

# Cotton Insect Update

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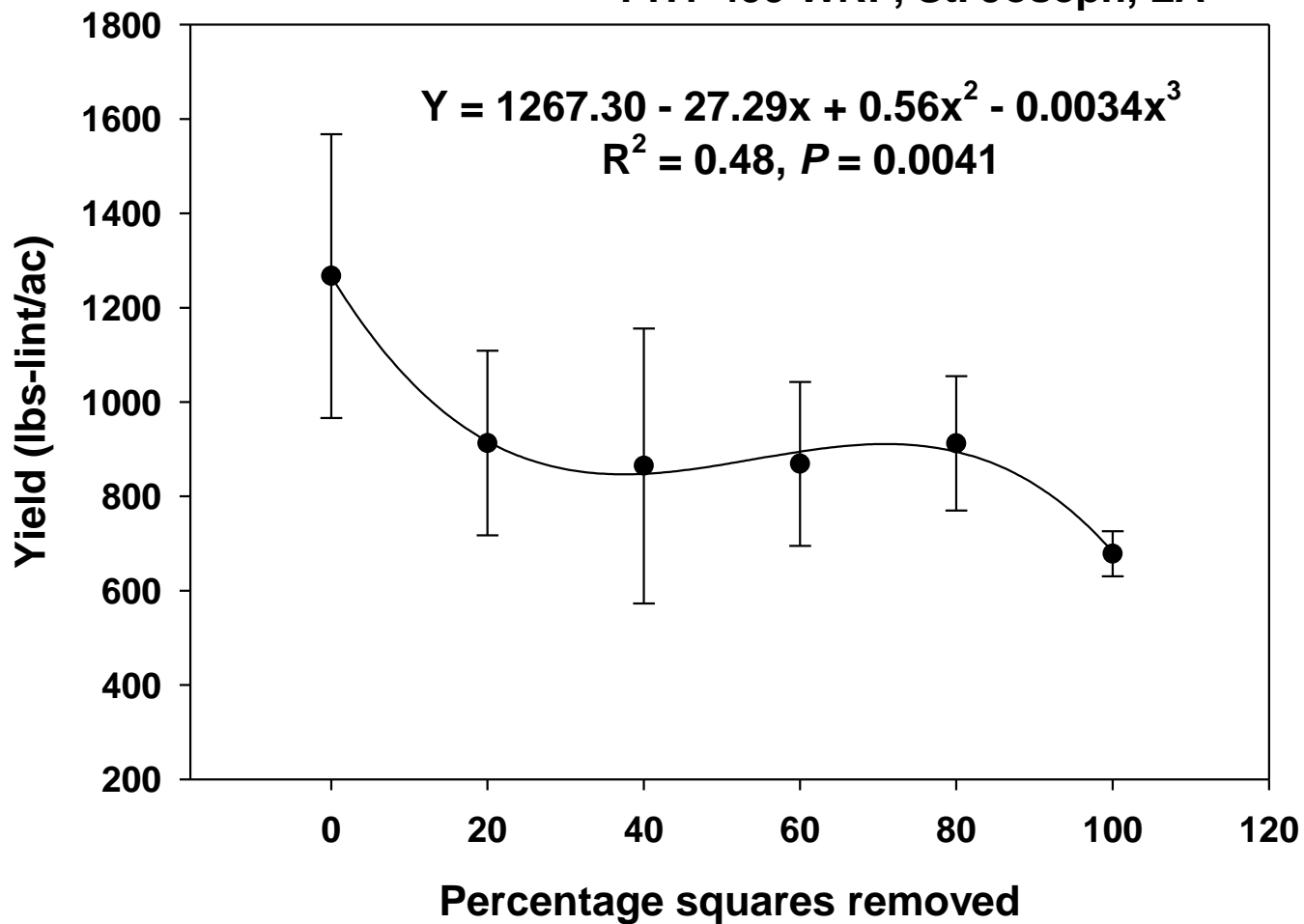
Marksville, LA



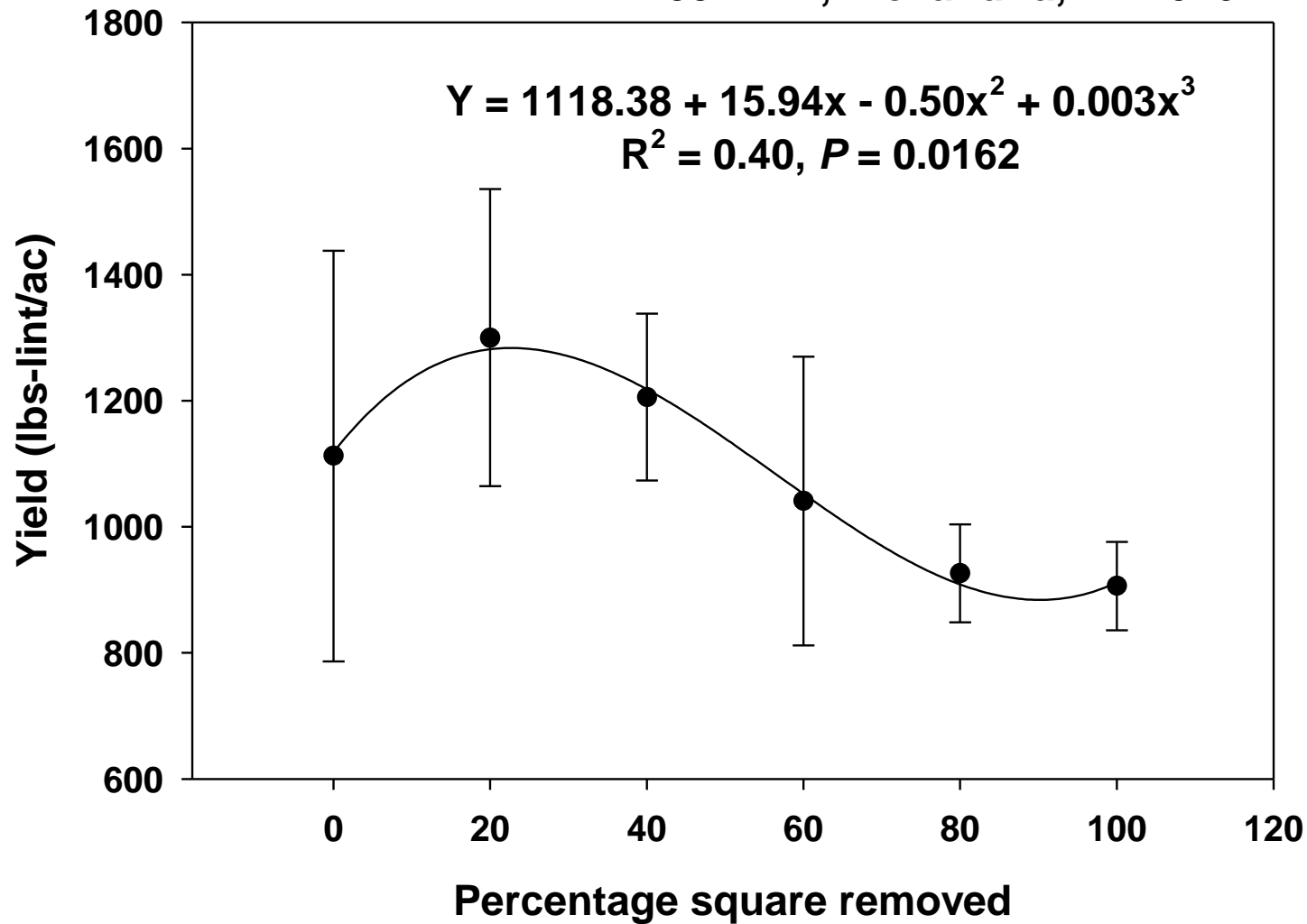
# Compensating early fruit loss

- Planted 2 varieties at 3 locations
  - PHY 499 WRF & PHY 222 WRF
  - Winnsboro, St Joseph and Alexandria
- 1/1000<sup>th</sup> acre sub-plots were used
- In these sub-plots at first bloom, we removed:
  - 0, 20, 40, 60, 80 or 100% of the squares.
- At harvest we plant mapped and hand-picked each plot

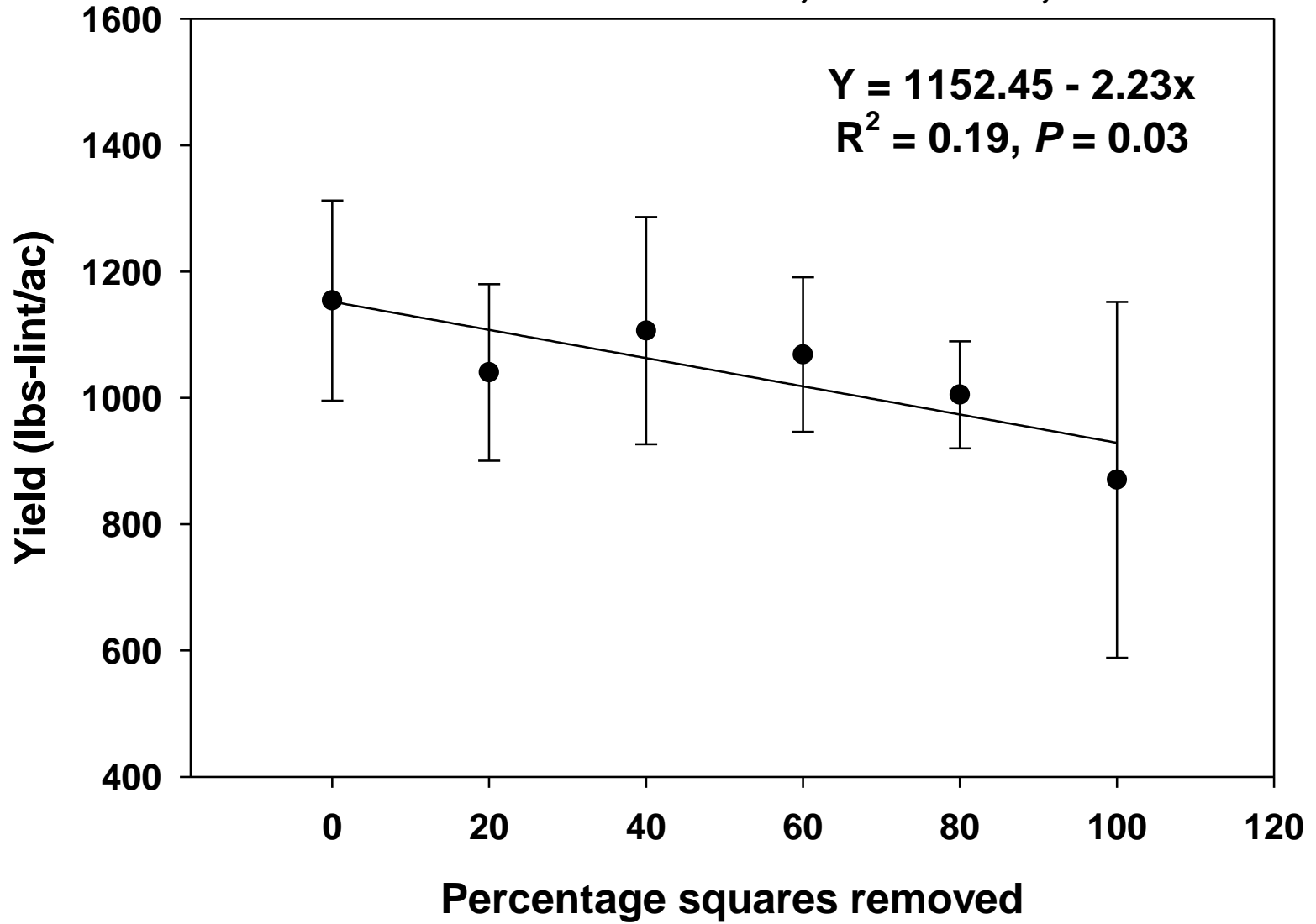
PHY 499 WRF, St. Joseph, LA



# PHY 499 WRF, Alexandria, LA 2016



# PHY 499 WRF, Winnsboro, LA 2016



# Why do we sometimes see unexpected injury in Bt cotton from bollworms?

- Field data demonstrates ALL current Bt cottons can experience unacceptable injury
- Possible contributing factors in Bt efficacy
  - Varietal expression
  - Plant maturity and health
  - Environmental conditions
  - Where eggs are laid
  - Resistance
  - High pest pressure



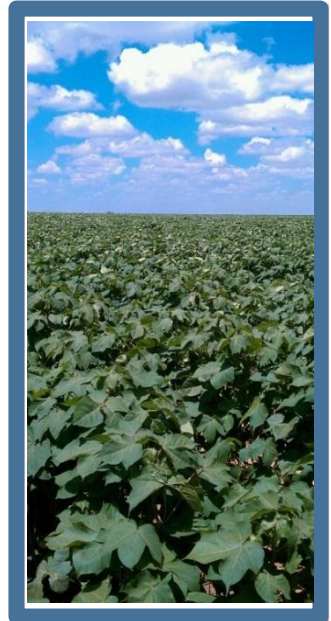


# Current Bt Technologies

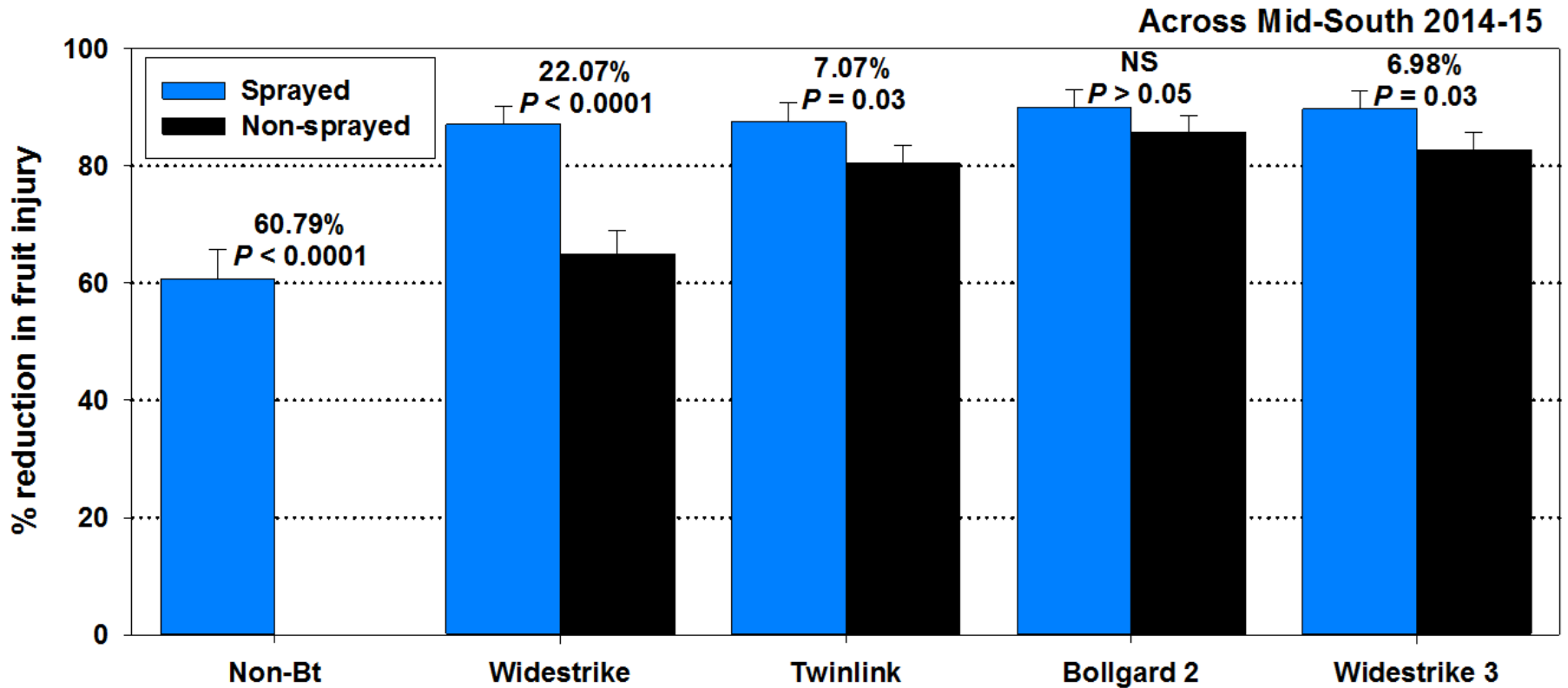
Company	1 <sup>st</sup> generation (single gene)	2 <sup>nd</sup> generation (dual gene)	3 <sup>rd</sup> generation (multi-gene)	3 <sup>rd</sup> generation (2017)
<b>Monsanto</b>	Bollgard (Cry1Ac)	Bollgard 2 (Cry1Ac+Cry2Ab)		Bollgard 3 (Cry1Ac+Cry2Ab+Vip3A)
<b>Dow</b>		WideStrike (Cry1Ac+Cry1F)	WideStrike 3 (Cry1Ac+Cry1F+Vip3A)	
<b>Bayer</b>		TwinLink (Cry1Ab+Cry2Ae)		TwinLink Plus (Cry1Ab+Cry2Ae+Vip3A)

# Experimental Design

- **Conducted during 2014 & 2105**
  - 5 locations in 2014
  - 7 locations in 2015
  - Arkansas, Louisiana, Mississippi and Tennessee
- **Small plot tests**
  - Typically 4 rows x 50 ft plots
- **5 x 2 factorial with 4 replicates**
  - Cotton technologies
  - Insecticide
- **Cotton technologies**
  - **Non-Bt**
    - PHY 315 RF
  - **WideStrike**
    - PHY 499 WRF
      - Cry1Ac + Cry1F
  - **Bollgard II**
    - ST 5288 BG2
      - Cry1Ac + Cry2Ab2
  - **TwinLink**
    - ST 5289 GLT
      - Cry1Ab + Cry2Ae
  - **WideStrike 3**
    - PHY 495 W3RF
      - Cry1Ac + Cry1F + Vip3A
- **Insecticide**
  - **Prevathon 17-20 fl-oz/ac**
  - **Non-sprayed**

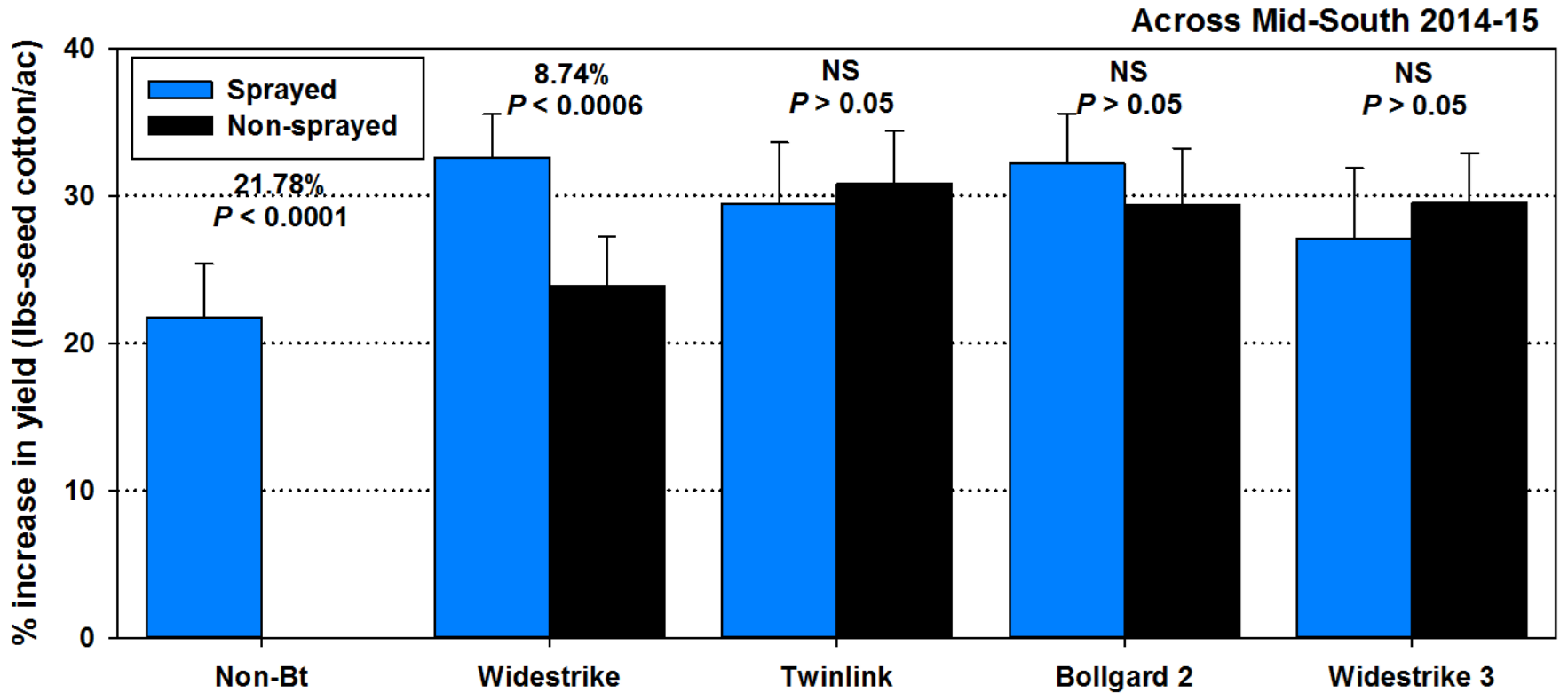






# Injury in Spray vs Non-spray

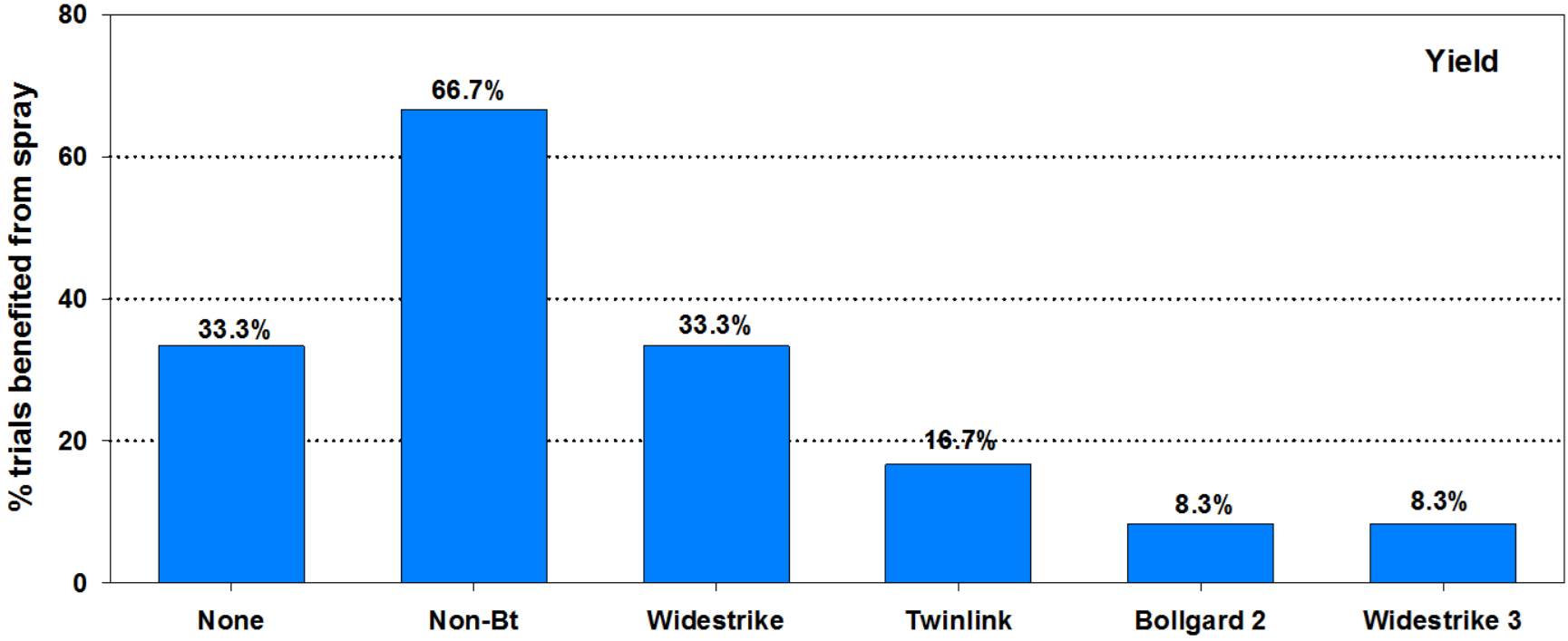




**Yield in Spray  
vs Non-spray**

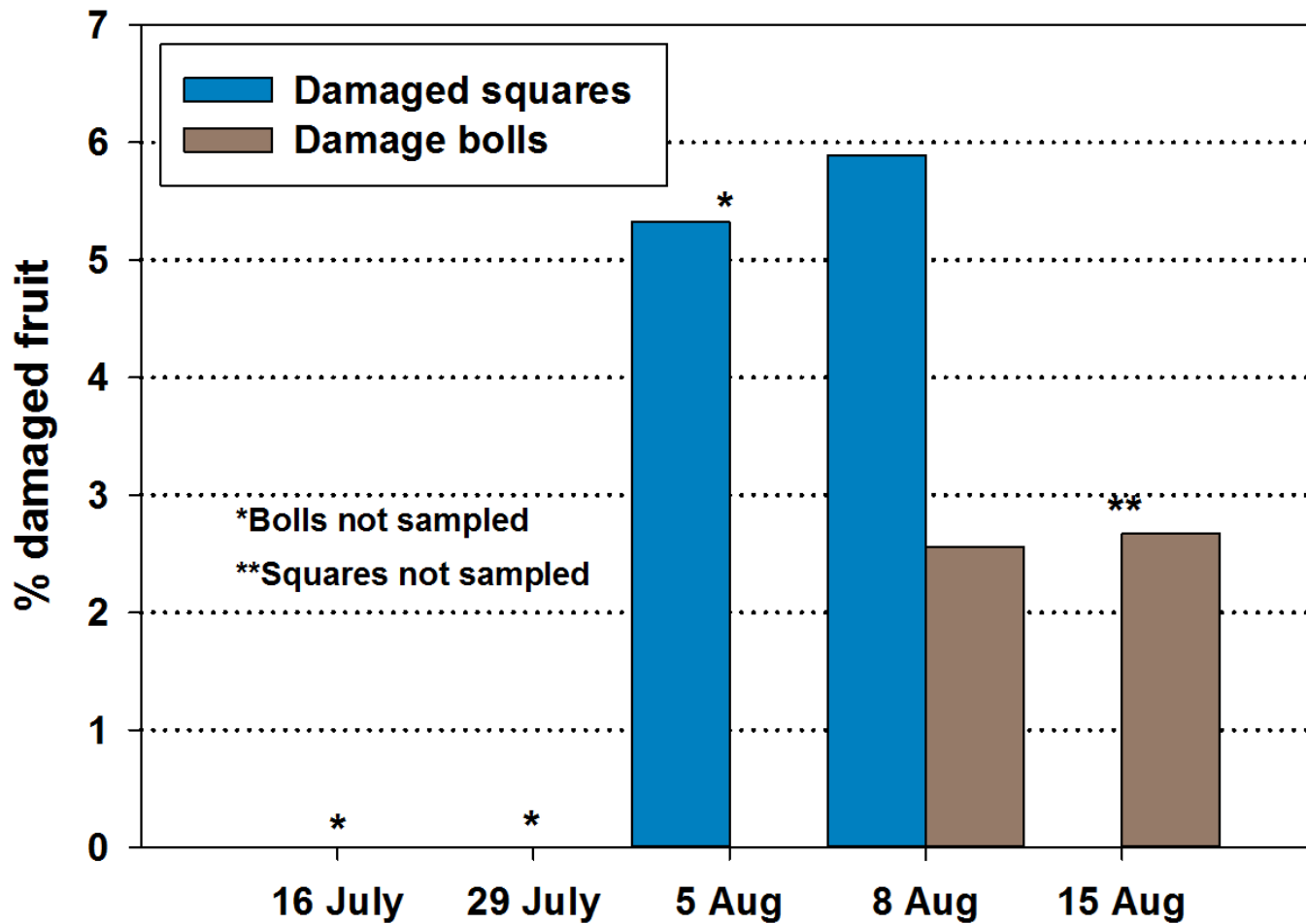


12 trials across Mid-South 2014-15



**% Sites Benefitting from Spray**



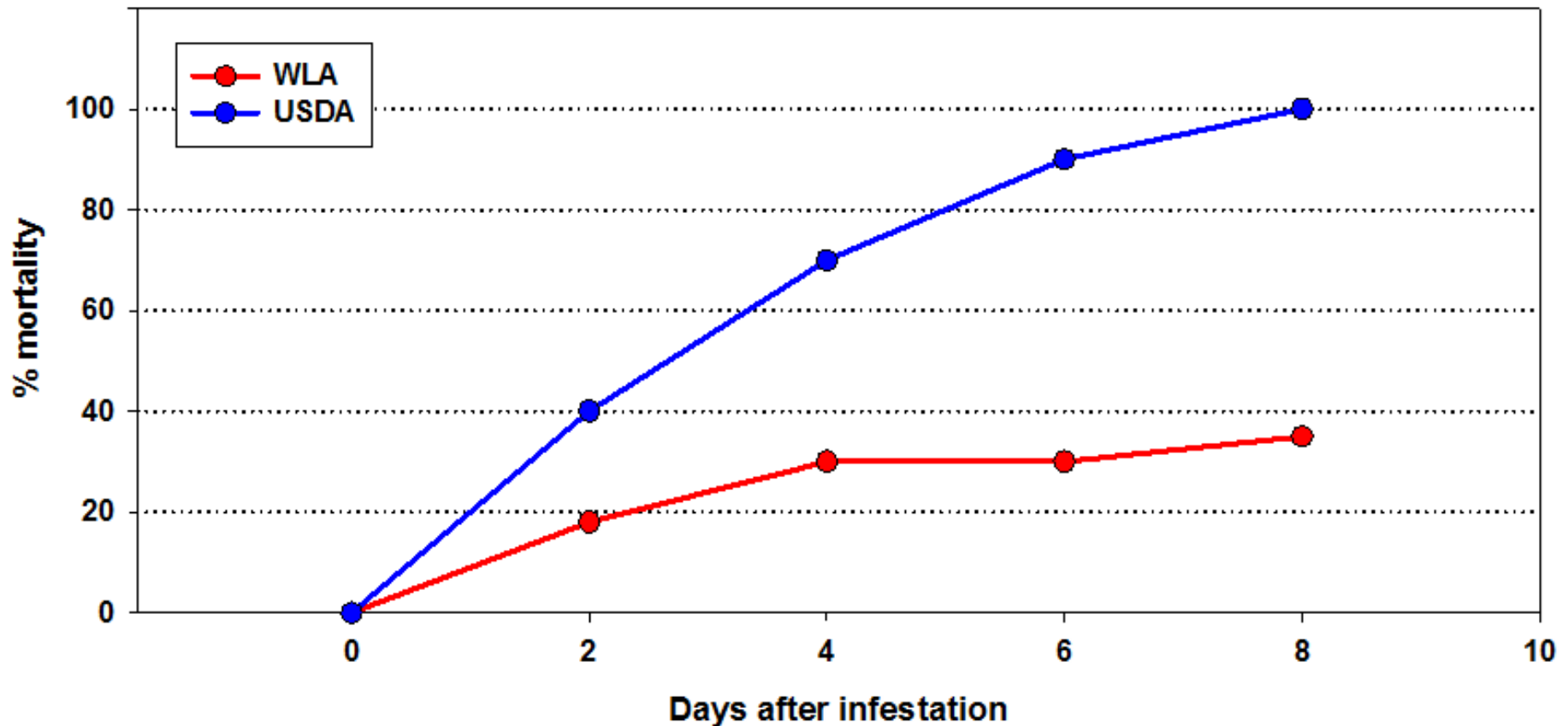


# Injury to WS3 Winnsboro 2015



# F1 Bioassay of Field Collected Larvae on WS3 Cotton

*H. zea* neonates feeding on cotton leaf tissue



# Ranking Current Bt Technologies



**1<sup>st</sup> Gen.**



BG WS

**2<sup>nd</sup> Gen.**



TL

**3<sup>rd</sup> Gen.**



**TwinLink Plus**

**Bollgard 3**

WS3 TL+?  
BG2 BG3?

Good

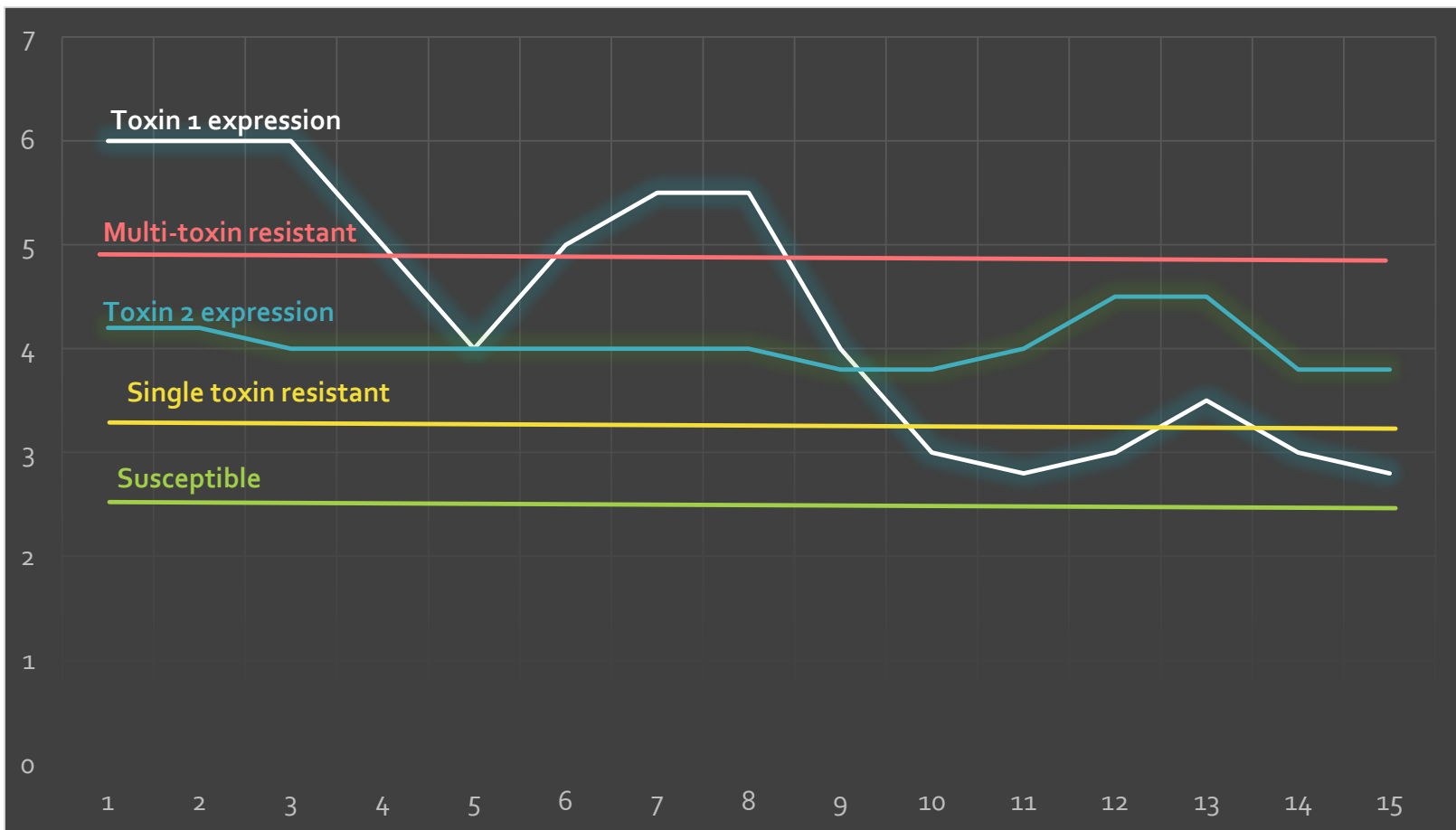


Best



# Near San Angelo – TwinLink Estimated 93% Loss





# Bt Toxin Expression Over Time



<b>Insect strain</b>	<b>Generation</b>	<b>LC<sub>50</sub> (95% CL) (µg/g)</b>	<b>Resistance ratio</b>
USDA-SS	/	0.265 (0.207, 0.339)	1
WB-LA	G1	1.340 (1.038, 1.738)	5.1
BR-LA	G2	> 10	> 37.7
AD-LA	G2	> 10	> 37.7
SV-MS	G1	> 10	> 37.7
SD-MS	G2	6.760 (3.856, 15.443)	25.5
MT-AR	G2	1.291 (1.024, 1.655)	4.9

Susceptibility of CBW to Cry1Ac Protein in Diet-incorporated - 2015

Insect strain	LC <sub>50</sub> -1 (95% CL) (µg/cm <sup>2</sup> )	RR-1	LC <sub>50</sub> -2 (95% CL) (µg/cm <sup>2</sup> )	RR-2
BZ-SS	0.027 (0.023, 0.031)	1.0	0.015 (0.012, 0.017)	1.0
<b>LA-AD</b>	<b>0.942 (0.575, 1.611)</b>	<b>34.9 *</b>	<b>0.412 (0.270, 0.620)</b>	<b>27.5 *</b>
TN-JN	0.202 (0.096, 0.394)	7.5	0.086 (0.038, 0.163)	5.7
TN-BG2	0.237 (0.193, 0.292)	8.8	0.143 (0.109, 0.185)	9.5
<b>MS-LD</b>	<b>1.341 (0.967, 1.930)</b>	<b>49.7 *</b>	<b>0.725 (0.534, 1.004)</b>	<b>48.3 *</b>
AR-TK	0.057 (0.041, 0.075)	2.1	0.024 (0.013, 0.038)	1.6

Susceptibility of CBW to Cry1Ac Protein in Diet-Overlay - 2016

<b>Insect strain</b>	<b>LC<sub>50</sub>-1 (95% CL) (<math>\mu\text{g}/\text{cm}^2</math>)</b>	<b>RR-1</b>	<b>LC<sub>50</sub>-2 (95% CL) (<math>\mu\text{g}/\text{cm}^2</math>)</b>	<b>RR-2</b>
BZ-SS	0.13 (0.10, 0.17)	1.0	0.09 (0.07, 0.11)	1.0
LA-AD	6.03 (4.32, 8.59)	46.4 *	3.21 (2.19, 4.59)	35.7 *
TN-JN	17.34 (12.42, 26.71)	133.4*	12.00 (9.00, 16.55)	133.3*
TN-BG2	1.78 (1.35, 2.42)	13.7 *	0.36 (0.30, 0.43)	4.0
MS-LD	1.36 (0.94, 2.06)	10.5 *	0.77 (0.56, 1.07)	8.6
AR-TK	0.31 (0.21, 0.47)	2.4	0.09 (0.06, 0.12)	1.0

# Susceptibility of CBW to Cry2Ab2 Protein in Diet-Overlay - 2016

<b>Insect strain</b>	<b>LC<sub>50</sub>-1 (95% CL) (<math>\mu\text{g}/\text{cm}^2</math>)</b>	<b>RR-1</b>	<b>LC<sub>50</sub>-2 (95% CL) (<math>\mu\text{g}/\text{cm}^2</math>)</b>	<b>RR-2</b>
BZ-SS	0.97 (0.85, 1.11)	1.0	0.82 (0.69, 0.97)	1.0
LA-AD	0.19 (0.15, 0.24)	-5.1	0.12 (0.10, 0.14)	-6.8
TN-JN	0.16 (0.12, 0.21)	-6.1	0.13 (0.09, 0.17)	-6.3
TN-BG2	0.18 (0.13, 0.23)	-5.4	0.12 (0.09, 0.16)	-6.8
MS-LD	0.14 (0.12, 0.16)	-6.9	0.11 (0.09, 0.12)	-7.5
AR-TK	0.17 (0.13, 0.23)	-5.7	0.13 (0.10, 0.17)	-6.3

# Susceptibility of CBW to Vip3a Protein in Diet-Overlay - 2016



# When to spray?

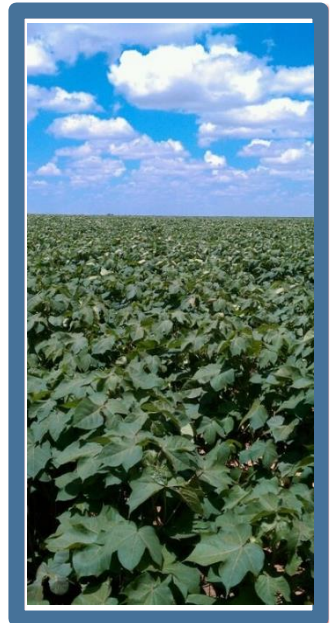




# Field Validation

- **Conducted during 2016**
  - 8 locations
  - Arkansas, Louisiana, Mississippi, Missouri and Tennessee
- **Small plot tests**
  - Typically 4 rows x 50 ft plots
- **3 x 3 factorial with 4 replicates**
  - Cotton technologies
  - Insecticide timing
- **Cotton technologies**
  - **Non-Bt**
    - DP 1441 RF
  - **Widestrike**
    - PHY 499 WRF
      - Cry1Ac + Cry1F
  - **Bollgard II**
    - ST 4946 BG2RF
      - Cry1Ac + Cry2Ab2
- **Insecticide timing**
  - **Non-treated**
  - **Preventative**
  - **Threshold of 6% injured fruit**
    - **Prevathon 19 fl-oz/ac**

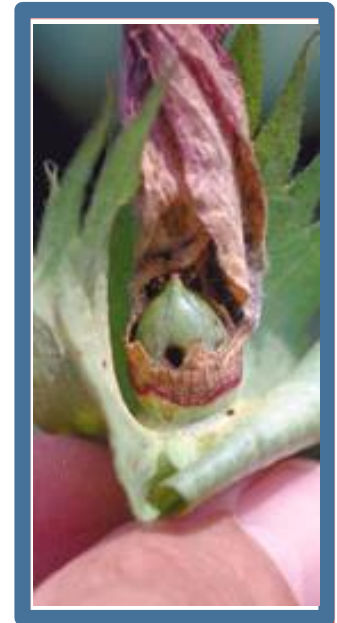
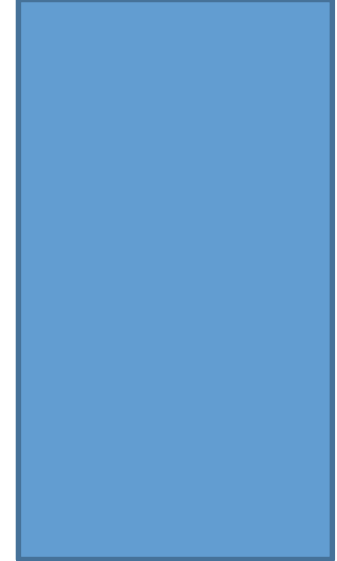
- Estimated Prevathon at 19 fl-oz + application cost at \$22.50
- Estimated Bt tech fees at \$27.00

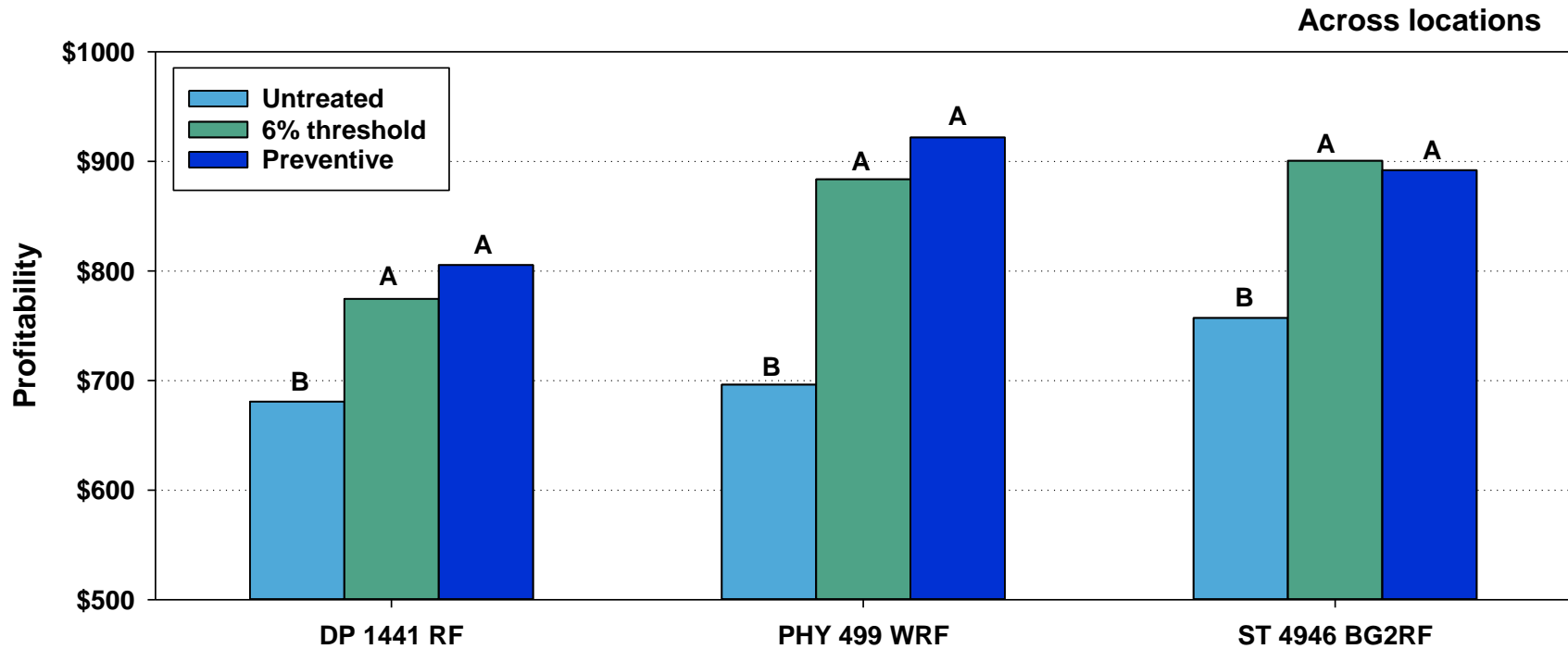


# Economic Threshold (% fruit injury)

*Set ET at 70% of EIL {ET ≈ 5-9% fruit injury}*

Value (\$/ac)	Low yield 800 lbs/ac		Med yield 1200 lbs/ac		High yield 1400 lbs/ac	
	EIL	ET	EIL	ET	EIL	ET
0.60	14.76	10.33	9.84	6.89	8.44	5.90
0.65	13.63	9.54	9.08	6.36	7.79	5.45
0.70	12.65	8.86	8.44	5.90	7.23	5.06
0.75	11.81	8.27	7.87	5.51	6.75	4.72
0.80	11.07	7.75	7.38	5.17	6.33	4.43
0.85	10.42	7.29	6.95	4.86	5.95	4.17
0.90	9.84	6.89	6.56	4.59	5.62	3.94
0.95	9.32	6.53	6.22	4.35	5.33	3.73
1.00	8.86	6.20	5.90	4.13	5.06	3.54





Variety ( $P = 0.0926$ ); Spray timing ( $P = 0.0017$ ); Variety X Spray timing ( $P = 0.8705$ )

$$\text{Profitability} = (\text{Yield} \times \text{Value} [\$0.70]) - ((\text{Insecticide} + \text{application costs} [\$22.50]) \times \# \text{ applications}) + \text{Bt tech fee} (\$27.00)$$

# Profitability



# Conclusions



- Setting every square is not critical
- Early season TPB control is forgiving
- No Bt cotton variety or technology is immune to unacceptable bollworm injury.
- Give the technology a chance to work.
- Based control decision on fruit injury with the presence of live larvae.
- Fruit injury threshold ranges from 3.54-10.33%. 6% is a good middle of the road threshold.

# EPA is Assessing All Pyrethroids

- In registration review, EPA is assessing whether pesticides continue to meet the registration requirements established under the Federal Insecticide, Fungicide and Rodenticide Act.
- Pyrethroids are among the only remaining broad-spectrum insecticides available for many crop uses and, in some cases, there are few or no effective alternatives.
- All pyrethroid and pyrethrin active ingredients are entering the preliminary risk assessment phase of registration review, including:
  - Bifenthrin (**Capture<sup>®</sup> LFR<sup>®</sup> insecticide**)
  - Cyfluthrin (**Baythroid<sup>®</sup> insecticide**)
  - Lambda-Cyhalothrin (**Warrior<sup>®</sup> insecticide**)
  - Gamma-Cyhalothrin (**Declare<sup>®</sup> insecticide**)
  - Cypermethrin (**Mustang<sup>®</sup> insecticide**)
  - Deltamethrin (**Decis<sup>®</sup> insecticide**)
  - Esfenvalerate (**Asana<sup>®</sup> insecticide**)
  - Fenpropathrin (**Danitol<sup>®</sup> insecticide**)
  - Permethrin (**Pounce<sup>®</sup> insecticide**)



**Capture LFR/3RIVE 3D Insecticide, Baythroid, Warrior, Declare Insecticide, Mustang insecticide, Decis, Asana, Danitol and Pounce insecticide are Restricted Use Pesticides.** Always read and follow label directions. Capture, LFR, 3RIVE 3D, Declare, Mustang and Pounce are trademarks of FMC Corporation or an affiliate. Baythroid and Decis are trademarks of Bayer. Warrior is a trademark of Syngenta Group Company. Asana and Danitol are trademarks of Sumitomo Chemical Company, Ltd. ©2016 FMC Corporation. All rights reserved.

# How to Comment

- Visit [www.defendbifenthrin.com](http://www.defendbifenthrin.com)
- Select the category that best applies to you
- Customize and submit your comments
- Comments uploaded through this platform will automatically be submitted to EPA's bifenthrin docket
- **Comments are due by March 31, 2017**



The EPA's recent risk assessment for the pyrethroid class of insecticides — reliable, effective pest control tools used by growers nationwide — will dramatically limit farmers' choices in crop protection products. The agency's overly conservative risk predictions are based on oversimplified science and place farmers' ability to use bifenthrin — a common pyrethroid insecticide used on more than 14 million acres annually — at risk.

### Act today to defend bifenthrin

The 60-day comment period is open now. You have important information the EPA needs to hear.

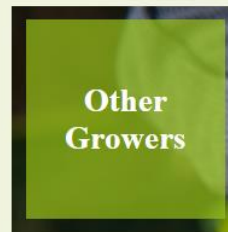
- Explain how you responsibly use pest management products containing bifenthrin on your farm.
- Outline the benefits, your actual use patterns and the critical nature of bifenthrin for agriculture.
- Request that the EPA not place any unnecessary label restrictions on bifenthrin that could limit your access to this important pest control tool.

Without vital context and input from those who use these products, the EPA could further encroach on your pest management options and severely limit your freedom to operate. The comment period is scheduled to close January 30, 2017.

### Submit your comments to the EPA

Please select the most appropriate category below to share with the EPA the importance of bifenthrin as a sustainable, economical and effective pest control tool.

#### Choose Your Role:



[www.defendbifenthrin.com](http://www.defendbifenthrin.com)

# Questions?

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