

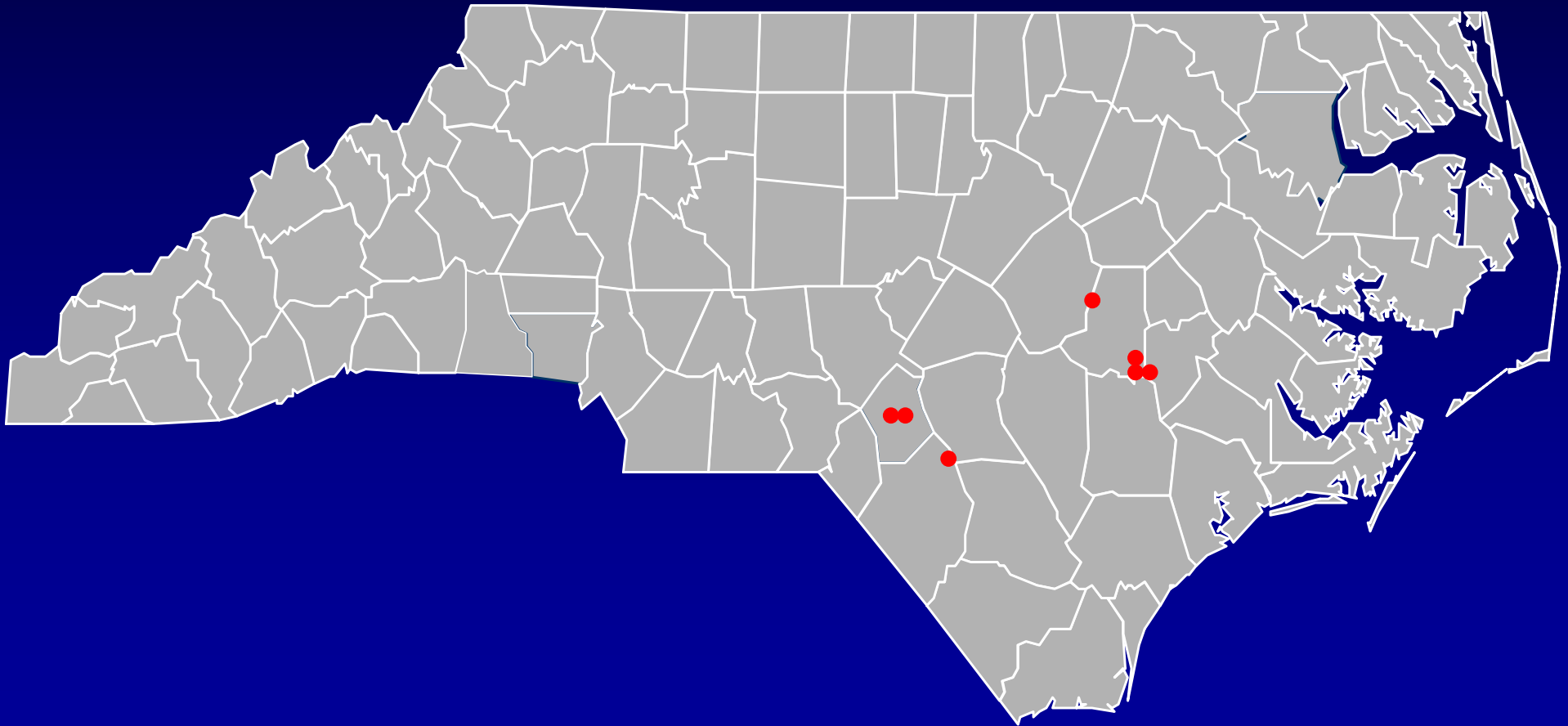






# Glyphosate-Resistant Palmer Amaranth

## Initial concerns in 2005







Untreated

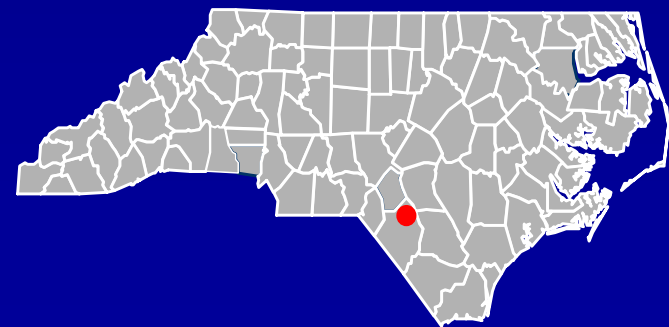


Glyphosate 0.75 lb ae/A

12 inches at treatment

14 DAT

Parkton, NC 2005







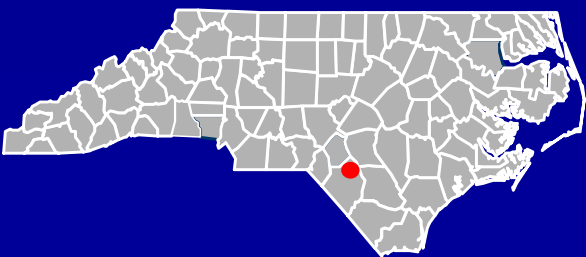
Untreated



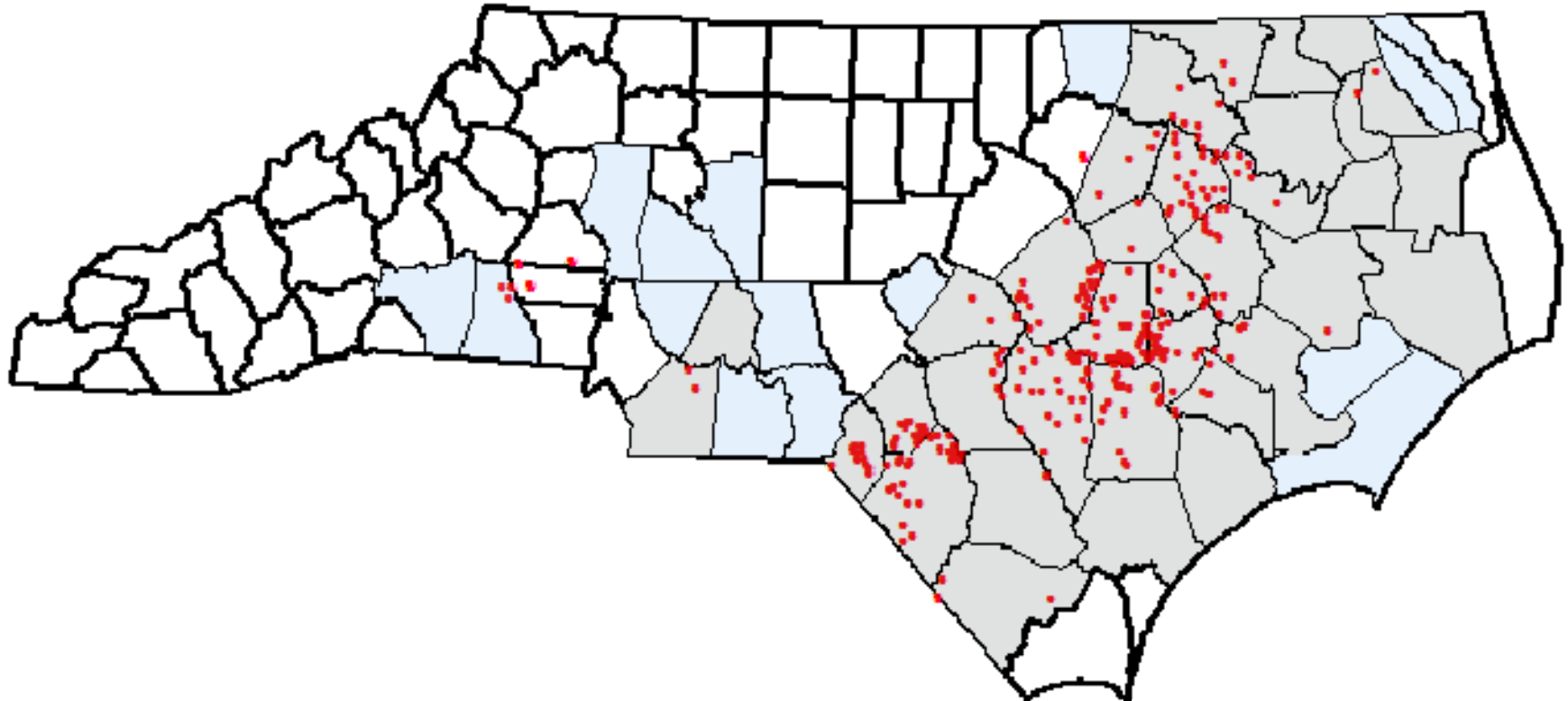
Glyphosate 3.0 lb ae/A

14 DAT

Parkton, NC 2005



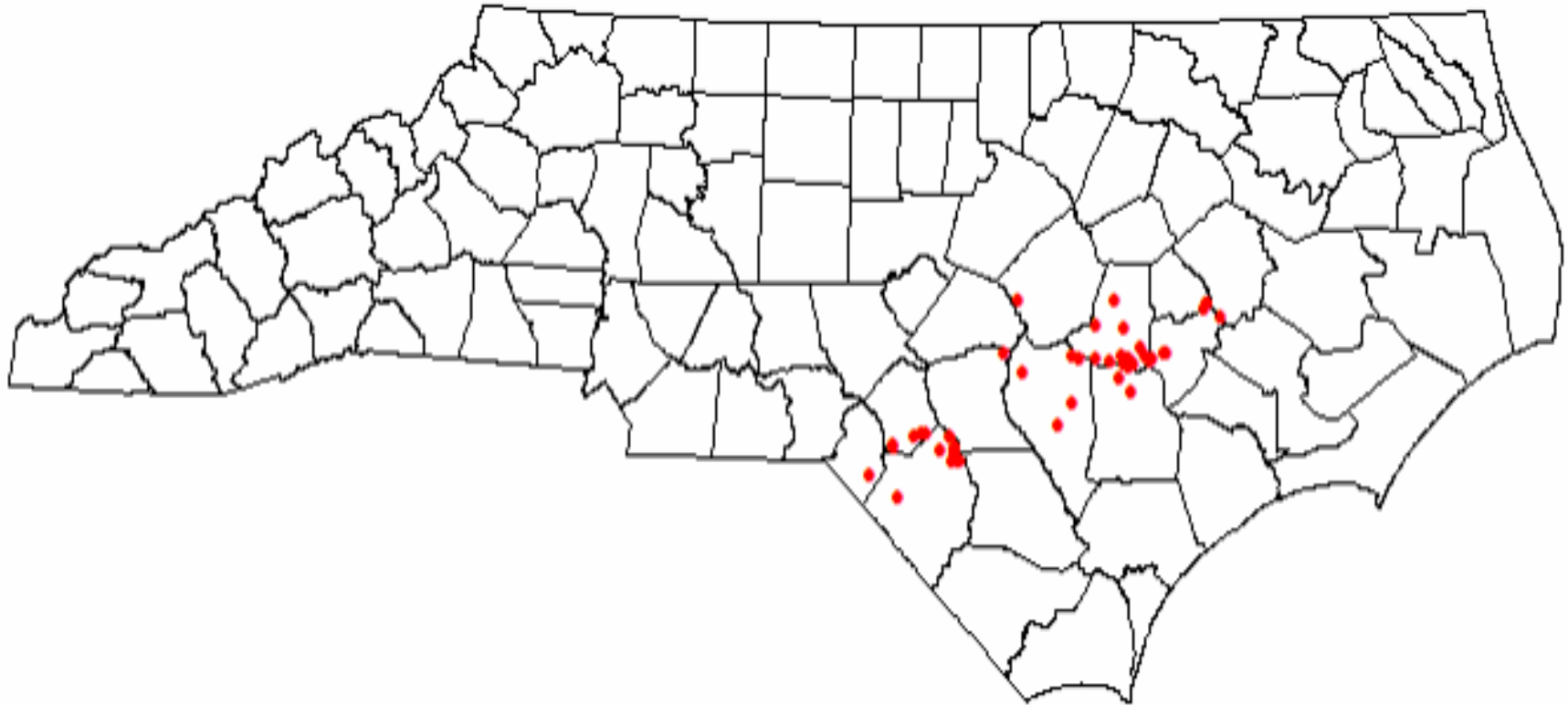
# 290 Fields Sampled in Fall 2005











49 of 290 Fields Resistant  
Located in 11 Counties



Known susceptible  
population



Untreated ← Treated →



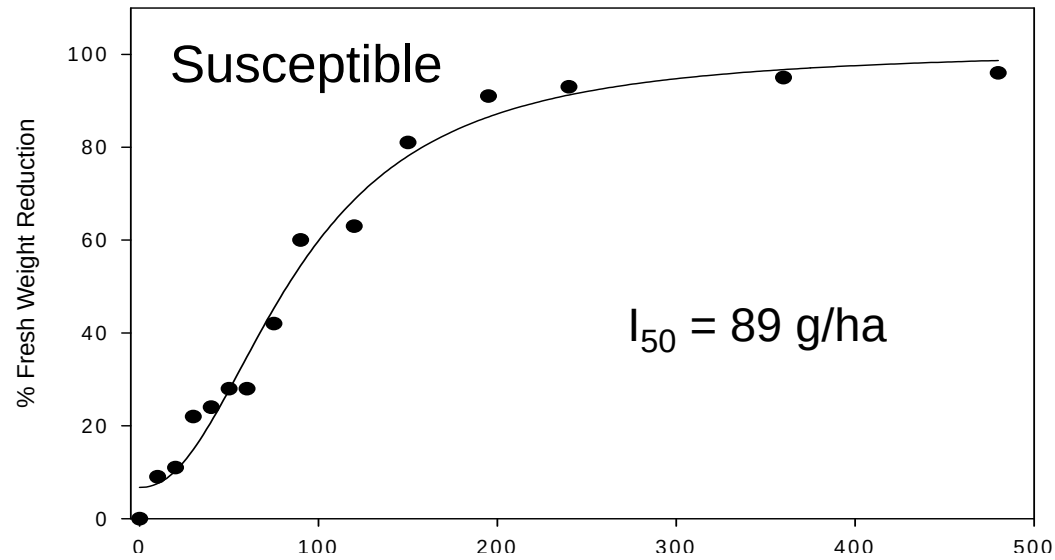
Untreated ← Treated →



Untreated ← Treated →

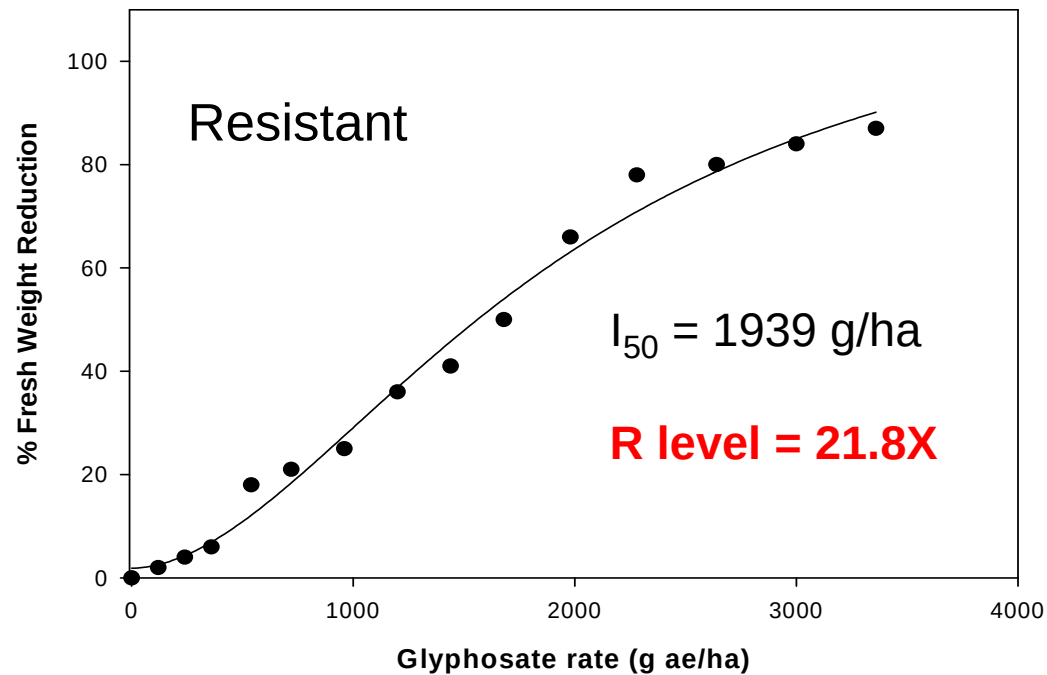


# Percent fresh weight reduction, greenhouse: North Carolina.



$$y = 6.747 + \frac{101.0643 - 6.7470}{1 + (x/88.9212)^{-2.1698}}$$

$$R^2 = 0.984$$



$$y = 1.8664 + \frac{121.9982 - 1.8644}{1 + (x/1939.2205)^{-1.8546}}$$

$$R^2 = 0.989$$



The background of the slide is a photograph of a field of tall, dry, yellowish-brown grass. In the distance, there is a dense line of green trees under a clear blue sky. The text is overlaid on this image.

# **Impacts**

**High level of awareness**

**Lot of worrying**

**Some action**









Untreated

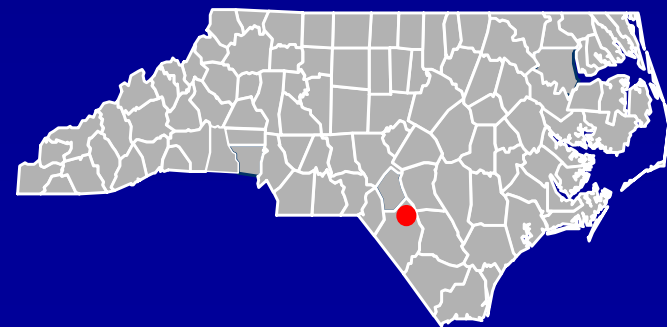


Glyphosate 0.75 lb ae/A

12 inches at treatment

14 DAT

Parkton, NC 2005









# What are telling our growers?

- Raising awareness
- Early detection





# Detect Resistance Early





Is this weed resistant?  
Wanna risk it?





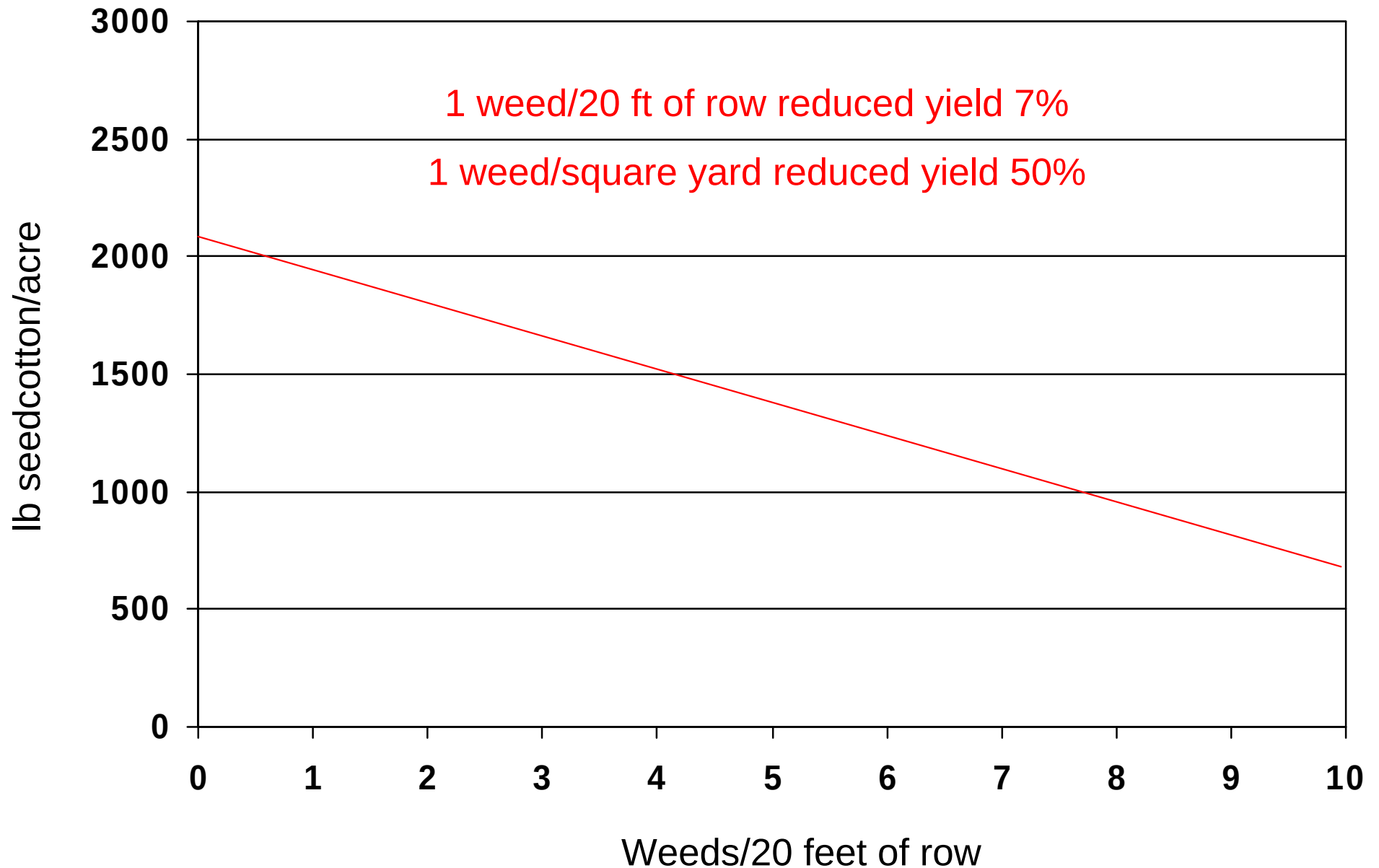
# What are telling our growers?

- Raising awareness
- Early detection
- Rotation; strive for good control in corn or soybeans; try to reduce seed bank





# Cotton yield vs Palmer density









# What are telling our growers?

- Raising awareness
- Early detection
- Rotation; strive for good control in corn or soybeans; try to reduce seed bank
- Multiple MOA's; strong focus on PRE's and residual control



# North Carolina, 2006

Mid-  
July



Untreated



Treated – no residual

Mid-  
Oct







Glyphosate-resistant Palmer amaranth

Robeson County, 2007



# Palmer Amaranth Resistance Management

- Reduce the seedbank
- Residual control is important
- Reduce selection pressure on ALS inhibitors







Weathermax 88 oz

Staple LX 10 oz

Culpepper, Macon Co., GA 2007



# Sample near Parkton, NC



Check/Glyphosate



Check/pyrithiobac







# Herbicide programs for Palmer amaranth control in RR Soybean

| <b>Glyph.<br/>resist.</b> | <b>ALS<br/>resist.</b>   | <b>Preplant or<br/>Preemergence</b>                                                                                                                     | <b>Postemergence</b>                                                                                                     |
|---------------------------|--------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------|
| <b>No</b>                 | <b>Yes<br/>or<br/>No</b> | <b>Authority MTZ<sup>1</sup>, Boundary,<br/>Dual Magnum, Envive, Intrro,<br/>Outlook, Prefix, Prowl,<br/>Sencor, Valor SX, or Valor XLT<sup>1</sup></b> | <b>Lighter infestations:<br/>Glyphosate</b>                                                                              |
|                           |                          |                                                                                                                                                         | <b>Heavy infestations:<br/>Glyph. + Dual Mag. or Sequence</b>                                                            |
| <b>Yes</b>                | <b>No</b>                | <b>Authority MTZ<sup>1</sup>, Boundary,<br/>Envive, Intrro, Prefix,<br/>Valor SX, or Valor XLT<sup>1</sup></b>                                          | <b>Glyphosate + Harmony GT<sup>2</sup>,<br/>Glyposate + Flexstar<sup>3</sup>, or<br/>Glyphosate + Reflex<sup>3</sup></b> |
| <b>Yes</b>                | <b>Yes</b>               | <b>Authority MTZ<sup>1</sup>, Boundary,<br/>Envive, Intrro, Prefix,<br/>Valor SX, or Valor XLT<sup>1</sup></b>                                          | <b>Glyphosate + Flexstar or<br/>Glyphosate + Reflex</b>                                                                  |

<sup>1</sup> Do not plant cotton in following year.

<sup>2</sup> An ALS inhibitor.

<sup>3</sup> Do not apply Flexstar or Reflex POST if Prefix used PRE.



# Herbicide programs for Palmer amaranth control in **non-RR** Soybean

| <b>Sickle-pod</b> | <b>ALS resist.</b> | <b>Palmer infestation</b> | <b>Preplant or Preemergence</b>                                                                                                                                  | <b>Postemergence</b>                                                                                                  |
|-------------------|--------------------|---------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------|
| <b>No</b>         | <b>No</b>          | <b>Light</b>              | Authority MTZ <sup>1,2</sup> , Boundary, Dual Magnum, Envive, Intrro, Outlook, Prefix, Sencor <sup>2</sup> , Valor SX <sup>3</sup> , or Valor XLT <sup>1,3</sup> | Flexstar <sup>4</sup> , Reflex <sup>4</sup> , Storm, or Ultra Blazer; can add Harmony GT <sup>5</sup> to any of these |
|                   |                    | <b>Heavy</b>              | Authority MTZ <sup>1,2</sup> , Boundary, Envive, Prefix, Sencor <sup>2</sup> , Valor SX <sup>3</sup> , or Valor XLT <sup>1,3</sup>                               |                                                                                                                       |
| <b>No</b>         | <b>Yes</b>         | <b>Light or heavy</b>     | Authority MTZ <sup>1,2</sup> , Boundary, Envive, Prefix, Sencor <sup>2</sup> , Valor SX <sup>3</sup> , or Valor XLT <sup>1,3</sup>                               | Flexstar <sup>4</sup> , Reflex <sup>4</sup> , or Ultra Blazer                                                         |
| <b>Yes</b>        | <b>Yes or No</b>   | <b>Light or heavy</b>     | Authority MTZ <sup>1,2</sup> , Boundary, or Sencor <sup>2</sup>                                                                                                  | Flexstar + Classic or Reflex + Classic                                                                                |

<sup>1</sup> Do not plant cotton in following year.

<sup>2</sup> Add Dual, Intrro, Outlook, or Prowl for grass control.

<sup>3</sup> Add Prowl for grass control.

<sup>4</sup> Do not apply Flexstar or Reflex POST if Prefix used PRE.

<sup>5</sup> An ALS inhibitor.





Untreated



PRE only



POST only



PRE + POST

Non-glyphosate programs, 2007



# Recommended southeastern US herbicide programs for Palmer amaranth control in RR cotton

| <b>Glyph.<br/>resist.</b> | <b>ALS<br/>resist.</b> | <b>Preplant or<br/>Preemergence</b>                                                               | <b>Postemergence<br/>1- to 4-leaf</b>                 | <b>Layby<br/>(Palmer &lt; 3")</b>                                                               |
|---------------------------|------------------------|---------------------------------------------------------------------------------------------------|-------------------------------------------------------|-------------------------------------------------------------------------------------------------|
| <b>No</b>                 | <b>No</b>              | <b>Staple*,<br/>Reflex**,<br/>Valor SX***,<br/><br/>Direx,<br/>Cotoran,<br/><br/>or<br/>Prowl</b> | <b>Light infestation:<br/><br/>Glyphosate</b>         | <b>Valor,<br/>Suprend,<br/>Direx,<br/><br/>or<br/>Layby Pro<br/>plus<br/>MSMA or glyphosate</b> |
|                           |                        |                                                                                                   | <b>Heavy infestation:<br/><br/>Glyph. + Dual Mag.</b> |                                                                                                 |

\* Limit to one application per year.

\*\* Caution if Valor preplant.

\*\*\* Preplant only.



# Recommended southeastern US herbicide programs for Palmer amaranth control in RR cotton

| <b>Glyph.<br/>resist.</b> | <b>ALS<br/>resist.</b> | <b>Preplant or<br/>Preemergence</b>                                                   | <b>Postemergence<br/>1- to 4-leaf</b>              | <b>Layby<br/>(Palmer &lt; 3")</b>                                                          |
|---------------------------|------------------------|---------------------------------------------------------------------------------------|----------------------------------------------------|--------------------------------------------------------------------------------------------|
| <b>Yes</b>                | <b>No</b>              | <b>Reflex* + Direx,<br/>Reflex* + Prowl,<br/>Direx + Staple**,<br/>or Valor SX***</b> | <b>No Palmer emerged:<br/>Glyph. + Dual Mag.</b>   | <b>Valor,<br/>Suprend,<br/>Direx,<br/>or<br/>Layby Pro<br/>plus<br/>MSMA or glyphosate</b> |
|                           |                        |                                                                                       | <b>Palmer &lt; 2 inches:<br/>Glyph. + Staple**</b> |                                                                                            |

\* Caution if Valor preplant.

\*\* Limit to one application per year.

\*\*\* Valor preplant only. Can follow with Direx, Cotoran, or Prowl preemergence.



# Recommended southeastern US herbicide programs for Palmer amaranth control in RR cotton

| <b>Glyph.<br/>resist.</b> | <b>ALS<br/>resist.</b> | <b>Infestation<br/>level</b>                                                        | <b>Preplant or<br/>Preemergence</b>                 | <b>Postemergence</b>                                                          |
|---------------------------|------------------------|-------------------------------------------------------------------------------------|-----------------------------------------------------|-------------------------------------------------------------------------------|
| <b>Yes</b>                | <b>Yes</b>             | <b>Reflex* + Direx,<br/>Reflex* + Prowl,<br/>Cotoran + Prowl,<br/>or Valor SX**</b> | <b>No Palmer emerged:<br/>Dual Mag.*** ± glyph.</b> | <b>Valor,<br/>Direx,<br/>or<br/>Layby Pro<br/>plus<br/>MSMA or glyphosate</b> |
|                           |                        |                                                                                     | <b>Palmer emerged:<br/>No options</b>               |                                                                               |

\* Caution if Valor preplant.

\*\* Valor preplant only. Can follow with Direx, Cotoran, or Prowl preemergence.

\*\*\* Shoot for 1-leaf cotton (label specifies minimum 3-inch cotton).





2007

Glyph. + 2,4-D burndown  
Gram. + Reflex PRE  
Glyph. + Dual first POST  
Glyph. Second POST  
Direx + MSMA Layby

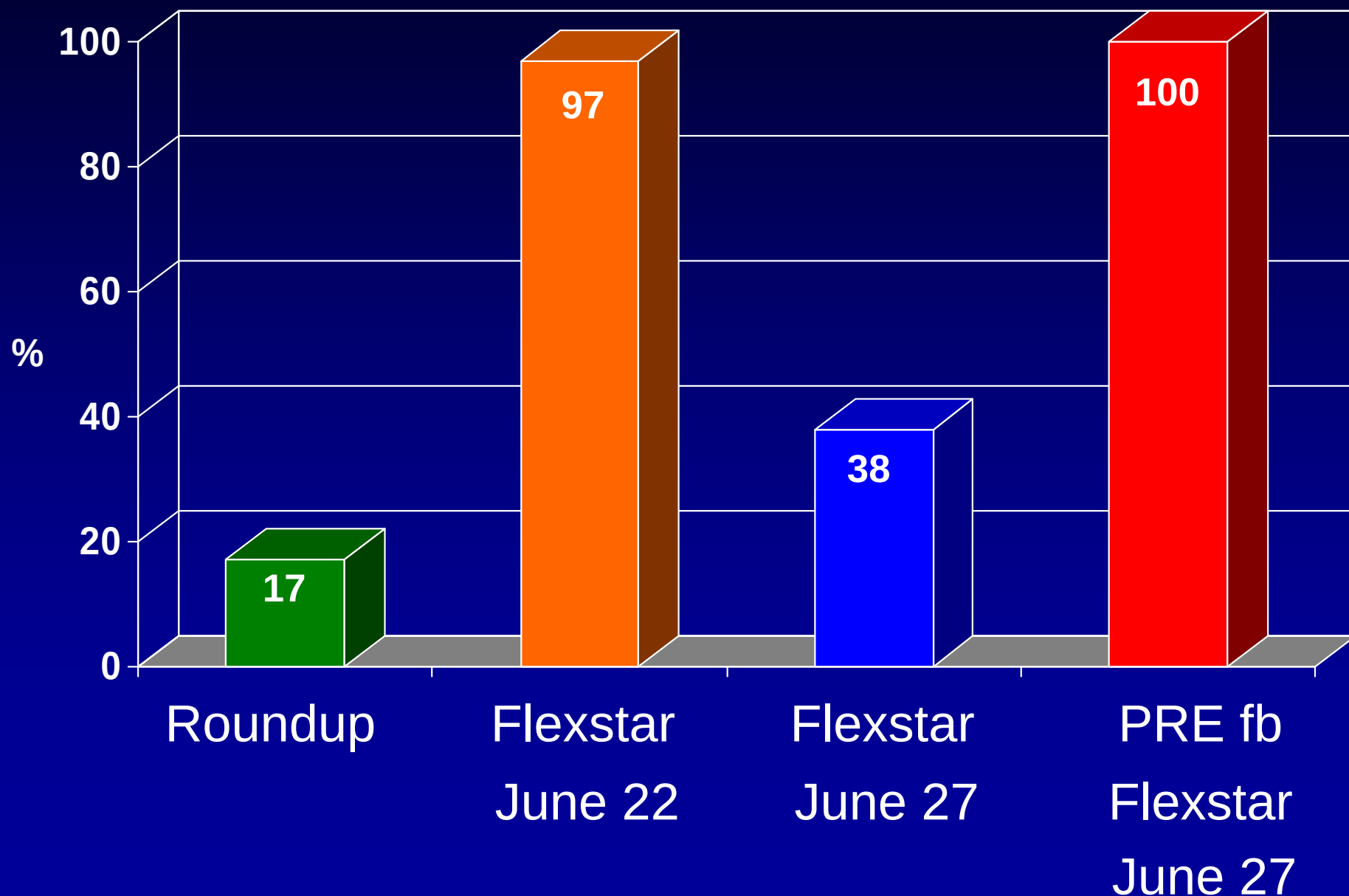


# PRE Herbicides

- Strongly recommended in RR systems (cotton, corn, soybean)
- Significant aid in resistance management
- Can offer other benefits

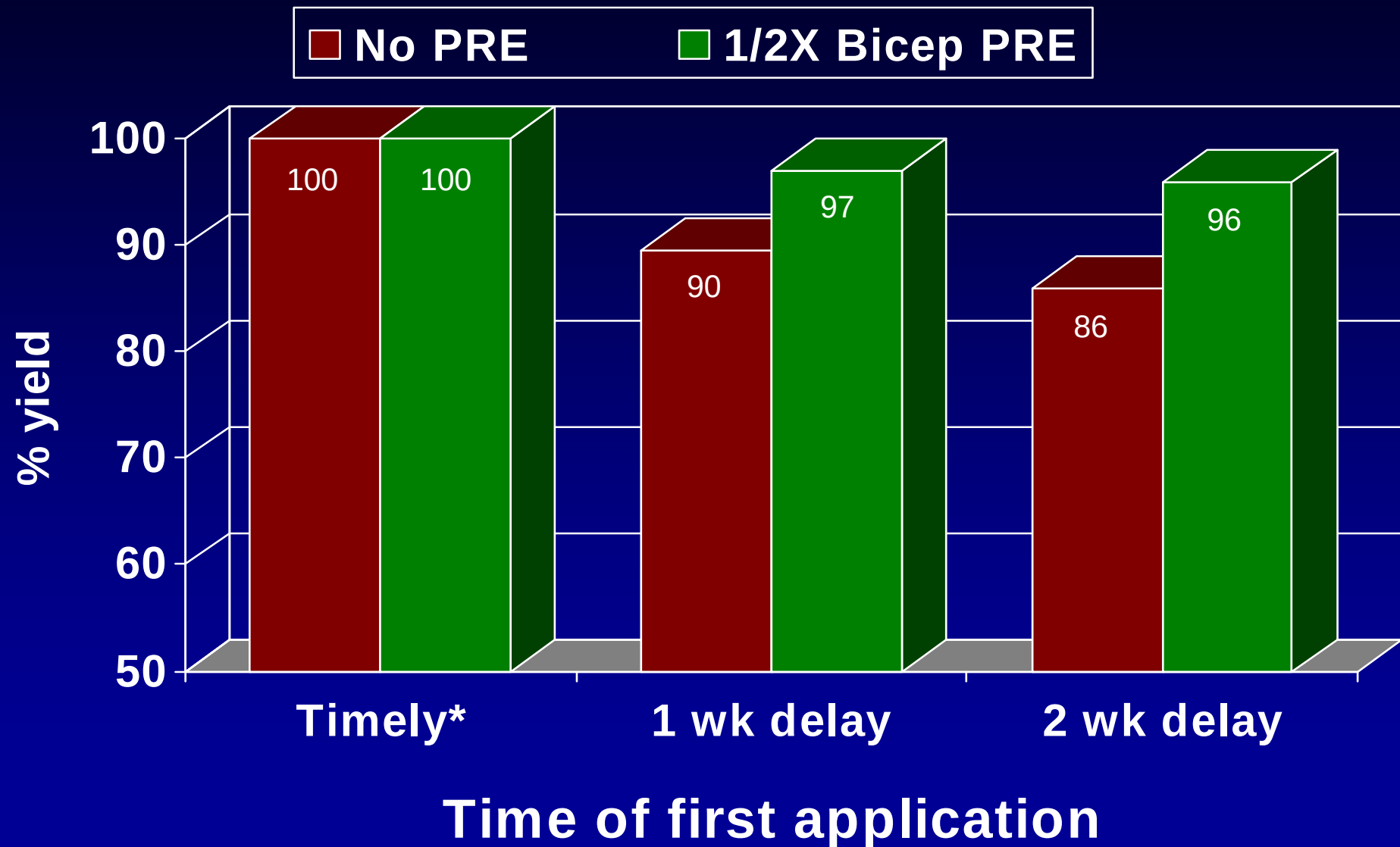


# Glyphosate-resistant Palmer amaranth. Soybeans. Robeson Co., 2007.





# Time of Glyphosate Application on RR Corn. Average of 6 locations, NC.\*\*

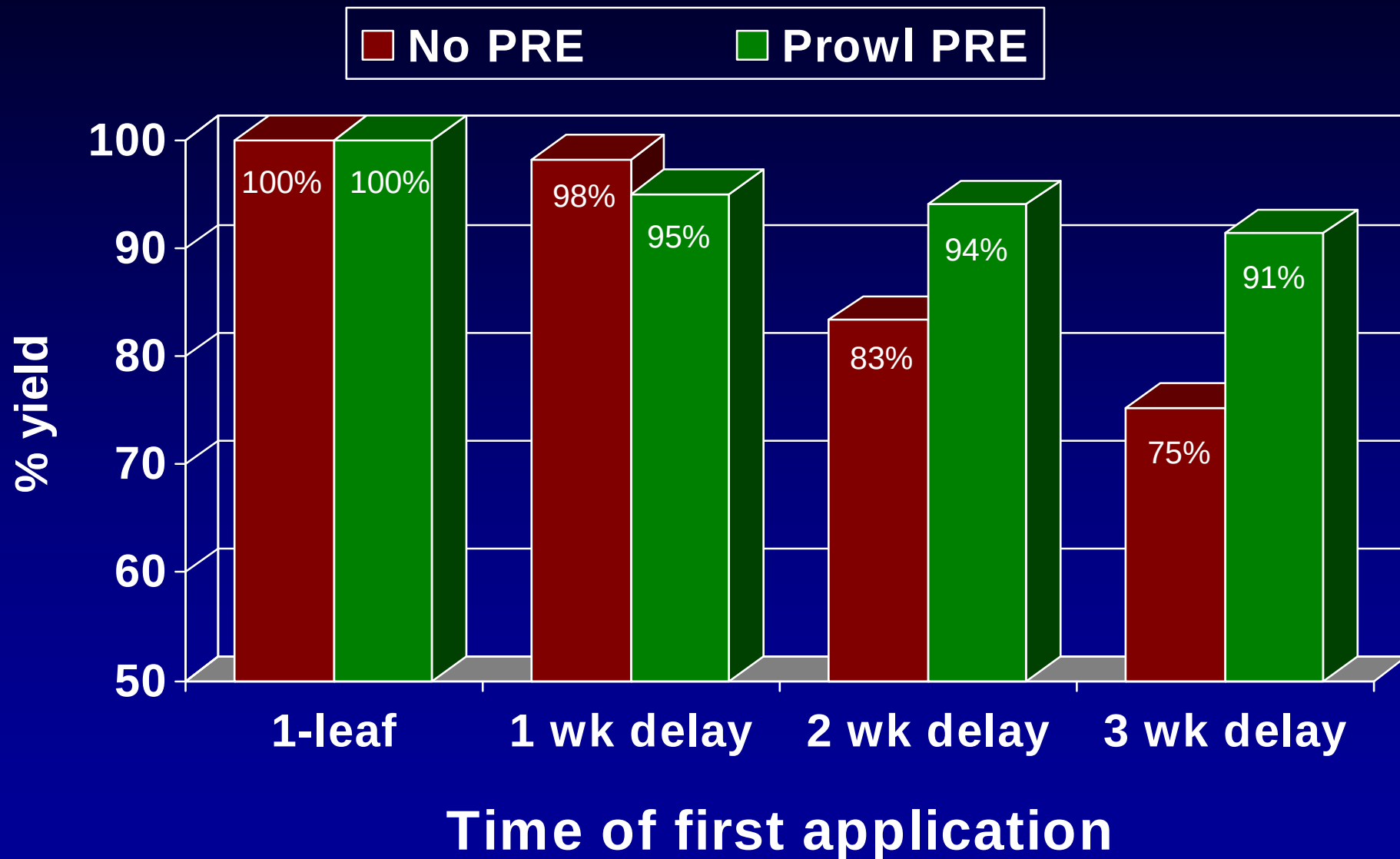


\* 2- to 3.5-inch weeds.

\*\* Parker, York, and Jordan. 2006. Weed Technol. 20:564-570.



# Time of First Glyphosate Application on RR Flex Cotton. Average of 3 locations, NC.









# Research Areas

- Salvage treatments
- No-till vs conventional tillage
- Chloroacetamides
- Residuals, especially PRE
- Flex/LL
- Physiology/ecology