Glyphosate-Resistant Weeds in NC
Glyphosate-Resistant Horseweed

- Initially found in 2003; resistant biotype spread quickly; assume all horseweed in eastern NC is resistant.
- Wind-borne seed; easily moves long distances.
- Problem in no-till. Postemergence options limited. Focus on good burndown program.
Burndown Program for Glyphosate-Resistant Horseweed

Two components of burndown program:

1. Something to kill emerged resistant horseweed
2. Something to give residual control
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
- Glyphosate + 2,4-D (2 pt)** + residual herbicide

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

**Waiting intervals required
   - Clarity: 21 days + rain (cotton)
   - 2,4-D: 30 days (cotton)
Untreated                          Roundup only                          Roundup + Valor

Roundup + Valor + Clarity         Roundup + Valor + 2,4 -D

Edgecombe Co., NC  2008
8 weeks after burndown
Edgecombe Co., 2008
GR Horseweed
Roundup at burndown

Roundup + 2 pt 2,4-D
+ 2 oz Valor
at burndown
Glyphosate-Resistant Palmer Amaranth

- Found in NC in 2005; now common

Glyphosate resistance observed in 49 of 290 fields (17%) sampled in fall of 2005.
Avoid cotton in badly infested fields; rotate out of cotton for a year or more and strive for good control in rotational crop; reduce seed bank
Impact of Crop Rotation and Good Control in Rotational Crop
(whole field in soybean in 2009; all treated alike in 2009)
GR Palmer Amaranth Control in RR Cotton
Southeast US Recommendations

- Avoid cotton in badly infested fields
- Aggressive Preplant and/or PRE herbicide program. Get it PRE or you don’t get it. No salvage POST options in RR cotton.
Weak PRE
Powermax + Dual Magnum POST-1
Powermax POST 2

Strong Pre
Powermax + Dual Magnum POST-1
Powermax POST-2
Hedging Against Lack of Timely Rain on PRE Herbicides: Palmer Amaranth in Cotton

• In conventional tillage, incorporate a yellow herbicide.
• In no-till cotton, put residual with preplant burndown. Paraquat if needed at planting (and usually needed).
<table>
<thead>
<tr>
<th>Preplant</th>
<th>PPI</th>
<th>PRE</th>
</tr>
</thead>
<tbody>
<tr>
<td>no-till</td>
<td>conv. till</td>
<td></td>
</tr>
<tr>
<td>Valor</td>
<td>Treflan</td>
<td>Cotoran</td>
</tr>
<tr>
<td>Diuron</td>
<td>Prowl</td>
<td>Diuron + Staple</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Reflex + Staple</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Reflex + Cotoran</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Reflex + diuron</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Prowl + Reflex</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Prowl + Cotoran</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Prowl + diuron</td>
</tr>
</tbody>
</table>
Palmer amaranth control by PRE herbicides; 40 days*

* Average of 5 locations; 2 in GA, 3 in NC. No other herbicides included.

** Applied same time as the PRE herbicides.
PRE herbicides in Palmer amaranth management system. Four locations, NC.*

* All with glyphosate/Dual Magnum POST -1, glyphosate POST -2, conventional layby.
What happened here?
Avoid cotton in badly infested fields

Aggressive Preplant and/or PRE herbicide program. Get it PRE or you don’t get it. No salvage POST options in RR cotton.

*** Concern over potential PPO resistance ***
# PPO Inhibitor Use in NC Crops

<table>
<thead>
<tr>
<th>Crop</th>
<th>Level of Concern*</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>High</strong></td>
<td><strong>Moderate</strong></td>
</tr>
<tr>
<td>Cotton</td>
<td>Reflex, Valor</td>
</tr>
<tr>
<td>Corn</td>
<td>Fierce (new for 2011)</td>
</tr>
<tr>
<td>Peanut</td>
<td>Blazer, Cobra, Storm, Valor</td>
</tr>
<tr>
<td>Soybean</td>
<td>Authority MTZ, Envive, Fierce, Flexstar, Flexstar GT, Prefix, Reflex, Resource, Storm, Valor, Valor XLT</td>
</tr>
<tr>
<td>Tobacco</td>
<td>Spartan</td>
</tr>
</tbody>
</table>

*Based on likelihood of use, time of use, use patterns.
GR Palmer Amaranth Control in RR Cotton
Southeast US Recommendations

- Avoid cotton in badly infested fields
- Aggressive Preplant and/or PRE herbicide program.

Get it PRE or you don’t get it. No salvage POST options in RR cotton.

Concern over potential PPO resistance. Valor and Reflex are both PPO inhibitors. Ideally, we would limit PPO inhibitors to one application/year, and especially avoid two applications at preplant and PRE.
GROUP 14 HERBICIDE

For control of certain weeds in cotton, dry beans, snap beans, and soybeans

Active Ingredient/Guarantee:
Sodium salt of fomesafen
5-[2-chloro-4-(trifluoromethyl)phenoxy]-N-(methylsulfonyle)-2-nitrobenzamide ........................................... 22.8%

Other Ingredients: .................................................. 77.2%

Total: ........................................................................ 100.0%

Contains 1,2-benzisothiazolin-3-one at 0.02% as a preservative.
Equivalent to 21.7% or 2 pounds per U.S. gallon or 240 grams per liter of fomesafen active ingredient.
Which is better in no-till or strip-till?

Valor preplant followed by a non-Reflex PRE

or

Diuron preplant followed by Reflex PRE
Which is better in no-till or strip-till?

Valor preplant followed by a non-Reflex PRE

or

Diuron preplant followed by Reflex PRE

Best if timely rainfall for activation of PRE not received

Best if PRE activated timely
## Preplant/PRE herbicides for Palmer amaranth in Cotton

<table>
<thead>
<tr>
<th>Preplant no-till</th>
<th>PPI conv. till</th>
<th>PRE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Valor</td>
<td>Treflan</td>
<td>Cotoran</td>
</tr>
<tr>
<td>Diuron</td>
<td>Prowl</td>
<td>Diuron</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Reflex</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Staple</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Prowl</td>
</tr>
</tbody>
</table>

- **Preplant no-till**
  - Valor
  - Treflan
  - Prowl

- **PPI conv. till**
  - Cotoran
  - Diuron
  - Reflex
  - Staple
  - Prowl

- **PRE**
  - Cotoran + Staple
  - Diuron + Staple
  - Reflex + Staple
  - Reflex + Cotoran
  - Reflex + diuron
  - Reflex + Prowl
  - Prowl + Cotoran
  - Prowl + diuron
Avoid cotton in badly infested fields

Aggressive Preplant and/or PRE herbicide program

Dual Magnum or Warrant early POST

Residual lay-by

Goal is to have overlapping residuals
Overlapping Residuals

Preplant  Preemergence  Residual POST  Residual Lay-by
What is Warrant?

• Encapsulated acetochlor (MON 63410 last year)
• Chemistry similar to alachlor and metolachlor
• Registered POST on
  cotton – emergence to first bloom
  corn – emergence to 30 inches
  soybean – emergence to R2
  \[\text{applications per year}\]
• Residual control only (primarily pigweed and grasses)
• Cotton tolerance at least as good as Dual Magnum
• Weed control similar to Dual Magnum
# 2011 Cotton Performance Plus Program

<table>
<thead>
<tr>
<th>Program Elements</th>
<th>Base Program (per acre)*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Valor® or Reflex®</td>
<td>$4</td>
</tr>
<tr>
<td>Cotoran®, Cotton Pro®, Caparol®, or Diuron 4L</td>
<td>$3 (2 applications)</td>
</tr>
<tr>
<td>Warrant™ Herbicide or Dual Magnum®</td>
<td>$4.50 or $3 (2 applications)</td>
</tr>
<tr>
<td>Gramoxone Inteon®</td>
<td>$1</td>
</tr>
</tbody>
</table>

Total Refund Available: $20

*Based upon published seed drop rates.

**Get Up to $20 Back Per Acre!**
Metolachlor ain’t s-Metolachlor
Know What You Are Buying

<table>
<thead>
<tr>
<th>Metolachlor</th>
<th>S-metolachlor</th>
</tr>
</thead>
<tbody>
<tr>
<td>Me-Too-Lachlor</td>
<td>Brawl</td>
</tr>
<tr>
<td>Parallel</td>
<td>Dual Magnum</td>
</tr>
<tr>
<td>Stalwart</td>
<td>Medal</td>
</tr>
</tbody>
</table>

1.5 pt = 1.0 pt

![Graph showing Palmer amaranth control with residual herbicides](image-url)

Days after PRE application

% control

- 1 pt Dual Mag
- 1 pt generic
### Residual lay-by options for cotton*

<table>
<thead>
<tr>
<th>Caparol</th>
<th>Diuron</th>
</tr>
</thead>
<tbody>
<tr>
<td>Suprend</td>
<td>Reflex**</td>
</tr>
<tr>
<td>Layby Pro</td>
<td>Valor***</td>
</tr>
<tr>
<td>Cotoran</td>
<td></td>
</tr>
</tbody>
</table>

* Follow height restrictions and rotational restrictions. Mix with MSMA or glyphosate.

** Max of 1.5 pt/year from all applications.

*** Max of 2 oz/year from all applications.
## Programs for Glyphosate-Resistant Palmer Amaranth in Roundup Ready Cotton – Coastal Plain

<table>
<thead>
<tr>
<th>Preplant Burndown&lt;sup&gt;1&lt;/sup&gt;</th>
<th>Preemergence</th>
<th>POST 1 (1-leaf cotton)&lt;sup&gt;2&lt;/sup&gt;</th>
<th>POST 2 (5- to 7-leaf cotton)&lt;sup&gt;2&lt;/sup&gt;</th>
<th>Layby&lt;sup&gt;2&lt;/sup&gt;</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Option 1</strong></td>
<td></td>
<td>glyphosate + Dual Magnum or Warrant (no Palmer emerged)</td>
<td>Glyphosate + Dual Magnum or Warrant</td>
<td>MSMA + diuron, Layby Pro, or Suprend</td>
</tr>
<tr>
<td>Glyphosate + Valor + 2,4-D or Clarity</td>
<td>Gramoxone + diuron + Prowl or Gramoxone + Cotoran + Prowl</td>
<td>glyphosate + Staple&lt;sup&gt;3&lt;/sup&gt; (Palmer 1” or less)</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Option 2</strong></td>
<td></td>
<td>glyphosate + Dual Magnum or Warrant</td>
<td>Glyphosate + Dual Magnum or Warrant</td>
<td>MSMA + diuron, Layby Pro, or Suprend</td>
</tr>
<tr>
<td>Glyphosate + Valor + 2,4-D or Clarity</td>
<td>Gramoxone + diuron + Staple&lt;sup&gt;3&lt;/sup&gt; or Gramoxone + Cotoran + Staple&lt;sup&gt;3&lt;/sup&gt;</td>
<td>glyphosate + Dual Magnum or Warrant</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Option 3</strong></td>
<td></td>
<td>glyphosate + Dual Magnum or Warrant (no Palmer emerged)</td>
<td>Glyphosate + Dual Magnum or Warrant</td>
<td>MSMA + diuron, Layby Pro, Suprend, or Valor</td>
</tr>
<tr>
<td>Glyphosate + diuron + 2,4-D or Clarity</td>
<td>Gramoxone + Reflex + Prowl</td>
<td>glyphosate + Staple&lt;sup&gt;3&lt;/sup&gt; (Palmer 1” or less)</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Option 4</strong></td>
<td></td>
<td>glyphosate + Dual Magnum or Warrant</td>
<td>Glyphosate + Dual Magnum or Warrant</td>
<td>MSMA + diuron, Layby Pro, Suprend, or Valor</td>
</tr>
<tr>
<td>Glyphosate + diuron + 2,4-D or Clarity</td>
<td>Gramoxone + Reflex + Staple&lt;sup&gt;3&lt;/sup&gt; + Prowl</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

1 Follow waiting intervals between application and planting as specified on Valor, 2,4-D, or Clarity labels.
2 Dual Magnum may be applied once per season; Warrant can be applied twice.
3 If grasses larger than 1 inch, use glyphosate in place of MSMA.
4 Staple not effective on ALS-resistant Palmer amaranth.
Comparison of University and Grower Weed Management Programs in a Continuous Cotton Rotation in North Carolina

<table>
<thead>
<tr>
<th>Approach</th>
<th>Lint yield</th>
<th>Weed control cost</th>
<th>Net Return</th>
<th>Weed population</th>
<th>Active ingredients</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>lb/acre</td>
<td>$/acre</td>
<td></td>
<td>Prior to POST</td>
<td>Late season</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Cotton price (cents/pound)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>0.60</td>
<td>0.80</td>
<td>1.00</td>
</tr>
<tr>
<td>Farmer</td>
<td>823</td>
<td>65.06</td>
<td>-51.63</td>
<td>113.05</td>
<td>277.73</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>35,837</td>
<td></td>
</tr>
<tr>
<td>Researcher</td>
<td>925</td>
<td>87.29</td>
<td>-12.69</td>
<td>172.37</td>
<td>357.43</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>26,275</td>
<td></td>
</tr>
<tr>
<td>P &gt; F</td>
<td>0.0157</td>
<td>&lt;0.0001</td>
<td>0.1210</td>
<td>0.0757</td>
<td>0.0562</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>0.3322</td>
<td></td>
</tr>
</tbody>
</table>

Side refers to university recommendation or farmer approach. Data include 8 farmers representing replications. Data are from 2006, 2007, 2008, and 2009 and represent a total of 30 farmer/year combinations.
Weed control with Ignite-based systems
Weed Management in Ignite-Tolerant Cotton

- Weaknesses of Ignite: not as effective as glyphosate on grasses, pigweed, nutsedge, other perennial weeds, or glyphosate-susceptible Palmer amaranth.

- Strengths of Ignite: morningglory, glyphosate-resistant (GR) horseweed, and GR Palmer amaranth, if timed properly.

Left: 29 oz Ignite
Right: 22 oz Powermax

GR Palmer amaranth, 14 days after treatment
Can Ignite be applied legally to WideStrike cotton? Yes.

According to the EPA (Dec. 2010), Ignite 280 herbicide can be applied to WideStrike cotton.
Can Ignite be applied legally to WideStrike cotton? Yes.

Neither Bayer nor Dow/PhytoGen recommend or warrant the use of Ignite on WideStrike cotton.

The grower is liable for any crop injury resulting from the application.

Neither NCSU nor NCCPA recommend use of Ignite on Widestrike cotton.
Can Ignite be applied to Phytogen’s WideStrike-traited cotton?

- Must address this question; 36% of acres in NC in 2010 was PHY 375WRF; expect much more in 2011.
- Growers need to know how best to use the product; don’t want surprises.
- Must institute good resistance management strategy. Lot of dependence will be placed on Ignite in future. Simply cannot afford resistance to Ignite.
Weed Management with Ignite in WRF or LL Cotton

- Timing is critical!! 3 to 4 inches maximum for consistent control of *Amaranthus* species.

Good preplant/PRE program gives some flexibility in timing.

From Ignite 280 label:

<table>
<thead>
<tr>
<th>Weed Species</th>
<th>Maximum Weed Height or Diameter (Inches)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>22 oz/A</td>
</tr>
<tr>
<td>Amaranth, Palmer&lt;sup&gt;2&lt;/sup&gt;</td>
<td>3</td>
</tr>
<tr>
<td>Pigweed, redroot&lt;sup&gt;2&lt;/sup&gt;</td>
<td>3</td>
</tr>
<tr>
<td>Pigweed, prostrate&lt;sup&gt;2&lt;/sup&gt;</td>
<td>3</td>
</tr>
<tr>
<td>Pigweed, spiny&lt;sup&gt;2&lt;/sup&gt;</td>
<td>3</td>
</tr>
<tr>
<td>Pigweed, smooth&lt;sup&gt;2&lt;/sup&gt;</td>
<td>3</td>
</tr>
<tr>
<td>Pigweed, tumble&lt;sup&gt;2&lt;/sup&gt;</td>
<td>3</td>
</tr>
</tbody>
</table>
Palmer amaranth must be small (3 to 4 inches) if consistently controlled by Ignite.
Ignite 1- to 2-leaf
Ignite 6-leaf

Ignite 3- to 4-leaf
Ignite 6-leaf

No PRE herbicide
Late-August Florida pusley control. Ed Murdock, Barnwell Co., SC.

<table>
<thead>
<tr>
<th>Treatment</th>
<th>PPI/PRE</th>
<th>EPOT</th>
<th>MPOT</th>
</tr>
</thead>
<tbody>
<tr>
<td>None</td>
<td>Ignite</td>
<td>Ignite</td>
<td>Ignite</td>
</tr>
<tr>
<td>Treflan</td>
<td>Ignite</td>
<td>Ignite</td>
<td>Ignite</td>
</tr>
<tr>
<td>Cotoran</td>
<td>Ignite</td>
<td>Ignite</td>
<td>Ignite</td>
</tr>
</tbody>
</table>
Weed Management with Ignite in WRF or LL Cotton

• Timing is critical!! 3 to 4 inches for consistent control of *Amaranthus* species.

• Ignite is a contact. Good spray coverage is critical. Minimum 15 GPA. Prefer flat-fan nozzles.
Weed Management with Ignite in WRF or LL Cotton

- Timing is critical!! 3 to 4 inches Palmer.
- Coverage critical. At least 15 GPA.
- Use additional chemistry, similar to RR program
  Better control, Ignite timing somewhat less critical
  **Absolutely must avoid Ignite resistance**
  - Strong PRE and/or preplant program for residual control
  - Dual POST for additional residual control
  - Residual lay-by

Performance Plus program applies to WRF cotton also; not to LL cotton
### Programs for Glyphosate-Resistant Palmer Amaranth in Glufosinate-Tolerant Cotton – Coastal Plain

<table>
<thead>
<tr>
<th>Preplant Burndown $^2$</th>
<th>Preemergence</th>
<th>POST 1 (1-leaf cotton) $^3$</th>
<th>POST 2 (5- to 7-leaf cotton) $^3$</th>
<th>Layby $^4$</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Option 1</strong></td>
<td></td>
<td>Ignite</td>
<td>(Palmer 3 to 4 inches or less)</td>
<td>MSMA + diuron, Layby Pro, or Suprend</td>
</tr>
<tr>
<td>Glyphosate + Valor + 2,4-D or Clarity</td>
<td>Gramoxone + diuron + Prowl or Gramoxone + Cotoran + Prowl</td>
<td>Ignite or Ignite + Dual Magrum (Palmer 3 to 4 inches or less)</td>
<td>Ignite (Palmer 3 to 4 inches or less)</td>
<td></td>
</tr>
<tr>
<td><strong>Option 2</strong></td>
<td></td>
<td>Ignite</td>
<td>(Palmer 3 to 4 inches or less)</td>
<td>MSMA + diuron, Layby Pro, or Suprend</td>
</tr>
<tr>
<td>Glyphosate + Valor + 2,4-D or Clarity</td>
<td>Gramoxone + diuron + Staple $^5$ or Gramoxone + Cotoran + Staple $^5$</td>
<td>Ignite or Ignite + Dual Magrum (Palmer 3 to 4 inches or less)</td>
<td>Ignite (Palmer 3 to 4 inches or less)</td>
<td></td>
</tr>
<tr>
<td><strong>Option 3</strong></td>
<td></td>
<td>Ignite</td>
<td>(Palmer 3 to 4 inches or less)</td>
<td>MSMA + diuron, Layby Pro, Suprend, or Valor</td>
</tr>
<tr>
<td>Glyphosate + diuron + 2,4-D or Clarity</td>
<td>Gramoxone + Reflex + Prowl</td>
<td>Ignite or Ignite + Dual Magrum (Palmer 3 to 4 inches or less)</td>
<td>Ignite (Palmer 3 to 4 inches or less)</td>
<td></td>
</tr>
<tr>
<td><strong>Option 4</strong></td>
<td></td>
<td>Ignite</td>
<td>(Palmer 3 to 4 inches or less)</td>
<td>MSMA + diuron, Layby Pro, Suprend, or Valor</td>
</tr>
<tr>
<td>Glyphosate + diuron + 2,4-D or Clarity</td>
<td>Gramoxone + Reflex + Prowl + Staple $^5$</td>
<td>Ignite or Ignite + Dual Magrum (Palmer 3 to 4 inches or less)</td>
<td>Ignite (Palmer 3 to 4 inches or less)</td>
<td></td>
</tr>
</tbody>
</table>

$^1$ If Ignite herbicide is applied to a Phytoen WRF cotton, grower assumes all liability for crop injury.

$^2$ Follow waiting intervals between application and planting as specified on Valor, 2,4-D, or Clarity labels.

$^3$ Apply Ignite 280 at 2.2 lb ai/acre on Phytoen WRF cotton. Make only two applications on Phytoen WRF cotton, and do not apply overlap after the 7-leaf stage of cotton. Higher rates are permitted on LibertyLink cotton; see label.

$^4$ Grasses larger than 1 inch may not be controlled.

$^5$ Staple not effective on ALS-resistant Palmer amaranth.
Check
  Received only
  Gramoxone burndown

Gramoxone burndown
  Prowl + Reflex PRE
  Ignite + Dual POST 1
  Ignite POST 2
  Direx + MSMA layby

Wayne Co., 2009
What to expect with Ignite applied to Phytogen WideStrike cotton?

- Expect some crop burn. Burn usually minor, but can be significant. May see lingering stunting.
WideStrike Injury from Ignite

Ignite 29 oz/A

Ignite 43 oz/A

Good advice: do not exceed 29 oz on WRF cotton.
What to expect with Ignite applied to Phytogen WideStrike cotton?

• Expect some crop burn. Burn usually minor, but can be significant. May see lingering stunting.

• Avoid application on thrips-infested cotton.
What to expect with Ignite applied to Phytogen WideStrike cotton?

- Expect some crop burn. Burn usually minor, but can be significant. May see lingering stunting.
- Avoid application on thrips-infested cotton.
- AMS enhances weed control, but can also enhance injury on WRF cotton; you might want to avoid it.
What to expect with Ignite applied to Phytogen WideStrike cotton?

- Expect some crop burn. Burn usually minor, but can be significant. May see lingering stunting.
- Avoid application on thrips-infested cotton.
- AMS enhances injury.
- Tank-mixing with Staple or Dual enhances injury (additive effect), has not affected yield in NC research.
What to expect with Ignite applied to Phytogen WideStrike cotton?

- Expect some crop burn. Burn usually minor, but can be significant. May see lingering stunting.
- Avoid application on thrips-infested cotton.
- AMS enhances injury. Best to avoid it.
- Tank-mixing with Staple or Dual enhances injury, has not affected yield.
- Mixing with insecticides has not increased burn or impacted yield. Cotton was not under thrips stress when treated.
What to expect with Ignite applied to Phytogen WideStrike cotton?

- Expect some crop burn. Burn usually minor, but can be significant. May see lingering stunting.
- Avoid application on thrips-infested cotton.
- AMS enhances injury. Best to avoid it.
- Tank-mixing with Staple or Dual enhances injury, has not affect yield.
- Mixing with insecticides has not increased burn or impacted yield. Cotton was not under thrips stress when treated.
- Research has shown no yield impact with 29 oz applied twice before 8-leaf stage. May see minor delay in maturity.

*Avoid late application* (at or near bloom; may reduce yield).
Tolerant of glyphosate and Ignite

• Generally best to not tank mix glyphosate and Ignite.
• Glyphosate does not hurt Ignite performance.
• Ignite can hurt glyphosate performance.
Concerns with Ignite on WRF Cotton

• With program discussed, no yield problems in research. But, injury obviously does not help the cotton. Some risk involved.

• Need to keep rate relatively low, for crop tolerance.

• With low rate, weed size becomes even more critical.

• Treating larger weeds with low rate will give inadequate control.

• Treating larger weeds with low rate is same as sub-lethal dose, which can lead to resistance.
# Ignite use on LibertyLink cotton

<table>
<thead>
<tr>
<th>Use pattern</th>
<th>1&lt;sup&gt;st&lt;/sup&gt; Applic.</th>
<th>2&lt;sup&gt;nd&lt;/sup&gt; Applic.</th>
<th>3&lt;sup&gt;rd&lt;/sup&gt; Applic.</th>
<th>Seasonal Max</th>
</tr>
</thead>
<tbody>
<tr>
<td>Option 1</td>
<td>22-29 oz</td>
<td>22-29 oz</td>
<td>22-29 oz</td>
<td>87 oz</td>
</tr>
<tr>
<td>Option 2</td>
<td>30-43 oz</td>
<td>22-29 oz</td>
<td>None</td>
<td>72 oz</td>
</tr>
</tbody>
</table>
## Ignite on WRF vs LL cotton

<table>
<thead>
<tr>
<th></th>
<th>WRF</th>
<th>LL</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Tolerance</strong></td>
<td>Acceptable with program discussed</td>
<td>Excellent</td>
</tr>
<tr>
<td><strong>Timing</strong></td>
<td>Try to avoid application after 7- to 8-leaf stage</td>
<td>Up to early bloom with no concerns</td>
</tr>
<tr>
<td><strong>Weed control</strong></td>
<td>Good if very timely; 29 oz, 3- to 4-inch max</td>
<td>Can use higher rates (up to 43 oz); better control of larger weeds or stressed weeds; no problems with AMS</td>
</tr>
</tbody>
</table>
## NC OVT Results

### Rocky Mt, 2010

<table>
<thead>
<tr>
<th>Variety</th>
<th>Lint (lb/A)</th>
</tr>
</thead>
<tbody>
<tr>
<td>DP 0935B2RF</td>
<td>1311</td>
</tr>
<tr>
<td>FM 1845 LLB2</td>
<td>1162</td>
</tr>
<tr>
<td>FM 1773 LLB2</td>
<td>1085</td>
</tr>
</tbody>
</table>

### NC: 3-year average

<table>
<thead>
<tr>
<th>Variety</th>
<th>Lint (lb/A)</th>
</tr>
</thead>
<tbody>
<tr>
<td>PHY 375WRF</td>
<td>1158</td>
</tr>
<tr>
<td>DP 0935B2RF</td>
<td>1150</td>
</tr>
</tbody>
</table>
What should a grower do concerning variety selection and resistant Palmer amaranth?

- An Ignite-resistant variety may be best option for fields heavily infested with resistant Palmer, assuming good management.

- For other fields, select variety based on agronomic performance (yield, fiber quality, etc). Look at OVT and other data.
Palmer Amaranth Control in Corn and Soybeans
Palmer Amaranth Management in RR Soybeans

1. Rotate with corn if possible
2. Start clean
3. Narrow rows
4. ALWAYS use a PRE herbicide
   A preplant residual would be preferred in full-season no-till soybeans.
Untreated

Atrazine-based program
<table>
<thead>
<tr>
<th>PRE</th>
<th>RR Corn</th>
<th>LL Corn</th>
<th>Conventional</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bicep</td>
<td>Halex GT + atrazine</td>
<td>Ignite + atrazine</td>
<td>Capreno + atrazine</td>
</tr>
<tr>
<td>Guardsman Max</td>
<td>Glyphosate + atrazine</td>
<td></td>
<td>Clarity + atrazine</td>
</tr>
<tr>
<td>Harness Extra</td>
<td>Glyphosate + Clarity</td>
<td></td>
<td>Laudis + atrazine</td>
</tr>
<tr>
<td>Lariat</td>
<td>Glyphosate + Dual II Magnum*</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lexar</td>
<td>Glyphosate + Warrant*</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*No activity on emerged glyphosate-resistant weeds. Residual control only.*
Post-Harvest Control of Palmer amaranth in Corn

- Control may be good during the season.
- Late flush can come in near or after harvest.
- Can produce millions of seed before frost.
- Post-harvest options:
  - Most effective:
    - Gramoxone (3 pt) + 2,4-D or Clarity
  - Less effective:
    - Disking or mowing (both must be repeated)
Palmer Amaranth Management in RR Soybeans

1. Rotate with corn if possible

2. Start clean

3. Narrow rows

4. ALWAYS use a PRE herbicide
   A preplant residual would be preferred in full-season no-till soybeans. (specific products covered later)
Palmer Amaranth Management in RR Soybeans

1. Rotate, control pigweed in rotational crop
2. Start clean
3. Narrow rows
4. ALWAYS use a PRE herbicide (or preplant residual in full-season no-till)
5. POST as need; tank mix if resistance suspected; TIMELY
Most POST soybean herbicide labels specify 6-leaf or 4-inch maximum Palmer amaranth.

It can grow 1 to 2 inches per day!
# PPO Inhibitor Use in NC Crops

<table>
<thead>
<tr>
<th>Crop</th>
<th>Level of Concern*</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>High</td>
</tr>
<tr>
<td>Cotton</td>
<td>Reflex, Valor</td>
</tr>
<tr>
<td>Corn</td>
<td>Fierce (new for 2011)</td>
</tr>
<tr>
<td>Peanut</td>
<td>Blazer, Cobra, Storm, Valor</td>
</tr>
<tr>
<td>Soybean</td>
<td>Authority MTZ, Envive, Fierce, Flexstar, Flexstar GT, Prefix, Reflex, Resource, Storm, Valor, Valor XLT</td>
</tr>
<tr>
<td>Tobacco</td>
<td>Spartan</td>
</tr>
</tbody>
</table>

*Based on likelihood of use, time of use, use patterns.
## Palmer Amaranth Programs for RR Soybeans

<table>
<thead>
<tr>
<th>PPO PRE</th>
<th>Non-PPO PRE</th>
<th>POST</th>
</tr>
</thead>
<tbody>
<tr>
<td>Authority MTZ ±</td>
<td>Boundary</td>
<td>Roundup + Blazer</td>
</tr>
<tr>
<td>grass herbicide</td>
<td>Canopy ±</td>
<td>Roundup + Cobra</td>
</tr>
<tr>
<td>Envive ± Prowl</td>
<td></td>
<td>Roundup + Flexstar*</td>
</tr>
<tr>
<td>Fierce</td>
<td></td>
<td>Roundup + Prefix*</td>
</tr>
<tr>
<td>Prefix*</td>
<td></td>
<td>Glyphosate + Harmony SG**</td>
</tr>
<tr>
<td>Valor ± Prowl</td>
<td></td>
<td>Glyphosate + Pursuit**</td>
</tr>
</tbody>
</table>

* Contains fomesafen. Only one application of fomesafen per ye ar.

** ALS inhibitor.
Glyphosate-resistant Palmer amaranth, Wayne Co., NC 2008; PRE herbicide followed by timely glyphosate tank mix
Weed Management in LibertyLink Soybean

• Weaknesses of Ignite: not as effective as glyphosate on grasses, pigweed, nutsedge, other perennial weeds, or glyphosate-susceptible Palmer amaranth.

• Strengths of Ignite: morningglory, glyphosate-resistant (GR) horseweed, and GR Palmer amaranth, if timed properly.

Left: 29 oz Ignite
Right: 22 oz Powermax

GR Palmer amaranth, 14 days after treatment
Palmer Amaranth Management in LL Soybeans

1. Rotate, control pigweed in rotational crop
2. Start clean
3. Narrow rows
4. ALWAYS use a PRE herbicide (or preplant residual in full-season no-till)
5. POST as need; Ignite TIMELY; Palmer maximum 3 to 4 inches; can mix with Dual Magnum or Warrant for residual control
Use Directions for Ignite 280

On LibertyLink Soybean

<table>
<thead>
<tr>
<th>Use Pattern</th>
<th>1\textsuperscript{st} Application</th>
<th>2\textsuperscript{nd} Application</th>
<th>Season Maximum</th>
</tr>
</thead>
<tbody>
<tr>
<td>Option 1</td>
<td>22 fl oz/A</td>
<td>22 fl oz/A</td>
<td>44 fl oz/A</td>
</tr>
<tr>
<td>Option 2\textsuperscript{1}</td>
<td>29-36 fl oz/A</td>
<td>None</td>
<td>36 fl oz/A</td>
</tr>
</tbody>
</table>

1). The “Option 2” use pattern allows for a single application at up to 36 fluid ounces of Ignite 280 SL Herbicide. Do not make an application of Ignite 280 SL Herbicide at a use rate greater than 22 fl oz per acre to soybeans beyond the V3-V4 vegetative growth stage (i.e., 3 to 4 fully expanded trifoliolate leaves beyond the unifoliolate leaves - approximately 10-14 days before the onset of first bloom).

Questions?