allow animals to graze on treated areas. May be tank mixed with certain pre-emergence herbicides for effective residual weed control. DO NOT apply when nuts are on the ground.
Gramoxone SL 2 lb/gal		2-4 pt			
<i>glufosinate</i> Cheetah Reckon 280 Rely 280 Lifeline 2.34 lb/gal	10	48 fl oz	0.88-1.5		Use for broad spectrum control of emerged weeds and grasses, both annuals and perennials. Apply as a directed spray in high spray volumes on non-bearing and bearing trees. Possesses contact and limits systemic activity, but does well on wild brambles and perennial grasses. Does not have soil residual activity. DO NOT contact foliage or green bark. <i>Glufosinate</i> formulations are loaded with surfactant therefore NO additional nonionic surfactants or crop oil is needed. The addition of spray graded ammonium sulfate fertilizer at 8-10 lb/100 gal will enhance <i>glufosinate</i> activity.

COMMERCIAL PECAN WEED CONTROL

HERBICIDE	MOA	BROADCAST RATE/ACRE		REI/PHI (Hours or Days)	REMARKS AND PRECAUTIONS
		AMOUNT OF FORMULATION	LBS ACTIVE INGREDIENT		
POST-EMERGENCE (continued)					
<i>glyphosate acid</i> Numerous brands 4SL Roundup Weather Max 5.5SL	9	1-2 qt 11-46 fl oz	1-2		Use for broad spectrum control of emerged weeds, both annuals and perennials. Apply as a directed spray on bearing and non-bearing trees. DO NOT allow spray to contact foliage, suckers, or green bark of trees. Use low rate for control of annual weeds less than 12" tall. Refer to product label for rates to control specific perennial weeds. Repeat applications may be made. Some <i>glyphosate</i> formulations require the addition of an adjuvant. DO NOT allow <i>glyphosate</i> to contact bark or leaves. Try to avoid applications in late summer and fall. Trees are more sensitive to <i>glyphosate</i> during that time. Allow at least 3 days between last application and harvest.
<i>carfentrazone</i> Aim 2 lb/gal		0.5-2 oz	0.008-0.031		Apply alone or tank mix with other herbicides for post-emergence control of broadleaf weeds including pigweed, morningglory, lambsquarters and prickly lettuce. DO NOT allow Aim to contact desirable foliage, flowers, or fruit. DO NOT apply within 3 days of harvest. Trees less than 2 years old must be shielded from direct contact with Aim. Sequential applications may be used as long as total use rate does not exceed 7.9 oz/A/year and there are 14 days between applications. Best results obtained when applied to weeds in the 2-3 leaf stage. Apply in combination with a non-ionic surfactant (1 qt/100 gal of spray solution) or crop oil concentrate (1 gal/100 gal of spray solution).
ROW MIDDLE VEGETATION SUPPRESSION					
<i>glyphosate acid</i> Numerous brands 4SL Roundup Weather Max 5.5 S80 WDGL		2-16 fl oz 1.3-5.85	0.06-0.5 0.06-0.25		Use for vegetative suppression in row middles. Apply 1-2 weeks after full green-up of bahiagrass or bermudagrass, or after grass has been mowed to a uniform height of 3-4". Rates should vary depending on vigor of vegetative growth and canopy of the grove, with the higher rates for more vigorous grass stands where less shade occurs. Low spray volumes (10 GPA) improve control. See respective labels for surfactant requirements. Sequential applications can be made to maintain growth suppression and prepare the orchard floor for mechanical harvest. Allow a minimum of 21 days between the last application and harvest.

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 H₂O, EC 2-6 qt
- **Norflurazon - 12**
 - Solicam 80 DF 2.5-5 lbs
- **Flumioxazin - 14**
 - Chateau 51 WDG 6-12 oz
 - Tuscany 51 WDG 6-12 oz



Residual PRE rates

- **Oryzalin - 3**

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



- **Indaziflam - 29**

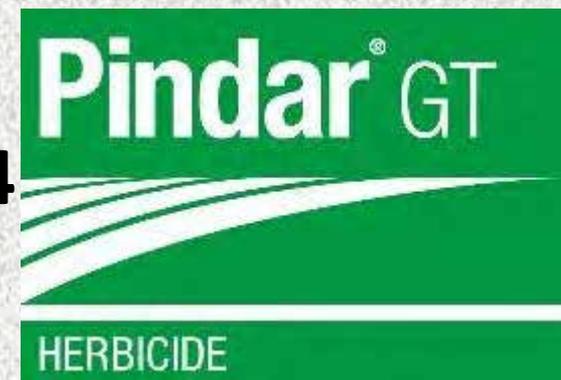
- Alion 1.67 SE **3.5 oz**

- **Can go up to 6.5 oz yr**



- **Oxyfluorfen + Pinoxaden – 2 & 14**

- Pindar GT 2-3 pts/ac



POST



- Apply
- Best t
- Broad
- 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**

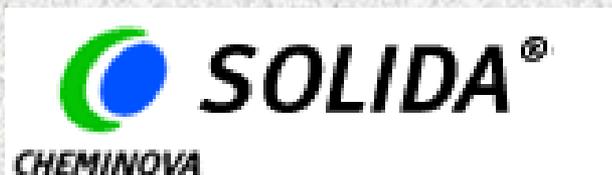
 - Mission 2.14-2.85 oz



- **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
ACCase inhibitor Grass herbicides	Multiple	FOP's DIM's	1
PS I inhibitor	Bipyridylum	Paraquat	22
EPSP synthase	Glycine	Glyphosate	9
Glutamine synthetase	Phosphinic acid	Glufosinate	10
PPO inhibitor	Triazolinone	Carfentrazone	14
Hill reaction inhibitor	Benzothiadiazinone	Bentazon	6
Auxin inhibitor	Phenoxy	2,4-D	4

What products for tree rows?

Product	Active Ingredient	WSSA Group
Gramoxone Inteon & Generics	Paraquat	22
Rely	Glufosinate	10
Roundup WeatherMax & Generics	Glyphosate	9
Basagran	Bentazon	6
Carfentrazone	Aim	12

POST only Herbicides – Group 1s

Annual and Perennial Grass Control

- **Fuazifop**

- Fusilade DX 2 EC



- **Sethoxydim**

- Poast 1.5 EC

- **Clethodim**

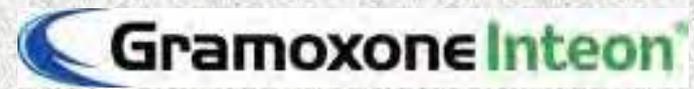
- Select 2 EC, Arrow 2 EC, Intensity 2 EC, Select Max, Intensity One



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**

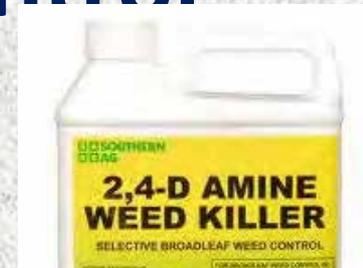
- Rage



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?
- Is 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



Sandaia
Herbicide

GROUP 2 HERBICIDE

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

ACTIVE INGREDIENT:
Halosulfuron-methyl, methyl 3-chloro-5-(4,6-dimethoxy-pyrimidin-2-yl-carbamoyl)sulfamoyl

OTHER INGREDIENTS:
1-methylpyrazole-4-carboxylate

% BY WT.
75.0%
25.0%
TOTAL 100.0%

**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

IF IN EYES	<ul style="list-style-type: none"> 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.
IF SWALLOWED	<ul style="list-style-type: none"> 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
Have the product container or label with you when calling poison control center, doctor or going for treatment. For emergency information concerning this product, call toll free 1-888-478-0798.

**PRECAUTIONARY STATEMENTS
HAZARDS TO HUMANS AND DOMESTIC ANIMALS
CAUTION**
Causes moderate eye irritation. Harmful if swallowed. Avoid contact with eyes or clothing.

PERSONAL PROTECTIVE EQUIPMENT (PPE)
Applicators and other handlers must wear:

- Long-sleeved shirt and long pants
- Shoes plus socks

 Follow manufacturer's instructions for cleaning/maintaining PPE. If no such instructions for washables, use detergent and hot water. Keep and wash PPE separately from other laundry.

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.
- Remove clothing immediately if pesticide gets inside. Then wash thoroughly and put on clean clothing.

ENVIRONMENTAL HAZARDS
This product is toxic to non-target vascular plants. Do not apply directly to water, to areas where surface water is present or to intertidal areas below the mean high water mark. Do not contaminate water when cleaning equipment or disposing of equipment washwaters.

Halosulfuron-methyl is known to leach through soil into ground water under certain conditions as a result of label use. This chemical may leach into ground water if used in areas where soils are permeable, particularly where the water table is shallow.

DIRECTIONS FOR USE
It is a violation of Federal law to 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 Tribe, consult the agency responsible for pesticide regulation.

NET CONTENTS: 10 OUNCES

Gowan
Produced For:
Canyon Group LLC
CFO Gowan Company



Alion
Herbicide

GROUP 25 HERBICIDE

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
ALION is a registered trademark of Bayer.
©2013 Bayer CropScience
Product of Germany US802095680 1302262 03/13

FIRST AID

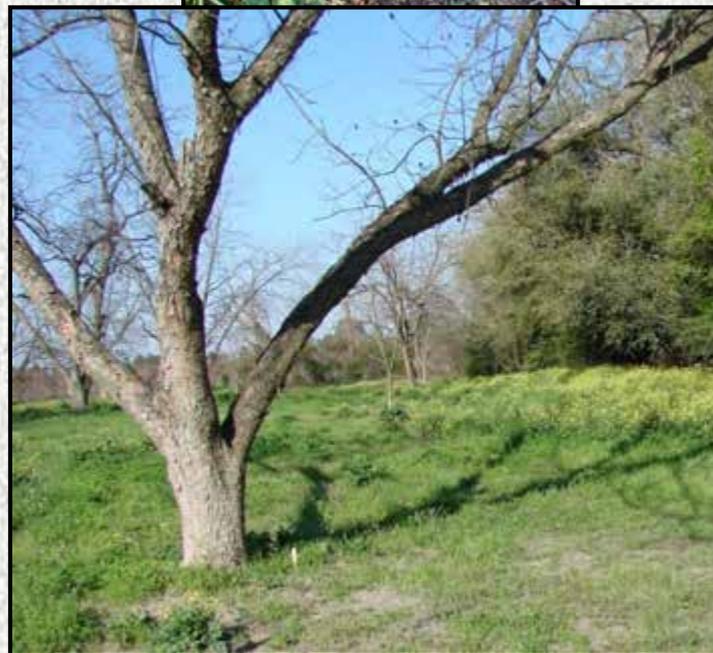
<ul style="list-style-type: none"> Take off contaminated clothing. Rinse skin immediately with plenty of water for 15-20 minutes. Call a poison control center or doctor for treatment advice. Move person to fresh air. If person is not breathing, call 911 or an ambulance, then give artificial respiration, preferably mouth-to-mouth if possible. Call a poison control center or doctor for further treatment advice. Call a poison control center or doctor immediately for treatment.

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USER SAFETY RECOMMENDATIONS:
Users should wash hands before eating, drinking, chewing gum, using tobacco or using the toilet.
Users should remove clothing/PPE immediately if pesticide gets inside. Then wash thoroughly and put on clean clothing.

Options for herbicide rotation?

- **Herbicides w PRE & POST**
- **Use the SU herbicides**
 - 2 MoA
- **Sandea 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 2019
- Consider alternatives in 2020
 - Tank mixes with Alion
- Driven by your weed spectrum
- Prowl H2O, Pindar GT & others
- Diuron/Direx/Karmex
- Surflan/Oryzalin
- Consider as many different MoA as possible
- Both PRE and POST options



Resistant Weed Management

- **Causes – 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



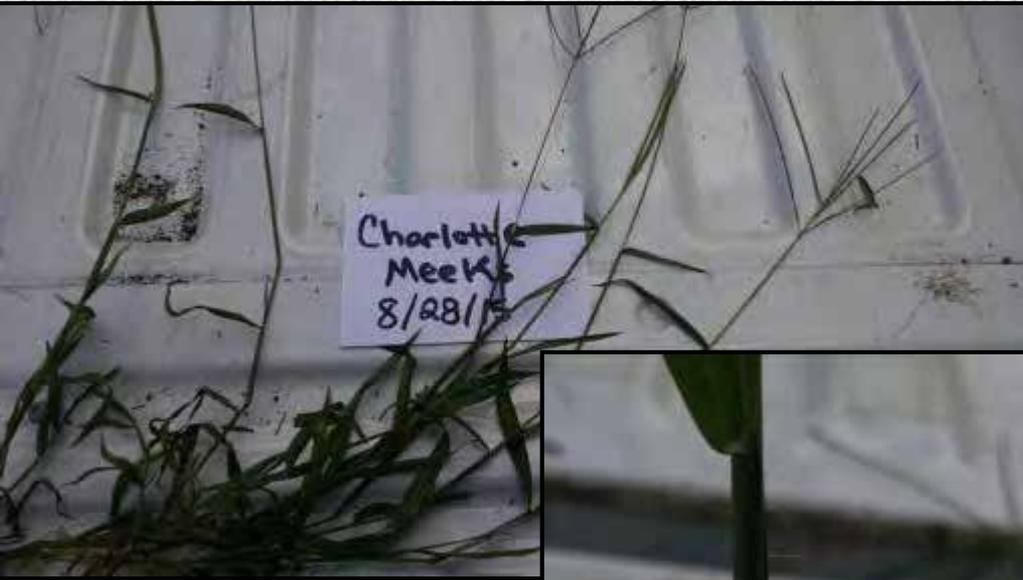
Sida species



Italian ryegrass



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)**
 - Oryzalin
- **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 & ALS resistant pigweed**



Thank you

- **Support**
 - **University of Georgia**
 - **Georgia Pecan Commission**
 - **Bayer Crop Sciences**
 - **Corteva**
- **Questions**

