Cotton Insect Update

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Marksville, LA

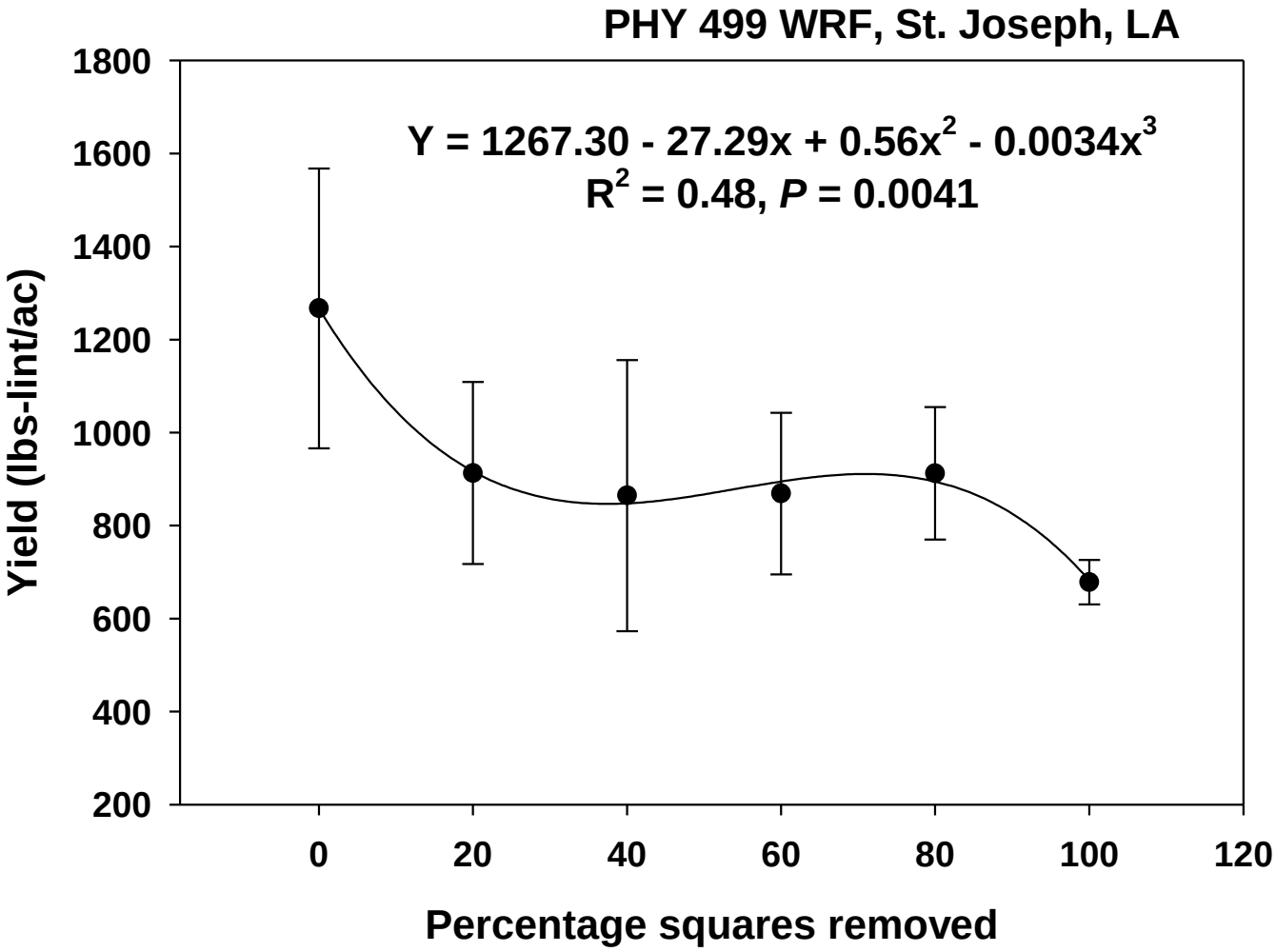
MSEWG Mid-South Entomologist Working Group

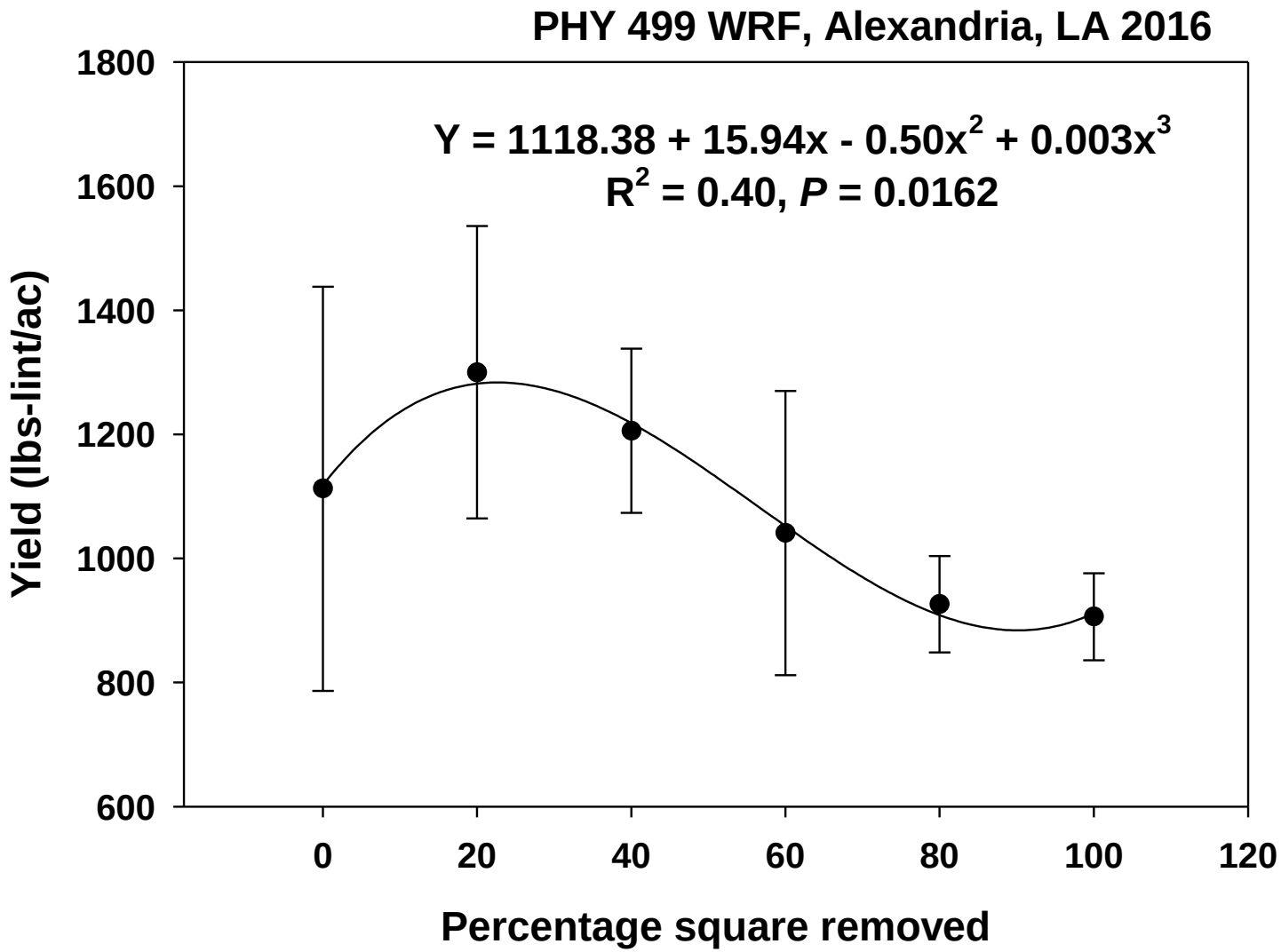
cotton

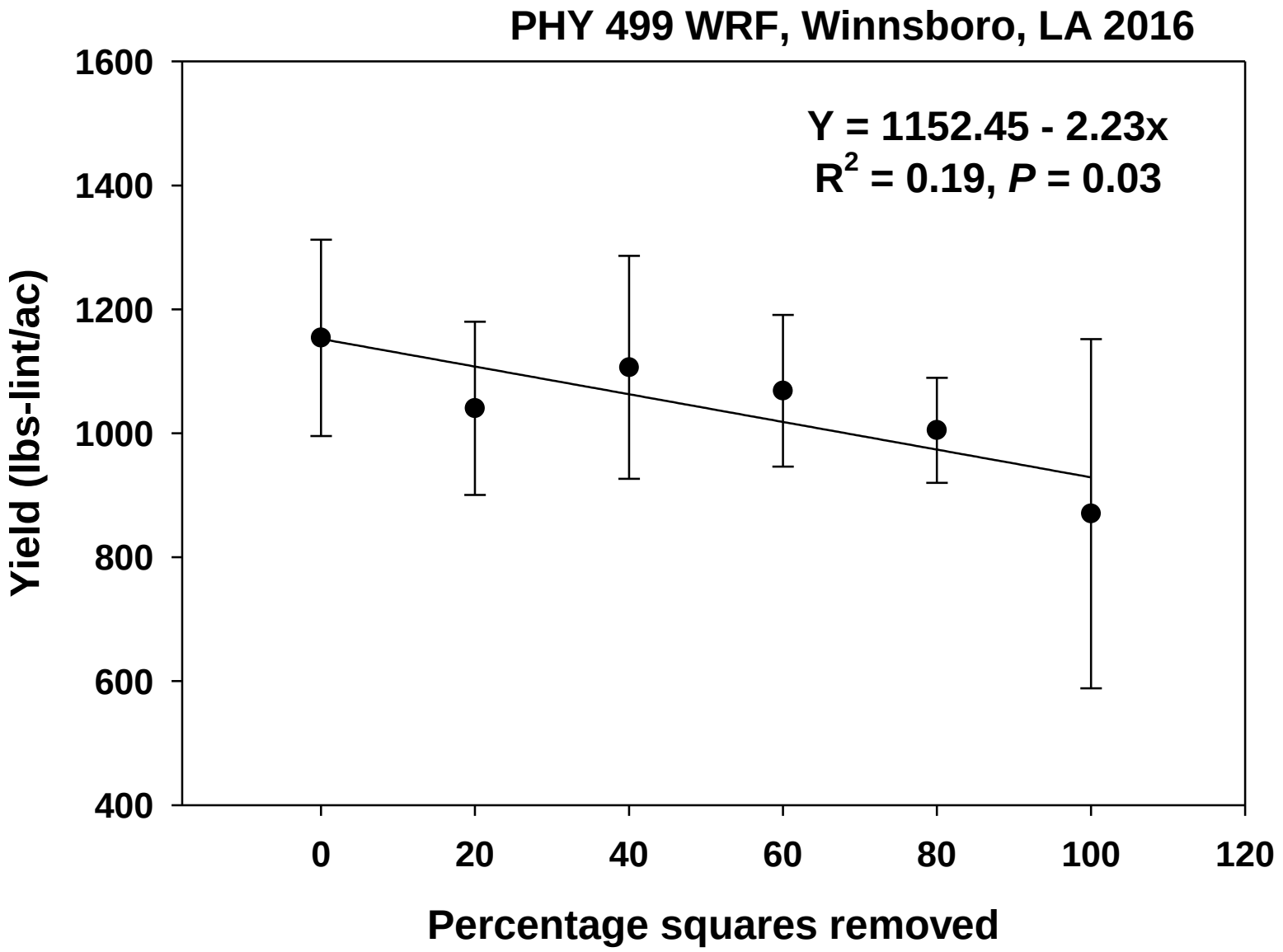
LSU AgCenter Research · Extension · Teaching

Compensating early fruit loss

- Planted 2 varieties at 3 locations
  - PHY 499 WRF & PHY 222 WRF
  - Winnsboro, St Joseph and Alexandria
- 1/1000th 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

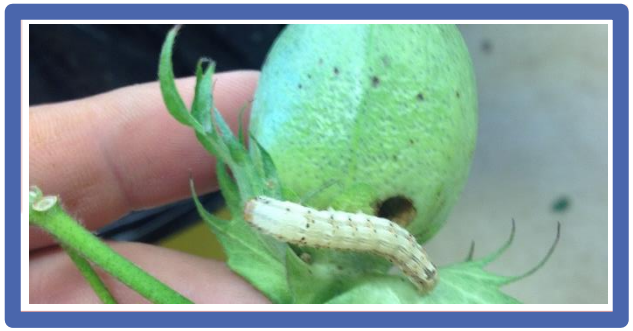

PHY 499 WRF, St. Joseph, LA
Y = 1267.30 - 27.29x + 0.56x2 - 0.0034x3
R2 = 0.48, P = 0.0041
Yield (lbs-lint/ac)
1800
1600
1400
1200
1000
800
600
400
200
0
20
40
60
80
100
120
Percentage squares removed


PHY 499 WRF, Alexandria, LA 2016
Y = 1118.38 + 15.94x - 0.50x2 + 0.003x3
R2 = 0.40, P = 0.0162
Yield (lbs-lint/ac)
1800
1600
1400
1200
1000
800
600
0
20
40
60
80
100
120
Percentage square removed


PHY 499 WRF, Winnsboro, LA 2016
Y = 1152.45 - 2.23x
R2 = 0.19, P = 0.03
Yield (lbs-lint/ac)
1600
1400
1200
1000
800
600
400
0
20
40
60
80
100
120
Percentage squares removed

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



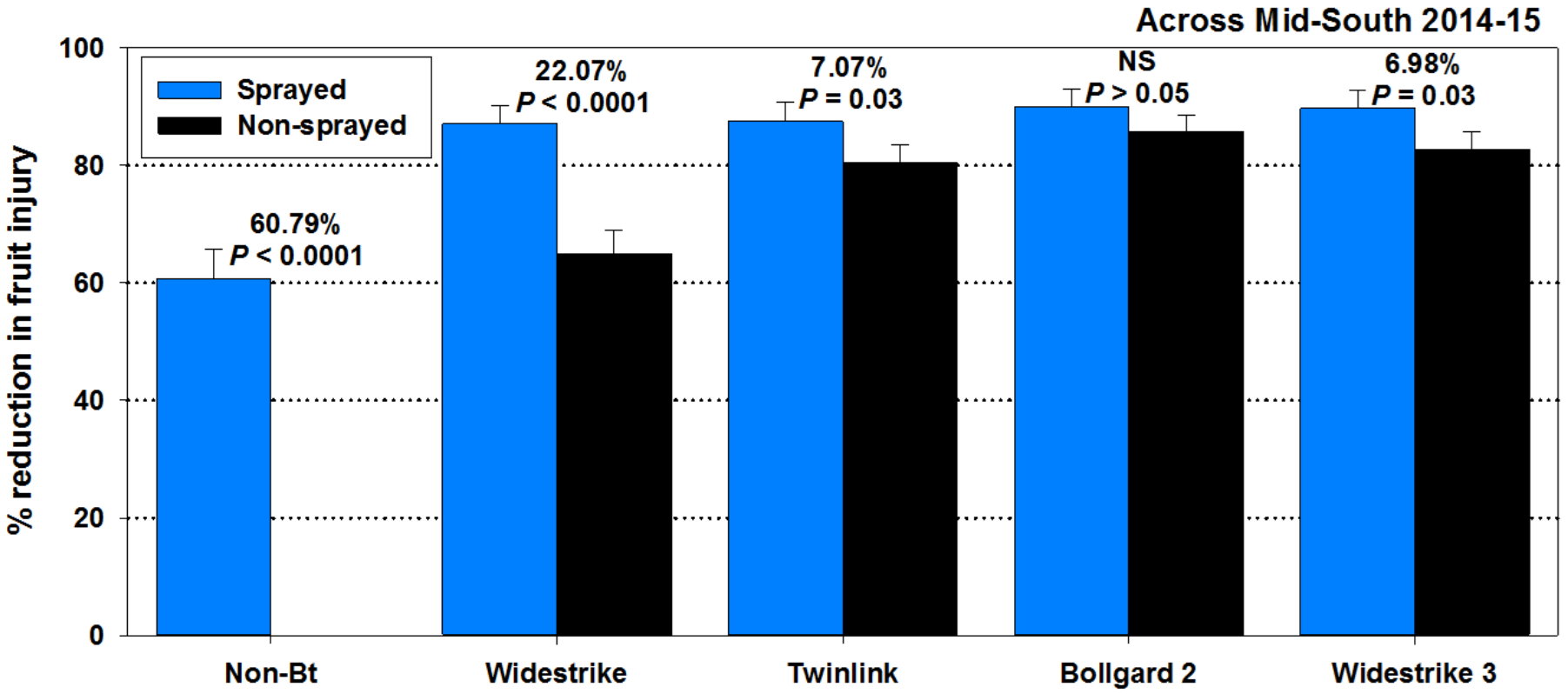
Current Bt Technologies

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

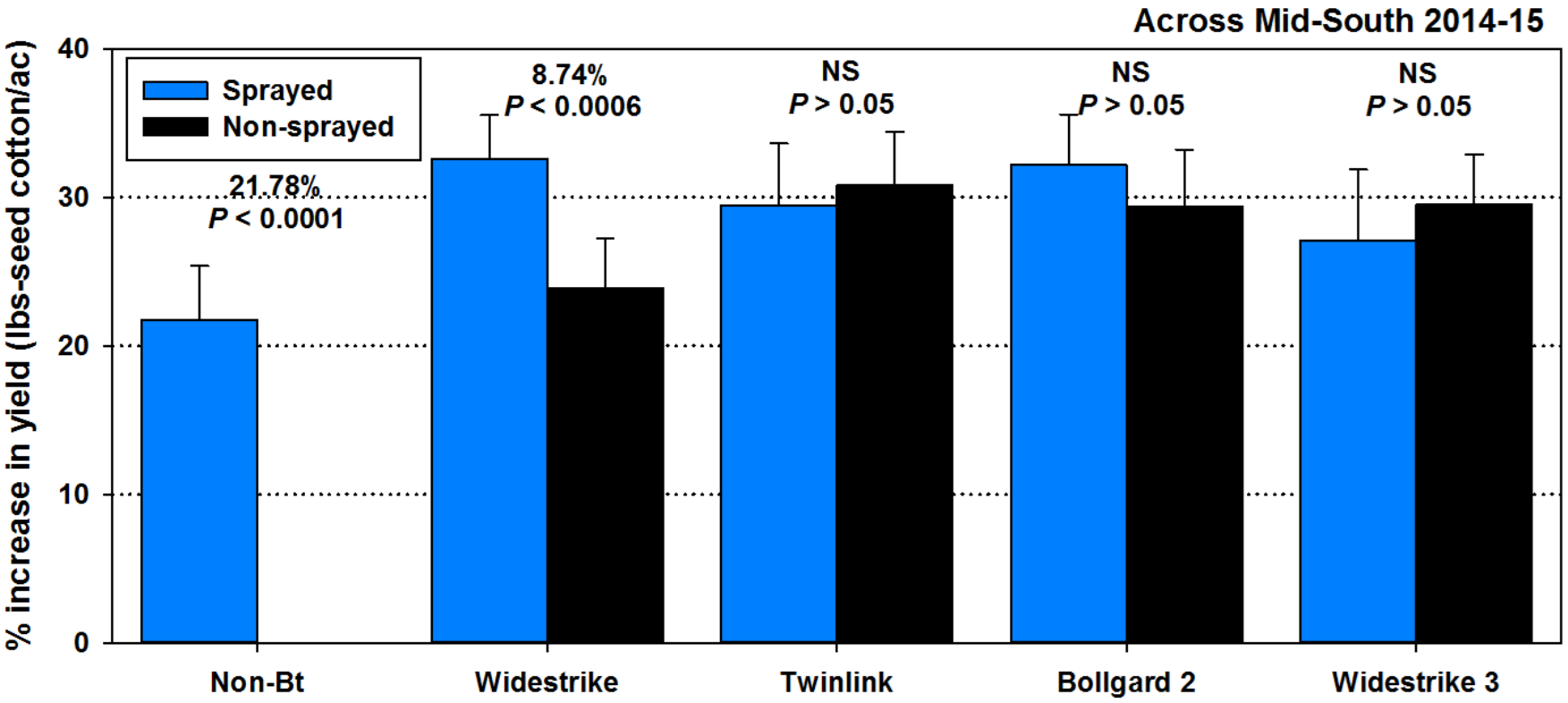
Experimental Design

- 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

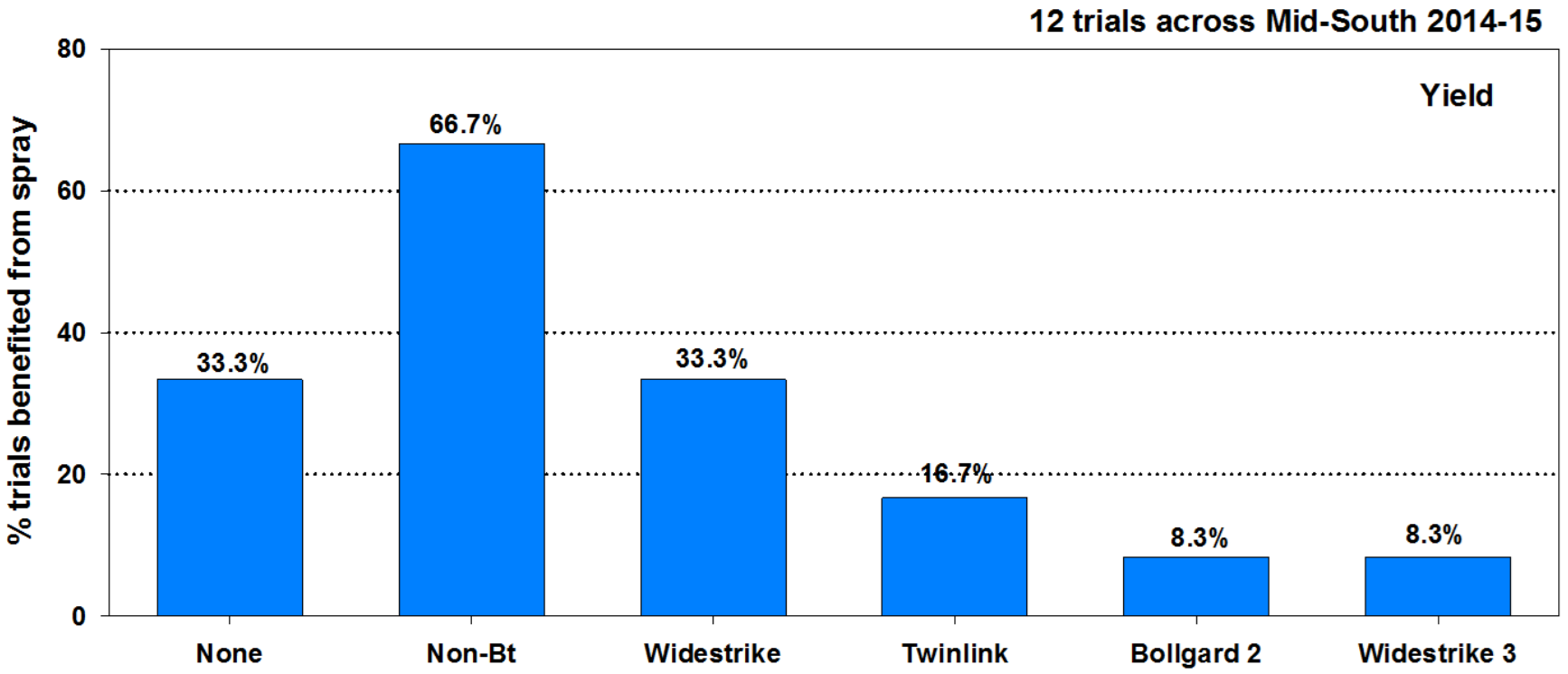
- Cotton technologies
  - Non-Bt
    - PHY 315 RF
  - WideStrike
    - PHY 499 WRF
      - Cry1Ac + Cry1F
  - Bollgard II
    - ST 5288 BG2
      - Cry1Ac + Cry2Ab2
  - TwinLink
    - ST 5289 GLT
      - Cry1Ab + Cry2Ae
  - WideStrike 3
    - PHY 495 W3RF
      - Cry1Ac + Cry1F + Vip3A
- Insecticide
  - Prevathon 17-20 fl-oz/ac
  - Non-sprayed



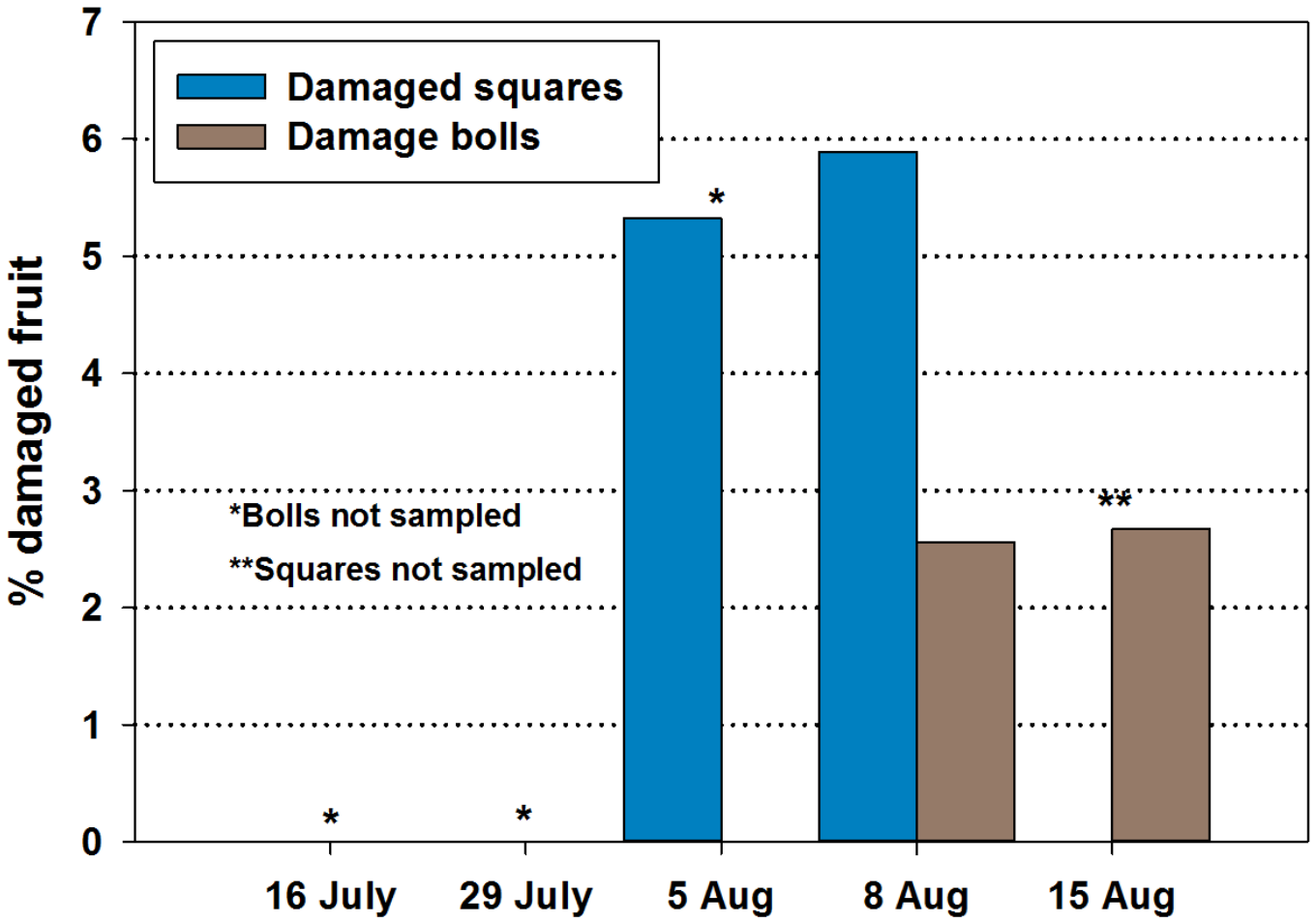
Injury in Spray vs Non-spray



Yield in Spray vs Non-spray

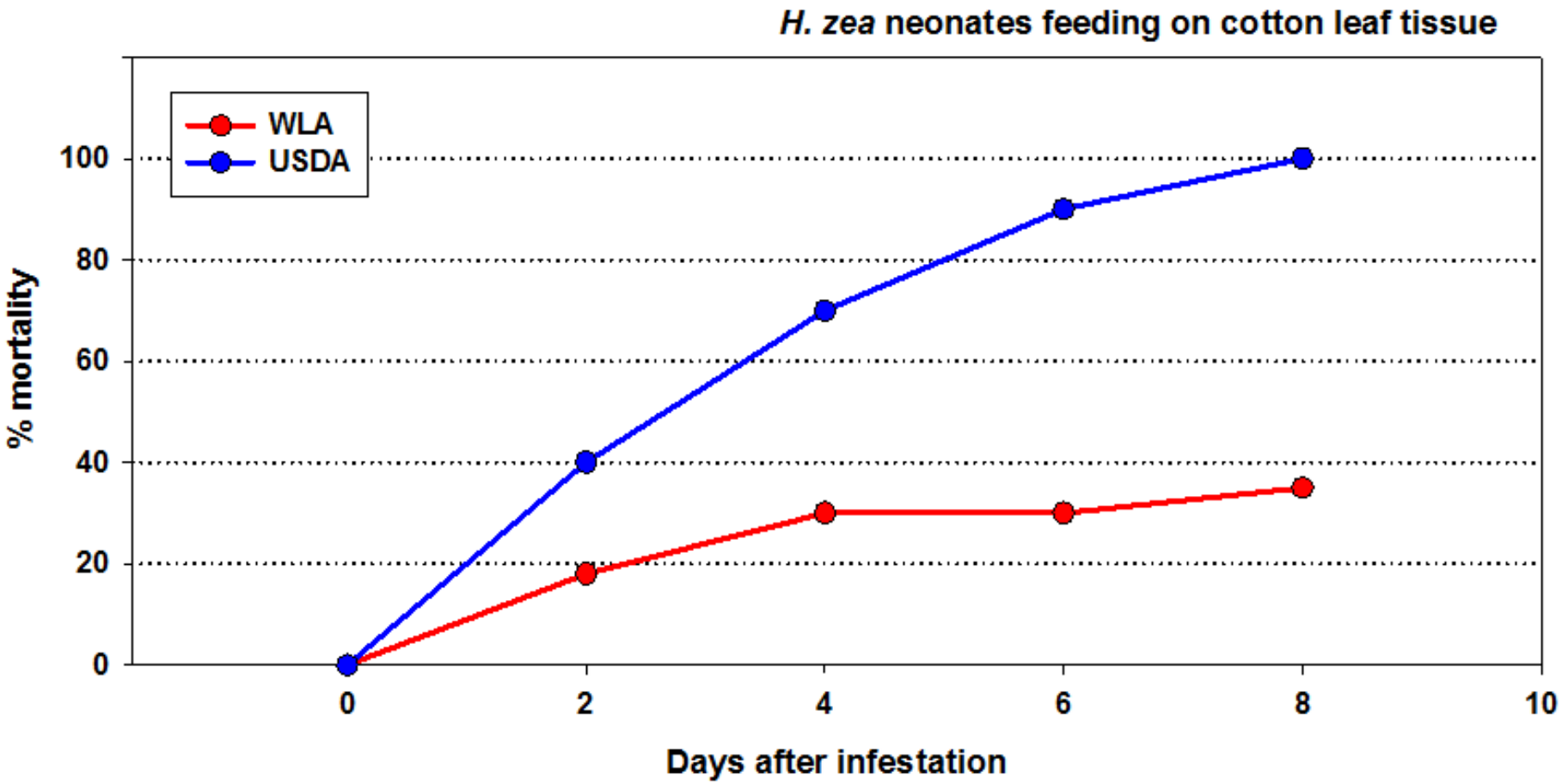


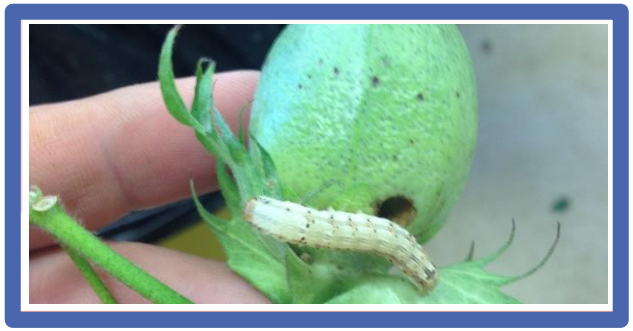
% Sites Benefitting from Spray



Injury to WS3 Winnsboro 2015

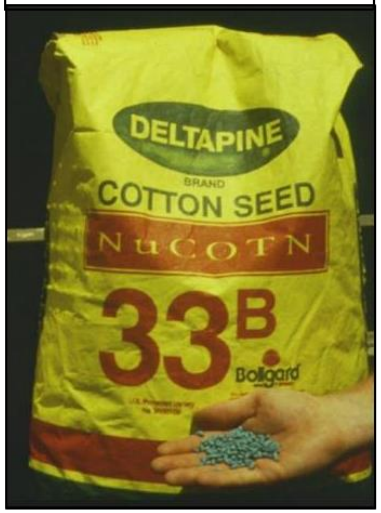
F1 Bioassay of Field Collected Larvae on WS3 Cotton





Ranking Current Bt Technologies

1st Gen.



2nd Gen.

TwinLink

3rd Gen.

TwinLink Plus

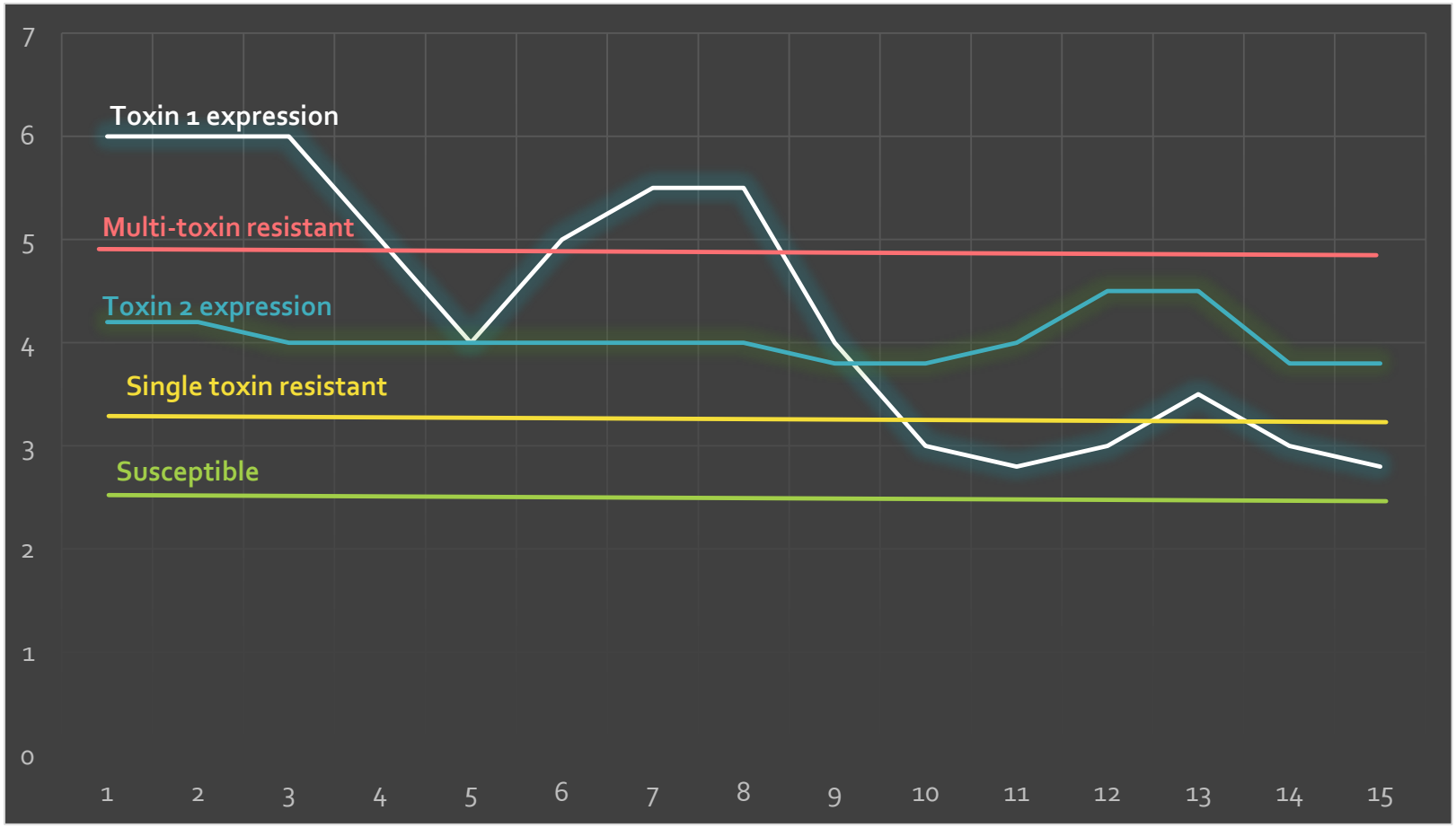
Bollgard3

WS3 TL+?

BG WS TL BG2 BG3?

Good → Best

Near San Angelo – TwinLink Estimated 93% Loss



Bt Toxin Expression Over Time

Insect strain	Generation	LC_{50} (95% CL) (µg/g)	Resistance ratio
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_{50}-1 (95% CL) ($\mu g/cm^2$)	RR-1	LC_{50}-2 (95% CL) ($\mu g/cm^2$)	RR-2
BZ-SS	0.027 (0.023, 0.031)	1.0	0.015 (0.012, 0.017)	1.0
LA-AD	**0.942 (0.575, 1.611)**	**34.9 ***	**0.412 (0.270, 0.620)**	**27.5 ***
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
MS-LD	**1.341 (0.967, 1.930)**	**49.7 ***	**0.725 (0.534, 1.004)**	**48.3 ***
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

Insect strain	LC_{50}-1 (95% CL) ($\mu g/cm^2$)	RR-1	LC_{50}-2 (95% CL) ($\mu g/cm^2$)	RR-2
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

Insect strain	LC_{50}-1 (95% CL) ($\mu g/cm^2$)	RR-1	LC_{50}-2 (95% CL) ($\mu g/cm^2$)	RR-2
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

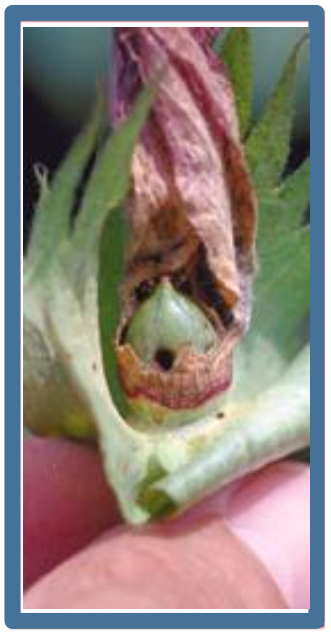
- Cotton technologies
  - Non-Bt
    - DP 1441 RF
  - Widestrike
    - PHY 499 WRF
      - Cry1Ac + Cry1F
  - Bollgard II
    - ST 4946 BG2RF
      - Cry1Ac + Cry2Ab2
- Insecticide timing
  - Non-treated
  - Preventative
  - Threshold of 6% injured fruit
    - Prevathon 19 fl-oz/ac

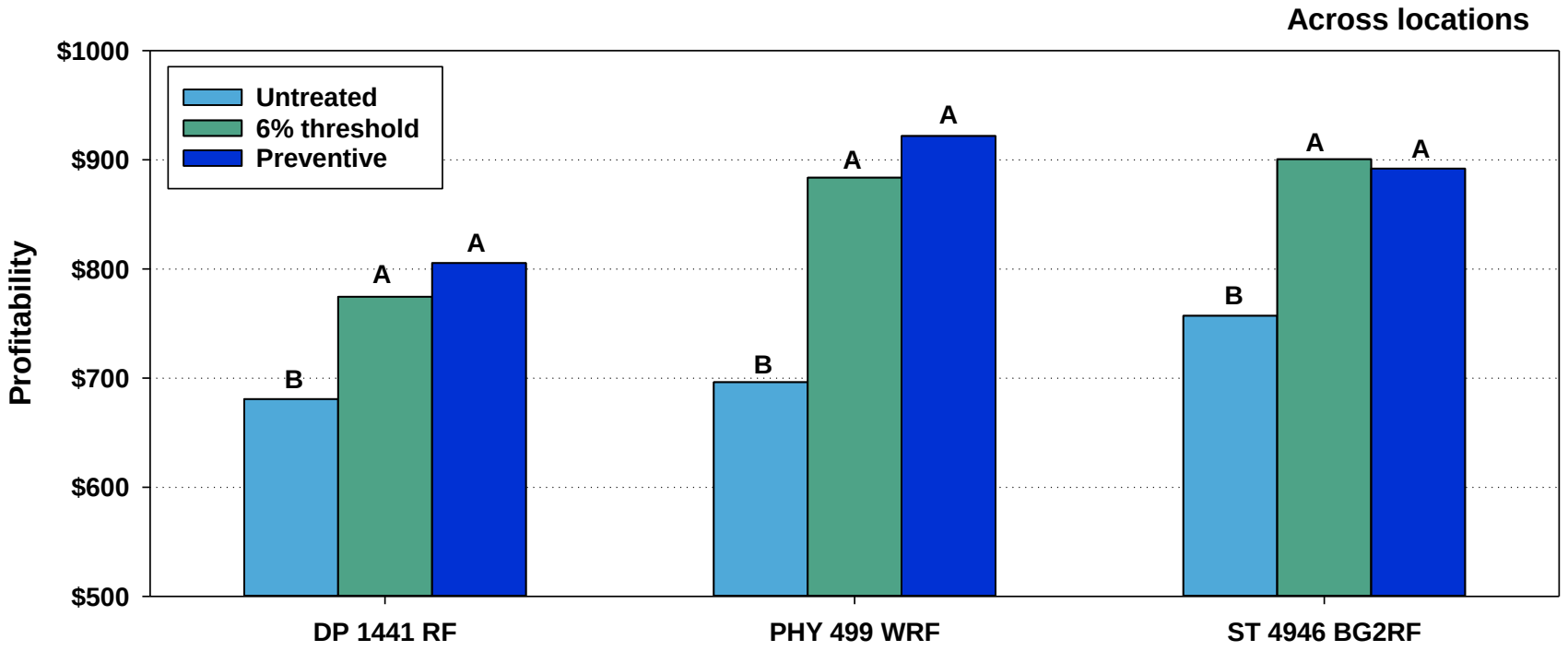
- Estimated Prevathon at 19 fl-oz + application cost at $22.50
- Estimated Bt tech fees at $27.00

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)

Profitability = (Yield x Value [$.70]) – ((Insecticide + application costs [$22.50]) x # applications) + 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.

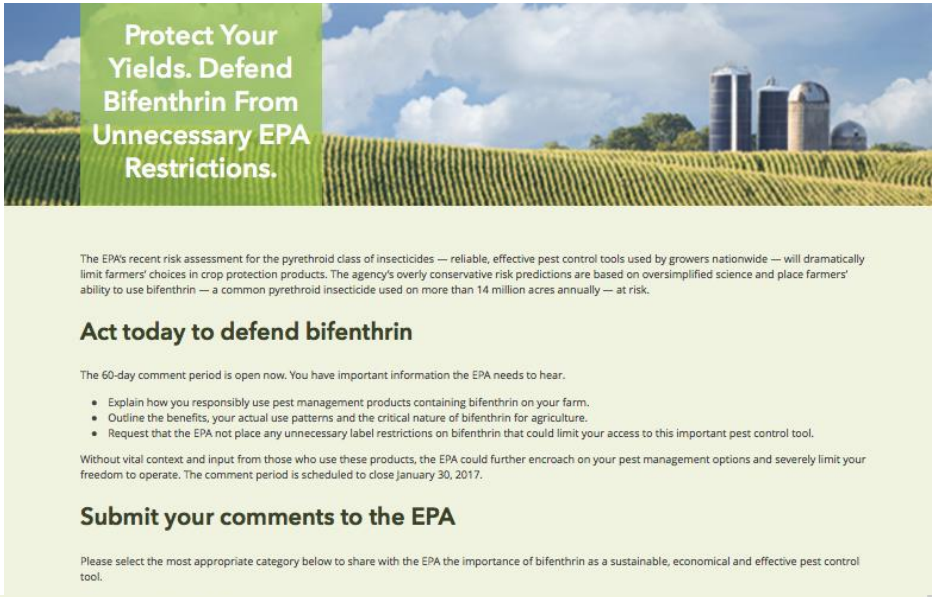
- Pyrethroids are among the only remaining broad-spectrum insecticides available for many crop uses and, in some cases, there are few or no effective alternatives.

- All pyrethroid and pyrethrin active ingredients are entering the preliminary risk assessment phase of registration review, including:

  - Bifenthrin **(Capture® LFR® insecticide)**
  - Cyfluthrin **(Baythroid® insecticide)**
  - Lambda-Cyhalothrin **(Warrior® insecticide)**
  - Gamma-Cyhalothrin **(Declare® insecticide)**
  - Cypermethrin **(Mustang® insecticide)**
  - Deltamethrin **(Decis® insecticide)**
  - Esfenvalerate **(Asana® insecticide)**
  - Fenpropathrin **(Danitol® insecticide)**
  - Permethrin **(Pounce® insecticide)**

How to Comment

- Visit **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**



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Questions?

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