Weed Management in Cotton
Cotton Herbicide Update

- Several new generics
- Names sometimes confusing
- Pay attention to what you pour in the tank
# Glufosinate brands

<table>
<thead>
<tr>
<th>Brand</th>
<th>Manufacturer</th>
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</thead>
<tbody>
<tr>
<td>Liberty 280</td>
<td>Bayer</td>
</tr>
<tr>
<td>Cheetah</td>
<td>NuFarm</td>
</tr>
<tr>
<td>Forfeit 280</td>
<td>Loveland</td>
</tr>
<tr>
<td>Interline</td>
<td>United Phosphorus</td>
</tr>
<tr>
<td>Refer</td>
<td>Summit Agro</td>
</tr>
<tr>
<td>Surmise</td>
<td>Albaugh</td>
</tr>
</tbody>
</table>

1 All registered for LL cotton. All contain 2.34 lb/gal glufosinate-ammonium.
Cheetah Max (cotton)

- Contains 2 lb/gal glufosinate-ammonium and 1 lb/gal fomesafen
- Primarily focused on soybean market
- 32 to 48 oz PRE on cotton on coarse soil
- Equivalent rates
  - 32 oz equivalent to 1 pt Reflex plus 27 fl oz Liberty; can mix with additional glufosinate

DO NOT APPLY POST OVERTOP COTTON
<table>
<thead>
<tr>
<th>Brand</th>
<th>Manufacturer</th>
<th>Uses in cotton</th>
</tr>
</thead>
</table>
| Reflex$^1$ | Syngenta    | PRE: coarse-textured soils  
Preplant: medium and fine soils  
Layby: any soil |
| Battlestar$^2$ | Albaugh     | PRE: coarse-textured soils  
Preplant: medium and fine soils  
Layby: any soil |
| Dawn$^1$    | Cheminova    | PRE: coarse-textured soils  
Preplant: medium and fine soils  
Layby: any soil |
| Ringside$^1$ | Syngenta    | PRE: coarse-textured soils  
Preplant: medium and fine soils  
Layby: any soil |
| Shafen$^1$  | Sharda USA   | PRE: coarse-textured soils  
Preplant: medium and fine soils  
Layby: any soil |
| Top Gun$^1$ | Loveland     | PRE: coarse-textured soils  
Preplant: medium and fine soils  
Layby: any soil |

$^1$ Contains 2 lb/gal fomesafen.  
$^2$ Contains 1.88 lb/gal fomesafen.
## Flumioxazin brands - WDG

<table>
<thead>
<tr>
<th>Brand</th>
<th>Manufacturer</th>
<th>Uses in cotton</th>
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<tbody>
<tr>
<td>Valor</td>
<td>Valent</td>
<td>Preplant POST-directed</td>
</tr>
<tr>
<td>Outflank</td>
<td>ADAMA (formerly MANA)</td>
<td>Preplant POST-directed</td>
</tr>
<tr>
<td>Panther</td>
<td>NuFarm</td>
<td>Preplant POST-directed</td>
</tr>
<tr>
<td>Rowel</td>
<td>Monsanto</td>
<td>Preplant POST-directed</td>
</tr>
</tbody>
</table>

¹ Contains 51% flumioxazin.
Cotton Herbicide Update

- Panther SC
  - Flowable formulation of flumioxazin; 4 lb/gal
  - 2 fl oz Panther SC = 2 oz of 51% WDG brands
  - Preplant and layby
Cotton Herbicide Update

• Panther D
  – Liquid formulation of flumioxazin + 2,4-D acid
  – 2 pt equivalent to 2 oz WDG flumioxazin + 2.1 pt 2,4-D
  – Preplant only
  – Waiting interval: accumulate 1 inch rate, then wait 30 days
  – **CAUTION:** do not confuse Panther D with either Panther WDG or Panther SC
Cotton Herbicide Update

- **Fierce**
  - Pre-mix of flumioxazin + pyroxasulfone
  - 3 oz/acre; equivalent to 2 oz Valor WDG plus 1.5 oz Zidua
  - Hoods in cotton at least 6 inches tall, no crop contact; layby to cotton 16 inches, contact only bottom 2 inches
  - Use non-ionic surfactant only
  - Can mix with diuron, glufosinate, glyphosate, or MSMA
  - Burndown activity from flumioxazin; residual activity from flumioxazin and pyroxasulfone; excellent residual on Palmer amaranth
Cotton Herbicide Update

• Outlook (dimethenamid-P)
  – Similar chemistry, similar spectrum to Warrant or Dual Magnum
  – Registered for POST application
  – Cotton first true leaf to mid-bloom
  – Limited NC research shows acceptable crop tolerance
  – Can mix with glufosinate or glyphosate
  – Coarse soil 12 fl oz
    Medium soil 14 fl oz
    Fine soil 16 fl oz
  – One application per year
Cotton Herbicide Update

- **Warrant Ultra**
  - Contains encapsulated acetochlor and fomesafen (2.82 + 0.63 lb/gal)
  - Preplant on medium and heavy soils; delay planting at least 21 days
  - PRE on coarse-textured soils
  - 48 to 60 oz/acre (3 to 3.75 pt)
  - Can tank mix with Cotoran or diuron
  - Excellent Palmer amaranth treatment

<table>
<thead>
<tr>
<th>Product rate/A</th>
<th>a.i./acre</th>
<th>Equivalent to</th>
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</thead>
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<tr>
<td>48 fl oz (3 pt)</td>
<td>1.057 lb acetochlor + 0.236 lb fomesafen</td>
<td>2.8 pt Warrant + 15 oz Reflex</td>
</tr>
</tbody>
</table>
Cotton Herbicide Update

• Warrant Ultra
  – Warrant has commonly been applied POST
  – Do NOT confuse Warrant and Warrant Ultra
  – Warrant Ultra applied overtop will result in you looking for soybean seed
Cotton Herbicide Update

• Brake F16
  – Section 18 in 2015
  – Full registration received Feb. 11, 2016
  – Preplant or PRE
  – Pigweed and other small-seeded broadleaves, grasses
  – Good crop tolerance
Horseweed (marestail)
Cotton Burndown Programs for Glyphosate-Resistant Horseweed

Two components of burndown program:

1. Something to kill emerged horseweed*
2. Something to give residual control

Programs:

Glyphosate + Clarity (1/2 pt)** + residual herbicide (Valor)

Glyphosate + 2,4-D (2 pt)** + residual herbicide (Valor)

*Best if applied while weed still in rosette state (top picture)

**Waiting intervals between application and planting.
Wait until April 25 and you have screwed up!
Glyphosate-resistant common ragweed

96 oz Weathermax  Untreated
Controlling Glyphosate-Resistant Common Ragweed in Cotton

1. Residual herbicide Preplant or PRE
   - Cotoran E
   - Direx G
   - Reflex G
   - Valor G

2. POST overtop options limited
   - Liberty E
   - Envoke G
   (must be small, < 2”)

3. Many POST-directed options
   - Caparol + MSMA E
   - Cobra + MSMA E
   - Direx + MSMA E
   - Layby Pro + MSMA E
   - Suprend + MSMA E
   - Cotoran + MSMA GE
   - Valor + MSMA GE
Don’t let up on the Palmer
Longevity of buried Palmer amaranth seed.
Adapted from Sosnoskie et al. 2013, Univ. Georgia

<table>
<thead>
<tr>
<th>Burial depth</th>
<th>% Viability @ 36 mon</th>
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</thead>
<tbody>
<tr>
<td>0.4 inch</td>
<td>9</td>
</tr>
<tr>
<td>1 inch</td>
<td>12</td>
</tr>
<tr>
<td>4 inches</td>
<td>15</td>
</tr>
<tr>
<td>16 inches</td>
<td>22</td>
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</table>

% viable seeds vs Months of burial
What is the impact of this on seedbank?
Don’t let up on the Palmer

Seed from ONE Palmer amaranth plant growing in cotton field; Clayton, NC 2015

1,032,400 seed
Don’t let up on the Palmer

• Residual + 2,4-D or dicamba preplant burndown; “yellow” herbicide PPI if in conventional tillage
• At least two residual active ingredients PRE
• Timely POST; residual in at least one POST
• Residual layby; layby still has a place in resistance management
PPO-Resistant Palmer amaranth

- Been expecting it; looks like it is here
- Definitely in AR, MS, TN; suspect some in NC
- Could be devastating, especially for soybean producers
- Examples of PPO inhibitors: Aim, Blazer, Cobra, Flexstar, Goal, Reflex, Sharpen, Spartan, Valor
- Resistance PRE vs POST?
- In cotton, try to limit to one application per year; always use a PPO in mix with another mode of action
Is it resistant?
You want to let it go to seed?
Wise Use of Liberty

• Always use residual preplant and preemergence herbicides
• Only two Liberty applications per year
• Timely Liberty application; full rate; good coverage; include a residual
• Still a place for layby applications
New Traits for Weed Management in Cotton
New Traits

**Enlist**
- Corn
- Cotton
- Soybean
  - 2,4-D, glyphosate, glufosinate

**Xtend**
- Cotton
- Soybean
  - dicamba, glyphosate, glufosinate
  - dicamba, glyphosate
Dicamba ≠ 2,4-D
Where are we with Enlist and Xtend traits?

<table>
<thead>
<tr>
<th>Trait</th>
<th>Crop</th>
<th>Traits Deregulated</th>
<th>Herbicide Registration</th>
</tr>
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<tbody>
<tr>
<td>Enlist</td>
<td>Corn</td>
<td>September 2014</td>
<td>October 2014*</td>
</tr>
<tr>
<td></td>
<td>Soybean</td>
<td>September 2014</td>
<td>October 2014*</td>
</tr>
<tr>
<td></td>
<td>Cotton</td>
<td>July 2015</td>
<td>Awaiting EPA</td>
</tr>
<tr>
<td>Xtend</td>
<td>Cotton</td>
<td>January 2015</td>
<td>Awaiting EPA</td>
</tr>
<tr>
<td></td>
<td>Soybean</td>
<td>January 2015</td>
<td>Awaiting EPA</td>
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</tbody>
</table>

* Enlist Duo; registered in 15 states (NC not included).
XtendFlex Cotton in 2016:

• Seed are available

• Not sure when there will be a label for dicamba-containing herbicide

• It is **ILLEGAL** to apply any dicamba product not specifically labeled for use on XtendFlex cotton
Cotton Tolerance with New Traits; It’s Good

But, you may see minor injury; the injury appears to be cosmetic
Weed control with the new traits
How do we manage off-target deposition in auxin-tolerant crops?
Impacts of Off-target Deposition

► Reduced yield
  • Rate of exposure
  • Growth stage at exposure
  • Growing conditions at and after exposure
Impacts of Off-target Deposition

► Reduced yield

► Marketability of tobacco, fruits and vegetables
  • Has a tolerance been established? What is residue level vs the established tolerance?
  • Injury may occur with non-detectable residue levels
  • Regardless of residue level, will buyer accept crop? “If we see injury, we don’t want it.”
Sources of Off-Target Deposition

► Vapor drift
► Spray drift
► Sprayer contamination
How to avoid dicamba vapor drift?

- Use only specified formulations; new formulations have very low volatility

- XtendFlex: Roundup Xtend (glyphosate + dicamba DGA salt)

  Xtendimax (dicamba DGA salt)

  Engenia (dicamba BAPMA salt)
dicamba acid

dimethylamine (DMA) salt

diglycolamine (DGA) salt

BAPMA salt
# Current Dicamba Formulations and Volatility

<table>
<thead>
<tr>
<th>Low volatility</th>
<th>High volatility</th>
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</thead>
<tbody>
<tr>
<td><strong>Diglycolamine salt</strong></td>
<td><strong>Dimethylamine salt</strong></td>
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<tr>
<td>Clarity</td>
<td>Banvel</td>
</tr>
<tr>
<td>Clash</td>
<td>Diablo</td>
</tr>
<tr>
<td>Detonate</td>
<td>Dicamba DMA</td>
</tr>
<tr>
<td>Dicamba HD</td>
<td>Rifle</td>
</tr>
<tr>
<td>DiFlexx</td>
<td></td>
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<tr>
<td>Sterling Blue</td>
<td></td>
</tr>
<tr>
<td>Strut</td>
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</table>

**Low volatility**
- Clarity: BASF
- Clash: Nufarm
- Detonate: Tenkoz
- Dicamba HD: Albaugh
- DiFlexx: Bayer
- Sterling Blue: Winfield
- Strut: Loveland

**High volatility**
- Banvel: Arysta
- Diablo: (Nufarm)
- Dicamba DMA: (Albaugh)
- Rifle: Loveland

**None of these products will likely ever be labeled for XtendFlex cotton.**
How to avoid dicamba spray drift?

- Use only nozzles and pressures that produce ultra coarse (UC) or extremely coarse (XC) droplets; basically AI or TTI nozzles.
### AIXR Drop Size Classification

<table>
<thead>
<tr>
<th>AIXR TeeJet® (AIXR)</th>
<th>15</th>
<th>20</th>
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<th>30</th>
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### AI Drop Size Classification

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Nozzles and Droplet Sizes

Dv0.1: 10% of spray volume in droplets less than this number

Dv0.5: 50% of spray volume in droplets less than this number, 50% of volume in droplets larger
Nozzles and Droplet Sizes

Droplets < 105 μm are "driftable fines"

Prefer Dv0.1 at least 200 μm

Example Reference Graph

Dv0.1  Dv0.5
How to avoid dicamba spray drift?

- Use only nozzles and pressures that produce UC or XC droplets; basically AI or TTI nozzles
- Boom height 20 to 24 inches

Photo courtesy of Stanley Culpepper
How to avoid dicamba spray drift?

- Use only nozzles and pressures that produce UC or XC droplets; basically AI or TTI nozzles
- Boom height 20 to 24 inches
- Wind 3 to 10 MPH; remember wind speed and direction changes during the day
- Minimum 10 GPA spray volume
- Max sprayer speed of 15 MPH
- No AMS; greatly increases volatility
- Do NOT spray if sensitive crop is downwind; if you can’t afford to buy the downwind crop, then don’t spray
Roundup Ready® Xtend Crop System

AFTER SPRAYING

**Triple-Rinse Clean-Out is Required**

- Properly and thoroughly clean spray equipment
  - Use triple-rinse method to thoroughly clean entire sprayer system
  - Triple-rinse is the most effective practice to reduce off-target movement from spray contamination of any herbicide
- Sprayer parts can trap herbicide, and additives and surfactants can cling

Slide provided by Monsanto
Excellent resource on cleaning sprayers and other equipment

Published Aug, 2015

>50 pages
Detailed pictures and instructions

XtendFlex Cotton in 2016:

• Seed are available

• Not sure when there will be a label

• It is **ILLEGAL** to apply dicamba until a label is granted