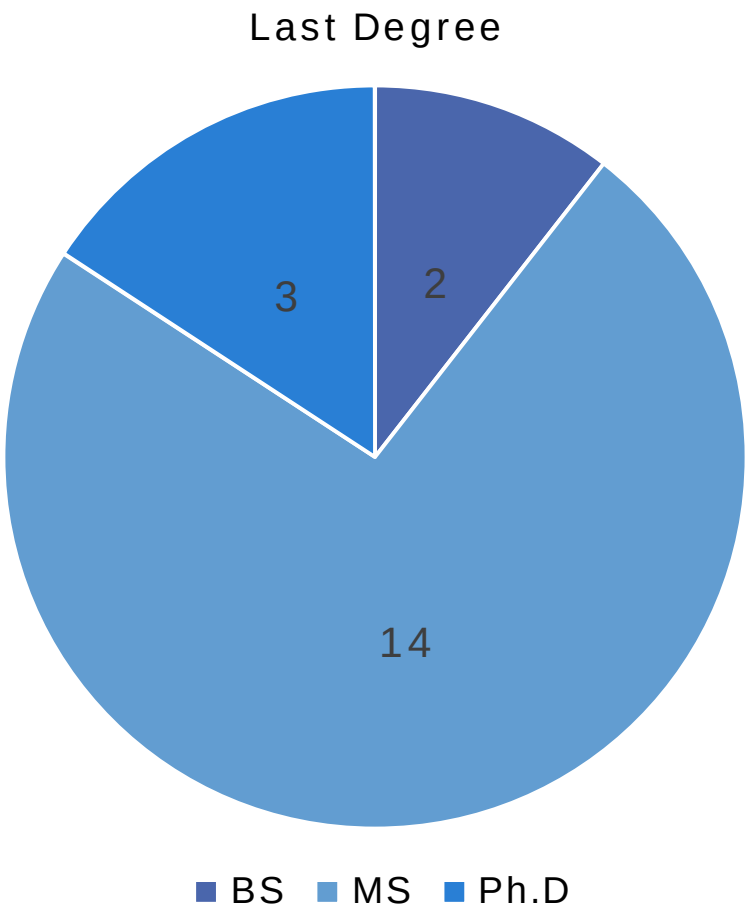
Texas IPM Program Update

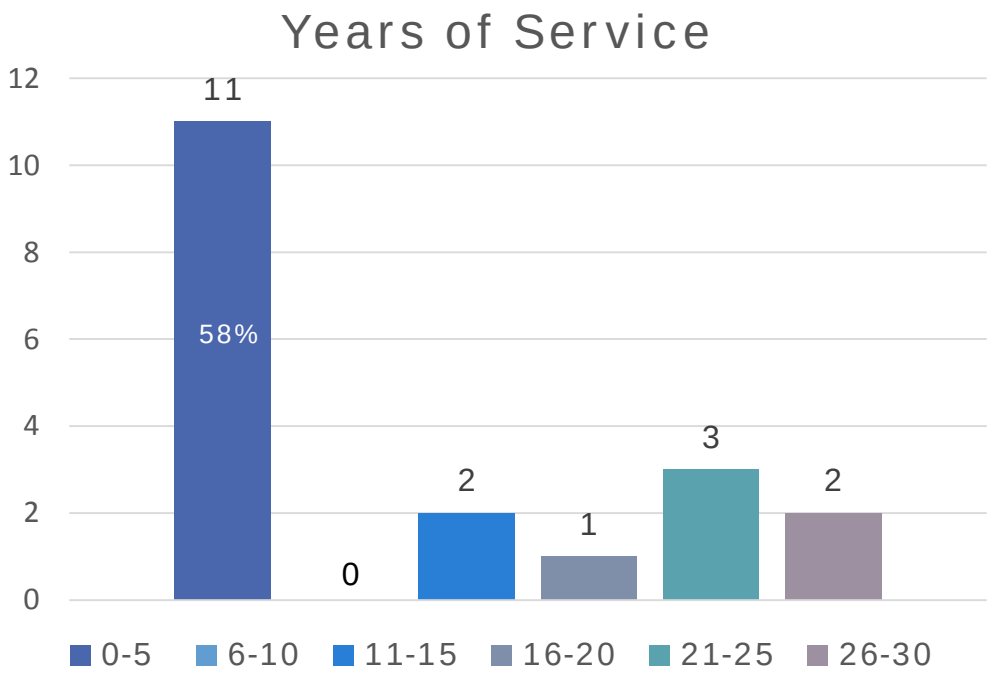
David Kerns
Department of Entomology
Texas A&M University
College Station, TX

West Texas Agricultural Chemicals Institute Conference
September 13, 2017

TEXAS IPM
Partners with Nature

TEXAS A&M AGRILIFE EXTENSION





13 IPM Agents/6 Program Specialists

Mostly MS as Last Degree

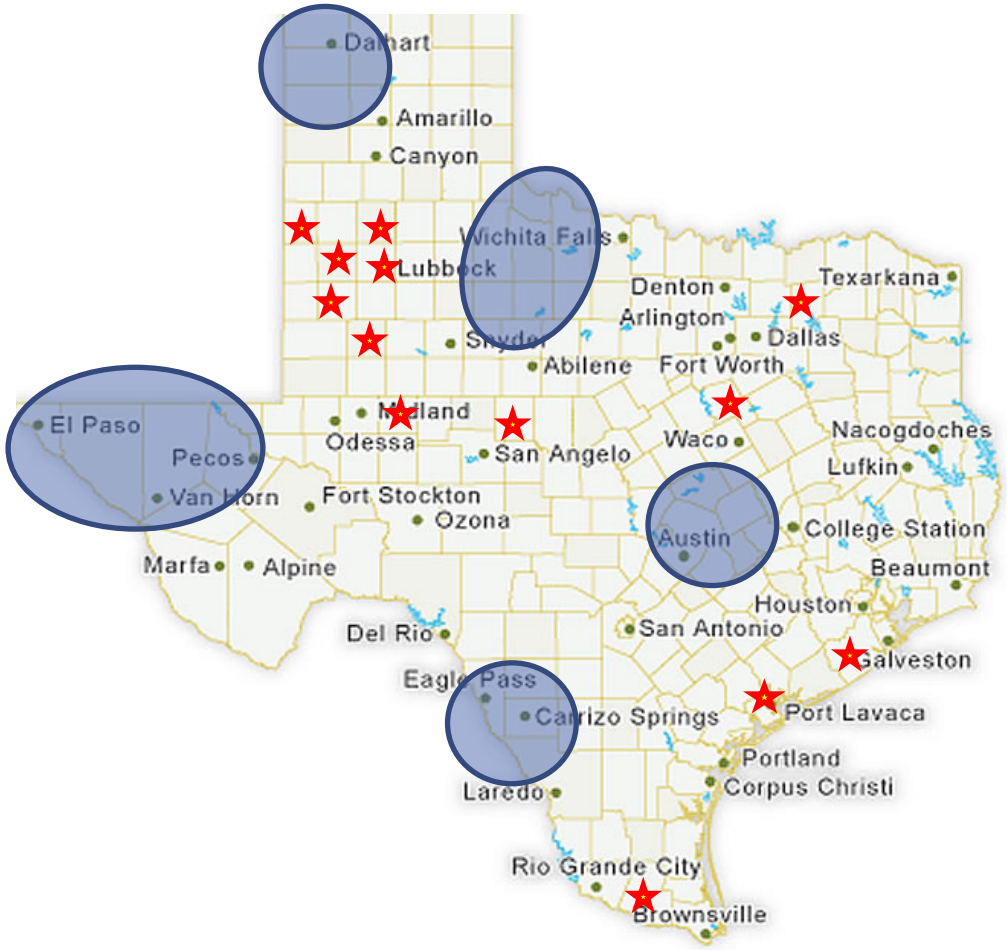
Currently 11 IPM Agents with less that 5 years of service (58%)

Where are we?

13 IPM Agents

Focus: Agriculture

- **Insect pest**
- **Plant pathogens**
- **Weed control**
- **Fertility**
- **Crop management**



Flexibility

IPM Agents

South Plains

- **Kerry Siders**
  - Hockley, Cochran, Lamb
- **Blayne Reed**
  - Hale, Swisher, Floyd
- **Tommy Doederlein**
  - Lynn and Dawson
- **Dr. Katelyn Keisheimer**
  - Lubbock, Crosby
- **Tyler Mays**
  - Terry, Yoakum, Gaines
- **John David Gonzales**
  - Bailey, Parmer, Castro

Central and South Texas

- **Xandra Morris**
  - Hill, McLennan
- **Dr. David Drake**
  - Commerce A&M, Hunt, Collins
- **Kate Harrell**
  - Wharton, Matagorda, Jackson
- **Stephen Biles**
  - Calhoun, Victoria, Refugio
- **Danielle Sekula**
  - Cameron, Hidalgo, Willacy

So. Rolling Plains and West Texas

- **Brad Easterling**
  - Glasscock, Reagan, Upton
- **Joel Webb**
  - Tom Green, Runnels

Where are we?

6 Program Specialists

Focus: Urban, School IPM, Pecans, Nursery & Greenhouse

Extension Program Specialists

Statewide Responsibilities

- **Bill Ree**
  - College Station
  - Pecan IPM
- **Erfan Vafaie**
  - Tyler/Overton
  - Greenhouse/Commercial Ornamental IPM
- **Janet Hurley**
  - Dallas Area
  - School IPM

Metropolitan Areas

- **Wizzie Brown**
  - Austin Area
  - Urban/Landscape IPM
- **Molly Keck**
  - San Antonio Area
  - Urban/Landscape IPM
- **Dr. Paul Nester**
  - Houston Area
  - Urban IPM\Invasive ants

What do we do?

- **Sampling soil to determine proper fertility needs**
- **Sampling soil to ascertain nematode risk**
- **Planting variety trials**
- **Scouting for insect, disease and weeds**
- **Monitoring ET and helping with irrigation timing**
- **Plant growth regulator and harvest aid timing**
- **Monitoring general crop growth, development and condition**
- **Conducting pesticide efficacy tests to aid in decision making**

Direction

Stakeholder Driven Objectives

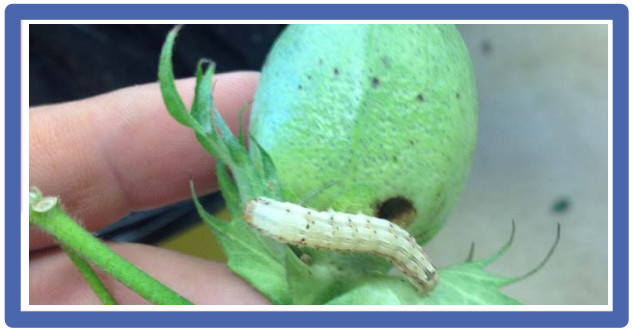
- Each unit has a Steering Committee that meets 2 or more times per year
- The IPM Agent or Program Specialist works with the Committee to:
  - Identify critical issues
  - Attract the Resources of TAMU and partners
  - Develop a plan to address issues
  - Address the issue with unbiased solutions and deliver solutions to stakeholders

Clientele Oriented Research

- Effective Extension is research driven
- Strong partnerships
  - Extension Specialists
  - Researchers
  - Other universities
  - Commodity organizations
  - Consultants
  - Industry

Develop synergistic relationships while maintaining objectivity

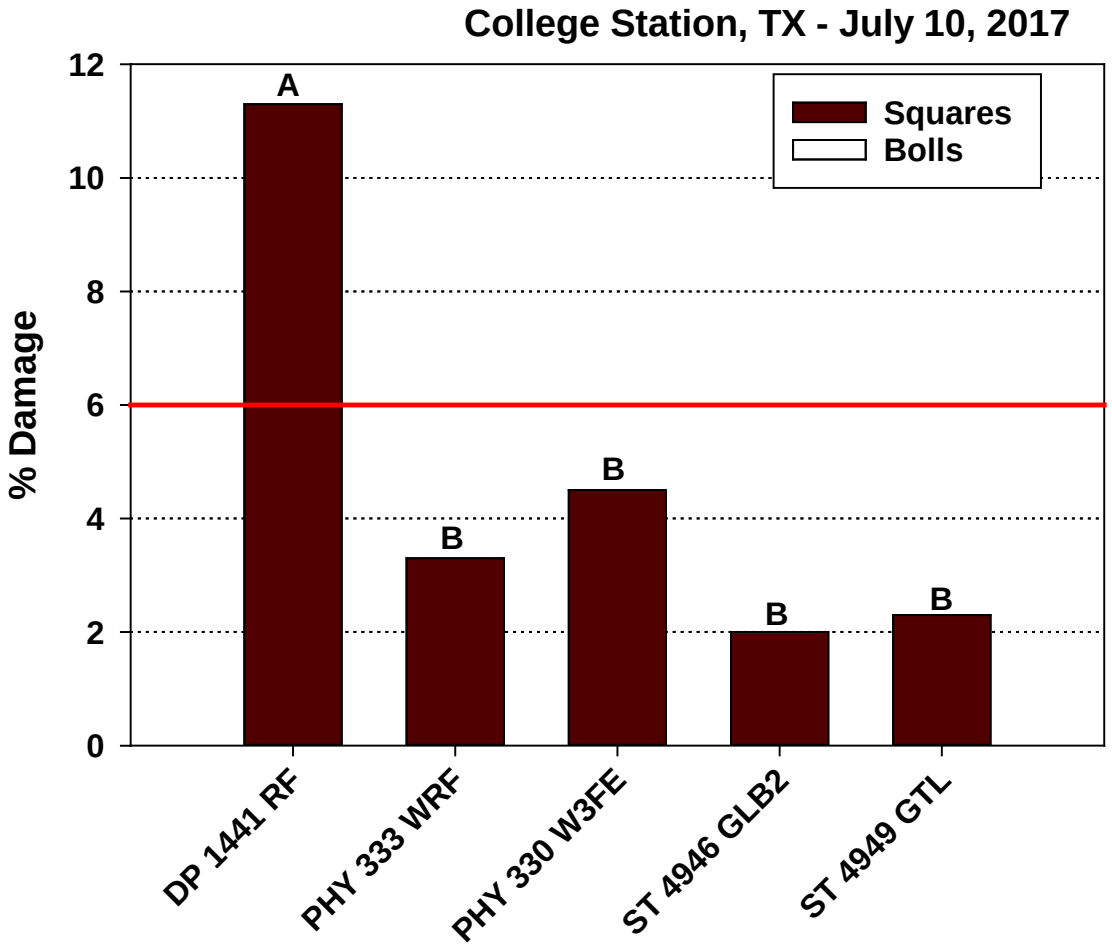
Unexpected Injury in Bt Cotton



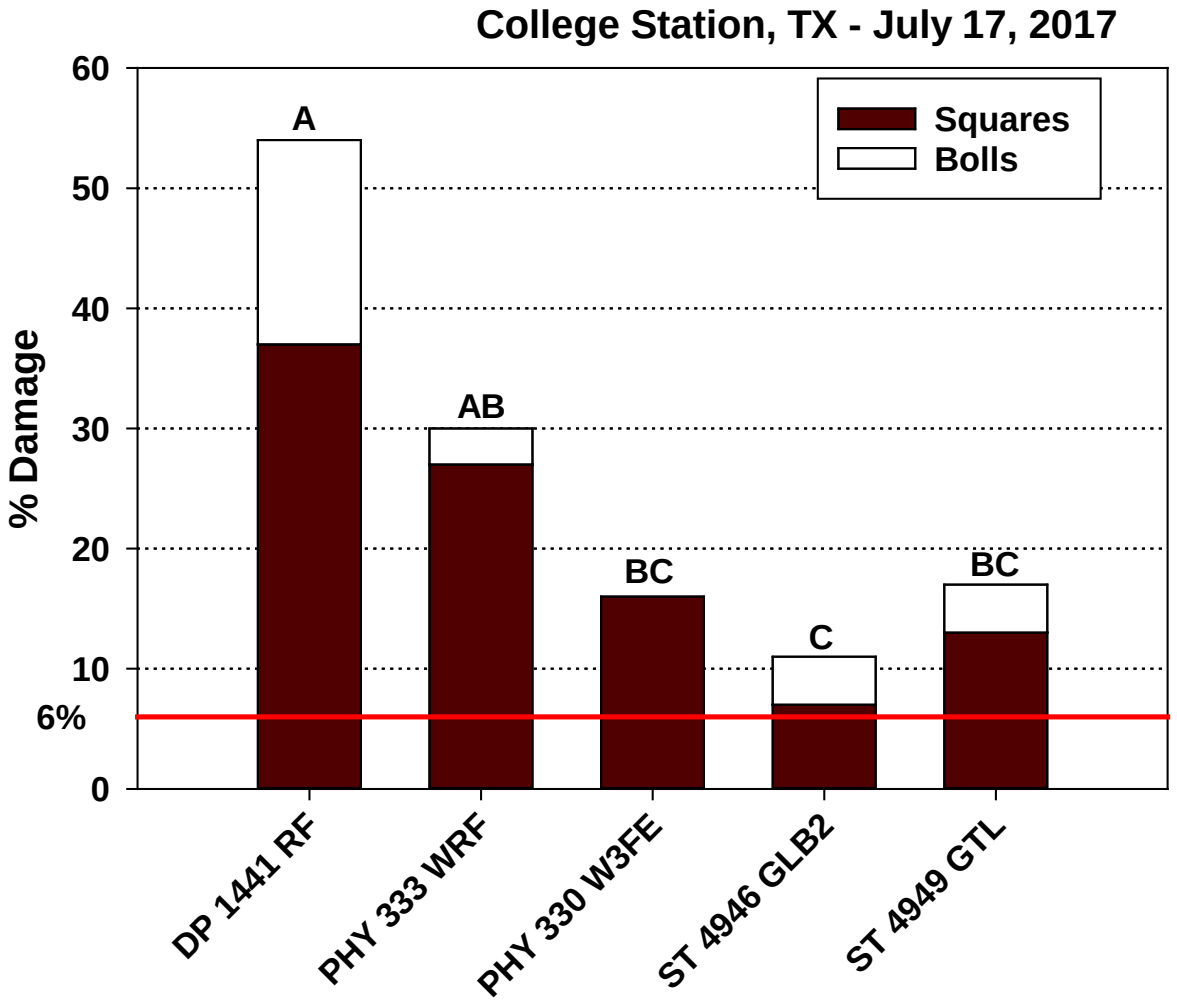
Current Bt Technologies

Company	1st generation (single gene)	2nd generation (dual gene)	3rd generation (multi-gene)
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)

Cry1Ac Cry2A Cry1F Vip3A



Difference in Fruit Injury



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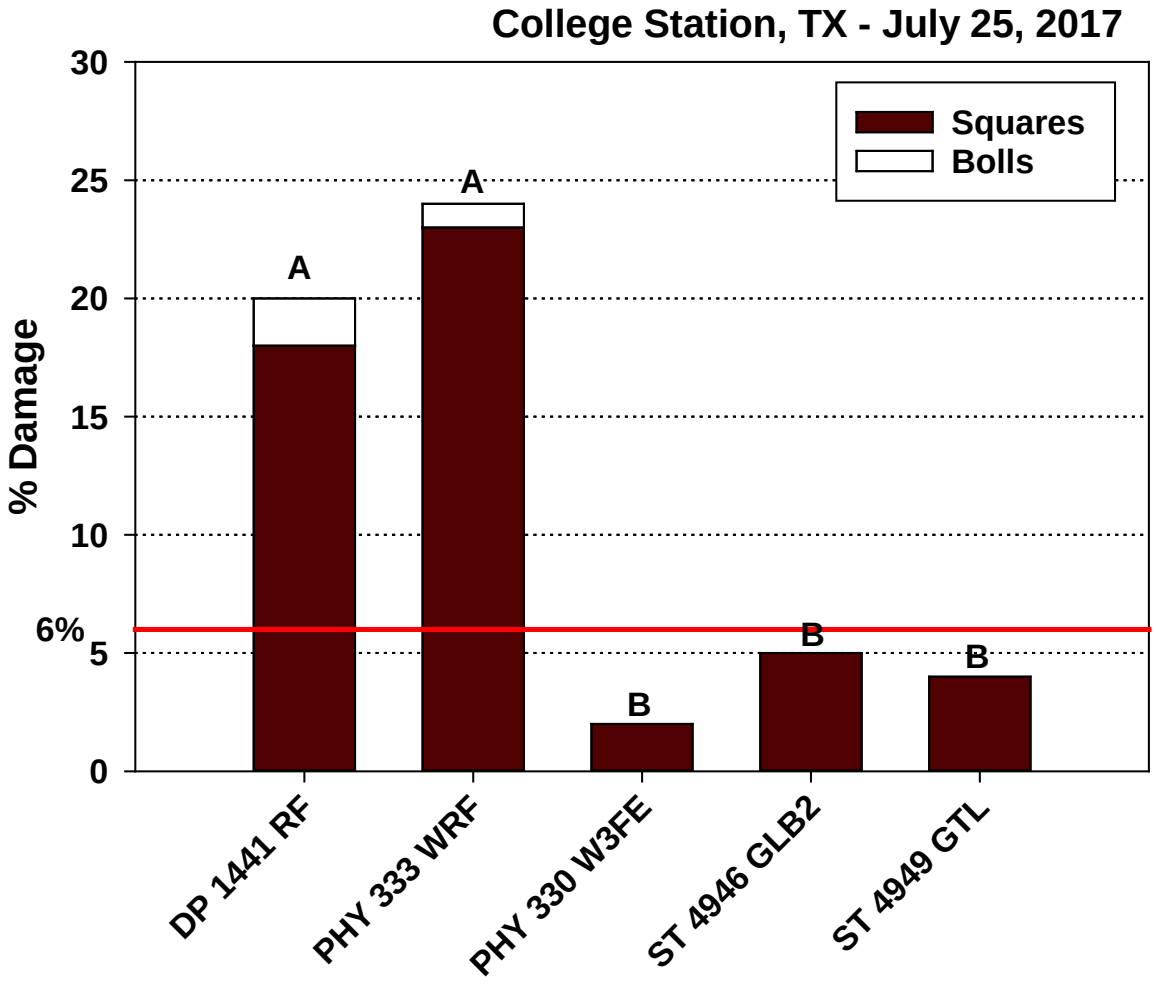

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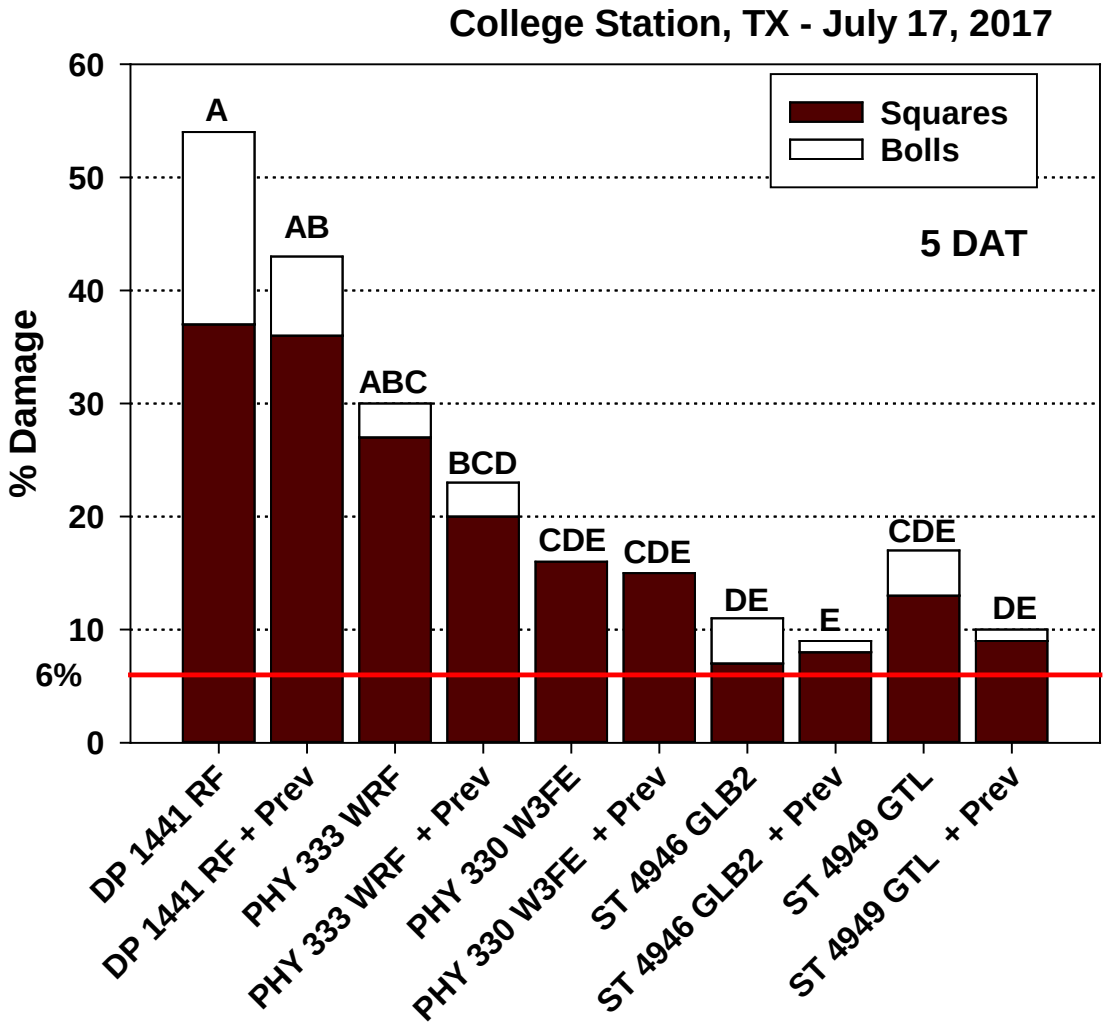
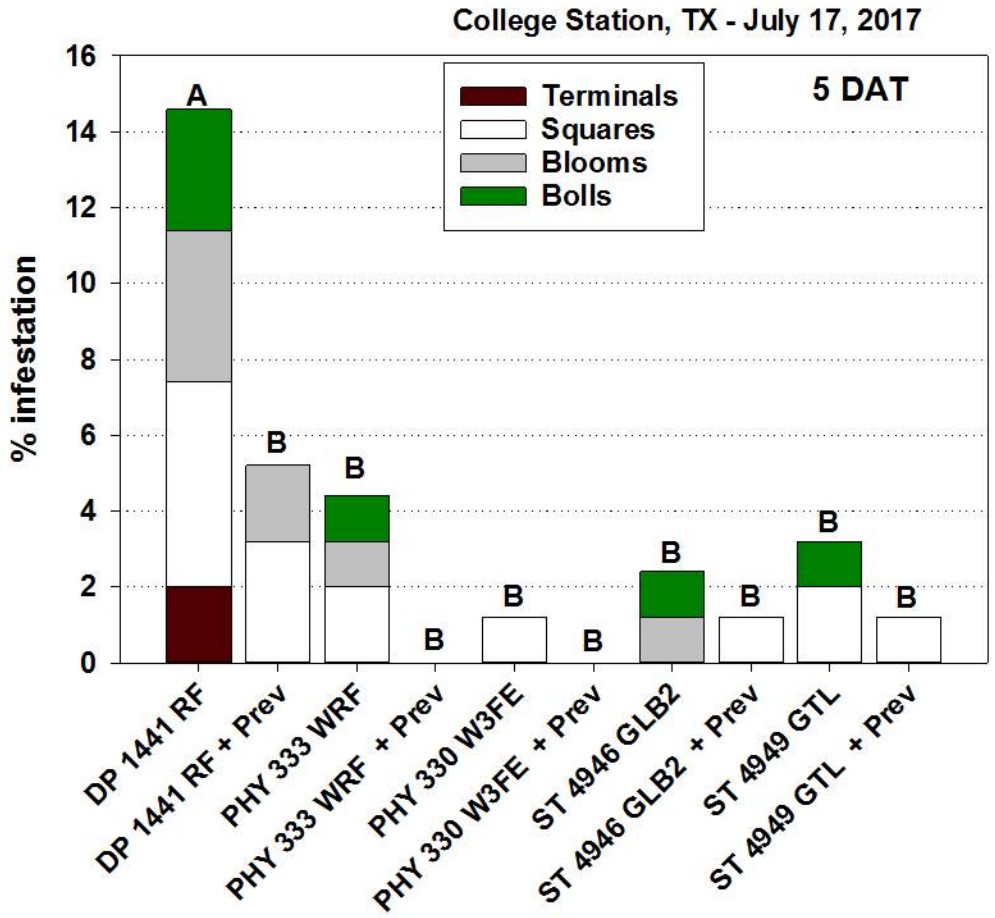
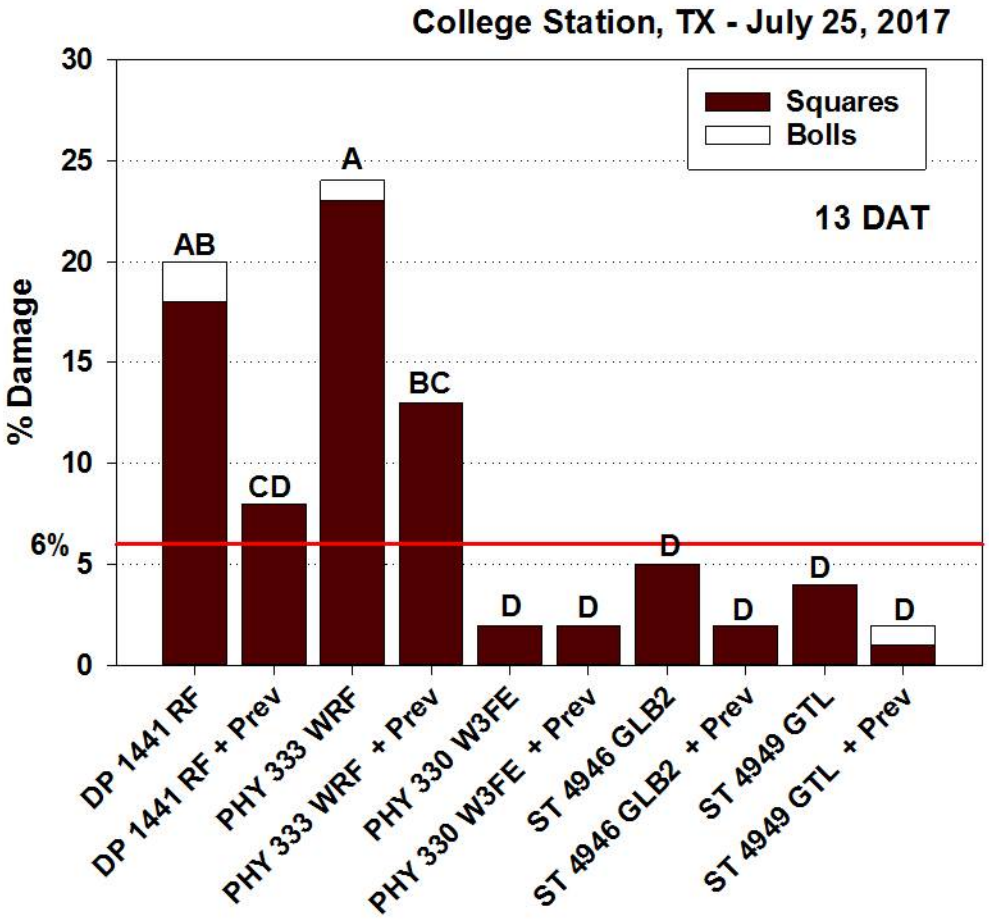


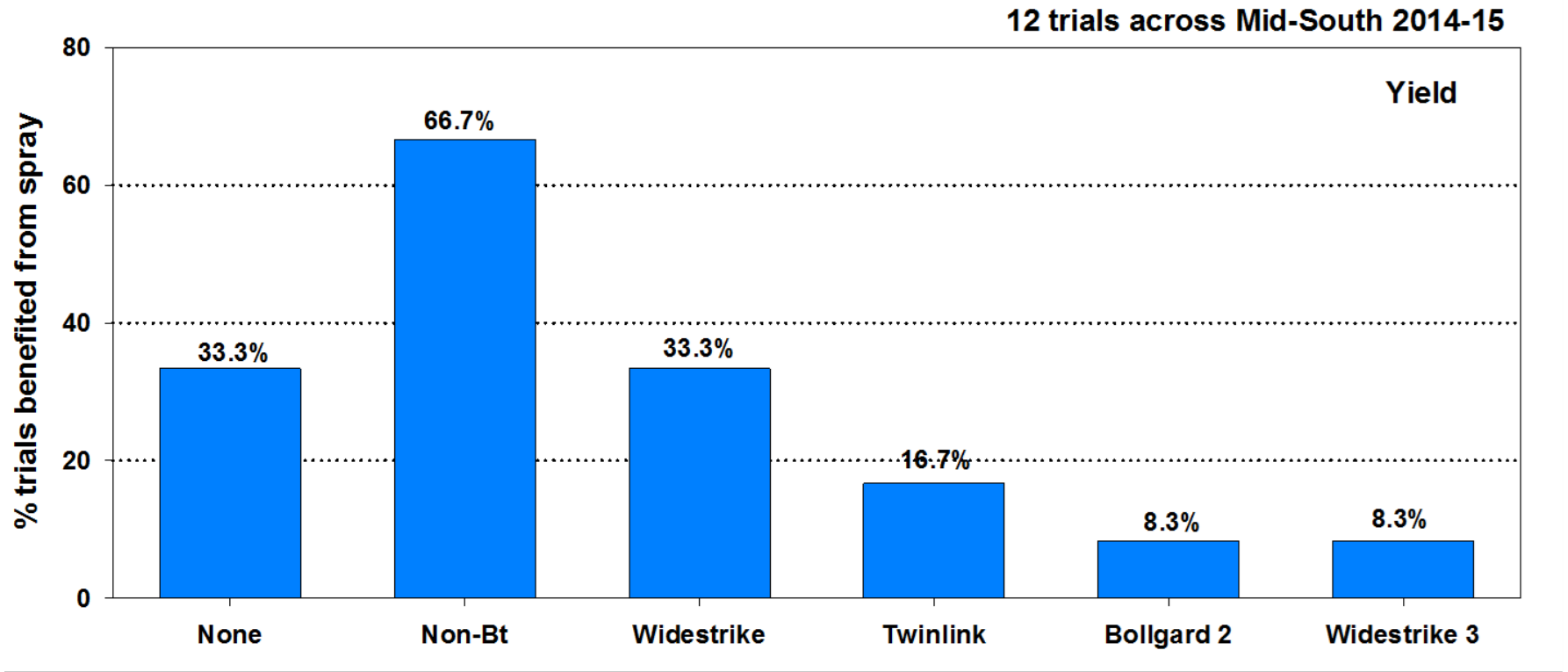
Spray vs No Spray



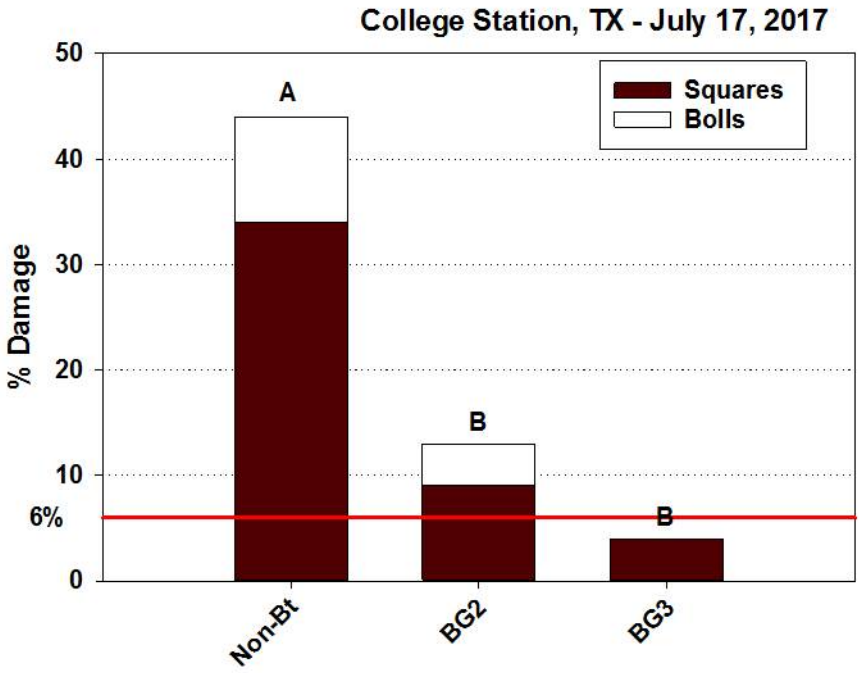
Spray vs No Spray

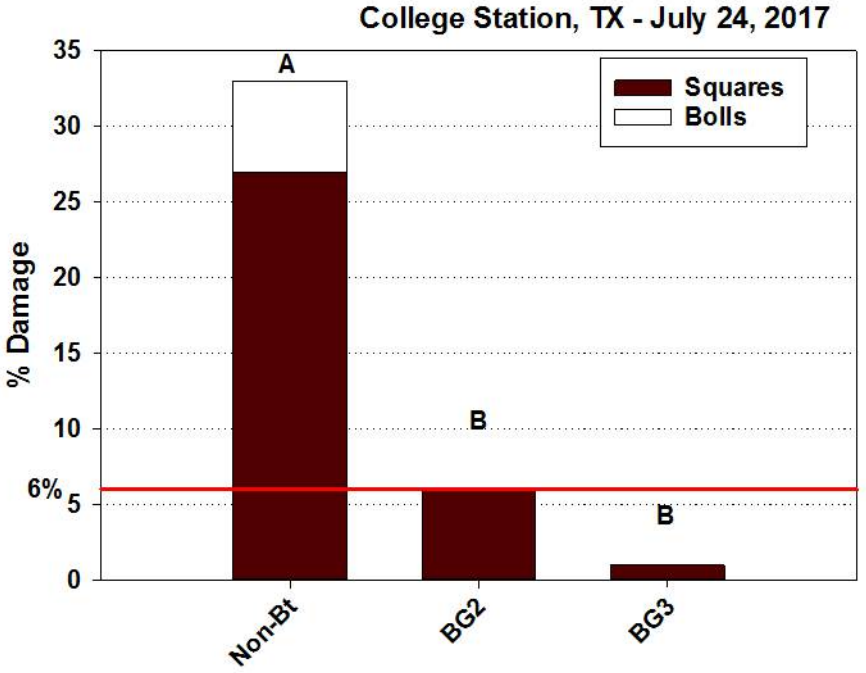


Spray vs No Spray

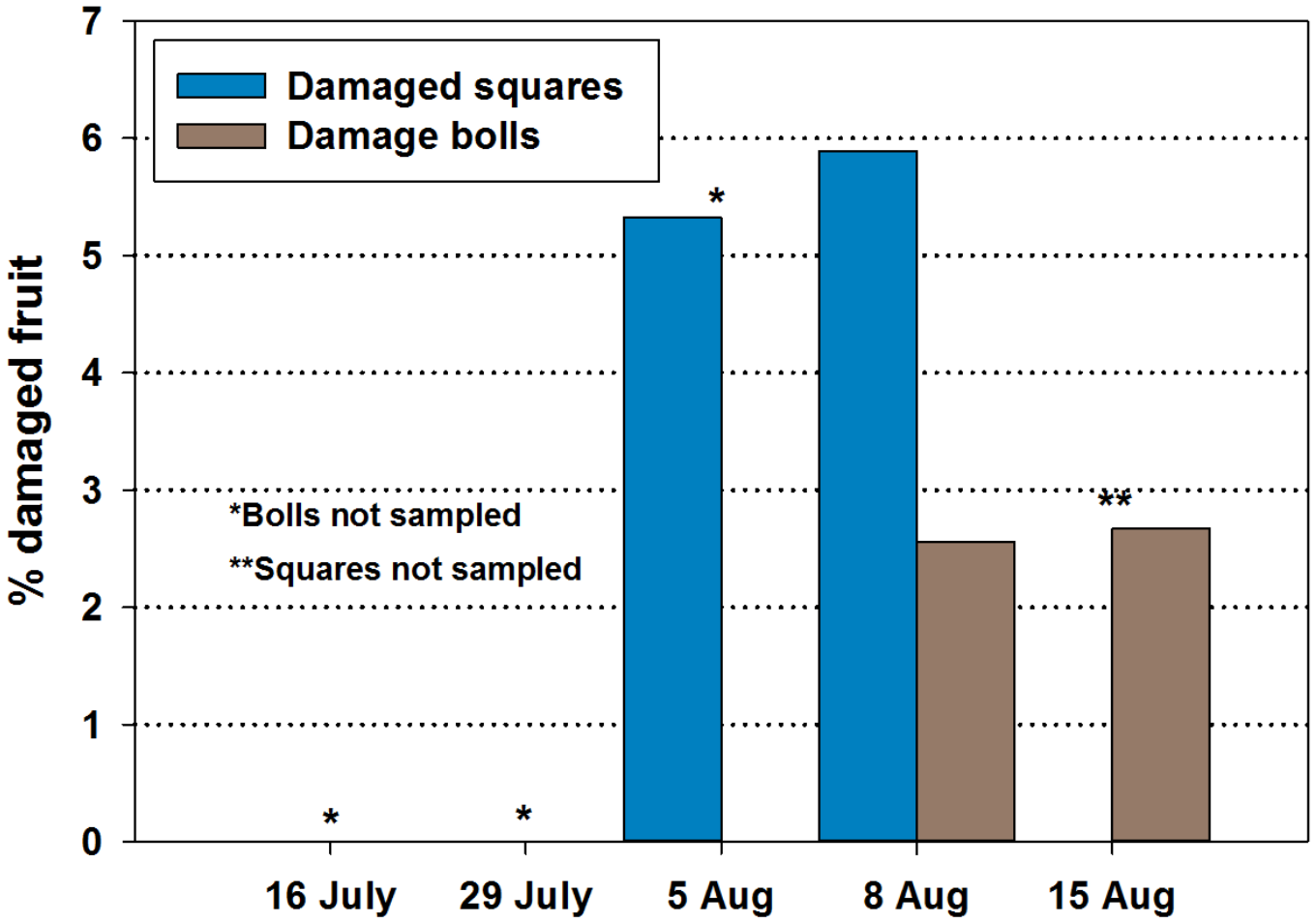


Percentage Sites with >5% Yield Differences

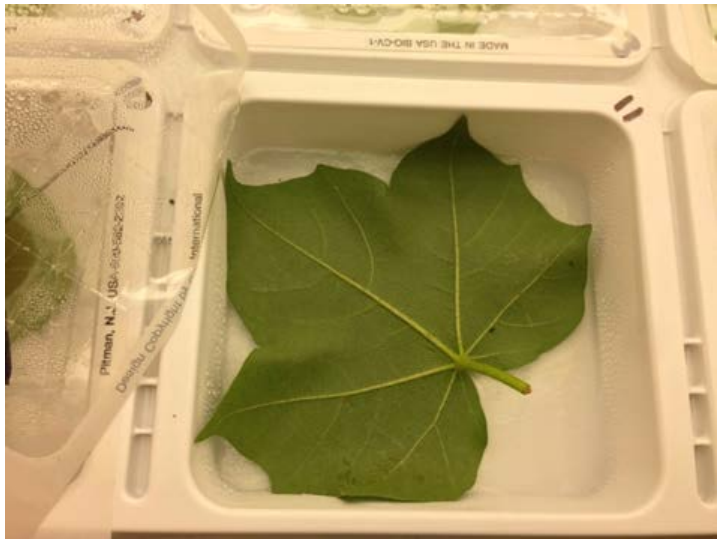

College Station, TX - July 17, 2017
% Damage
50
40
30
20
10
6%
0
Squares
Bolls
A
B
B
Non-Bt
BG2
BG3


College Station, TX - July 24, 2017
% Damage
35
30
25
20
15
10
6%
5
0
Squares
Bolls
A
B
B
Non-Bt
BG2
BG3

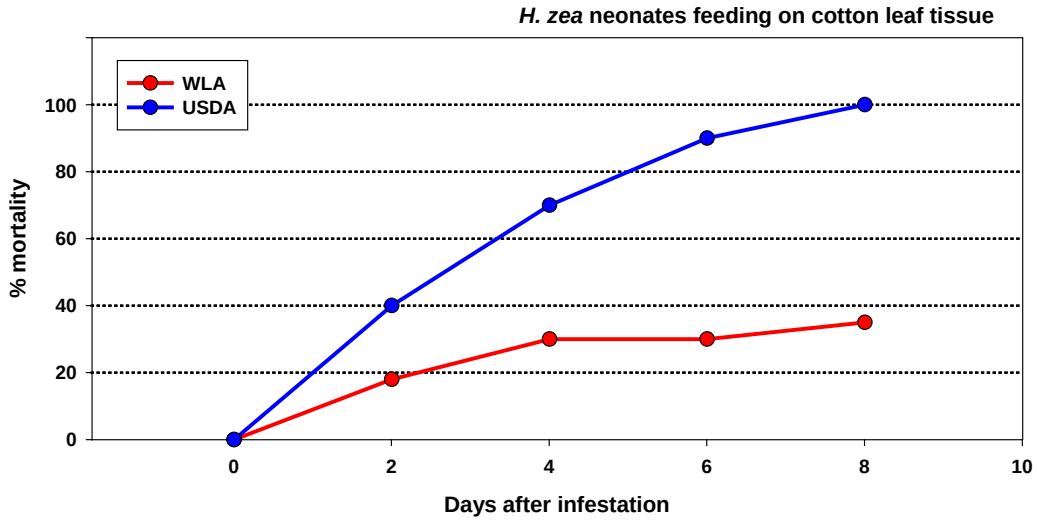
Bollgard 3



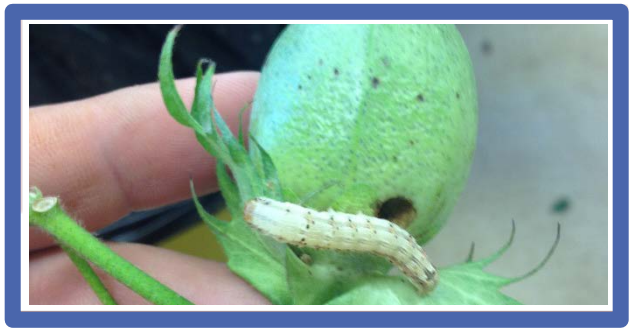
Injury to WideStrike 3



F1 Bioassay of Field Collected Larvae on WS3 Cotton



Near San Angelo – TwinLink Estimated 93% Loss



Ranking Current Bt Technologies

1st Gen.

2nd Gen.

TwinLink - 2014

3rd Gen.

Widestrike 3
TwinLink +
Bollgard 3

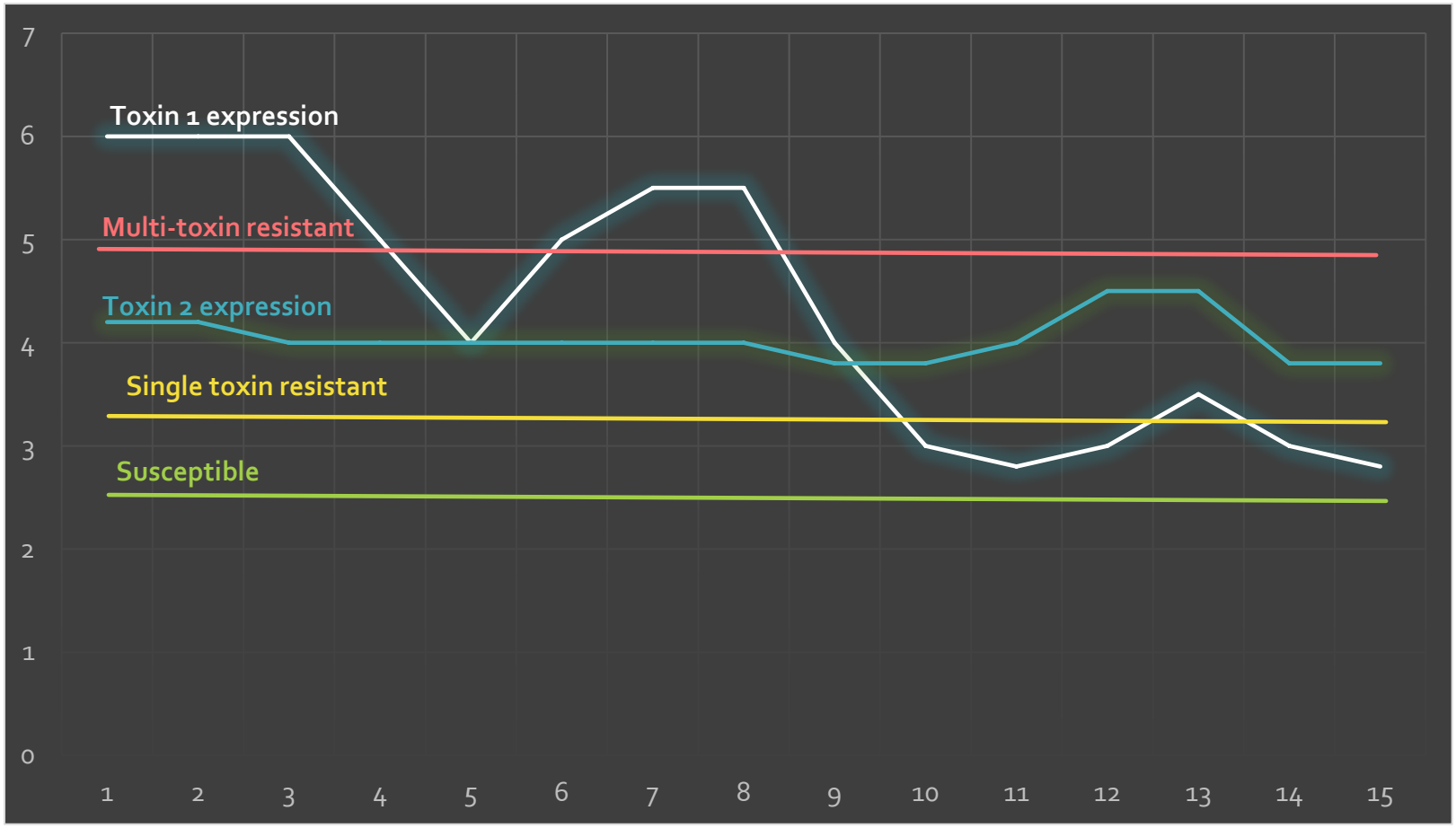
BG3
WS3 TL+

BG ← WS ← TL ← BG2

Good → Best

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

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



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) ($\mu g/cm^2$)	LC_{50}-2 (95% CL) ($\mu g/cm^2$)
BZ-SS	> 4.00	> 4.00
LA-AD	> 4.00	> 4.00
TN-JN	> 4.00	> 4.00
TN-BG2	> 4.00	> 4.00
MS-LD	> 4.00	> 4.00
AR-TK	> 4.00	> 4.00

Susceptibility of CBW to Cry1F 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

What about 2017?

- We are currently testing populations
  - Texas, Louisiana, Arkansas, Mississippi, Tennessee
- Preliminary results suggest widespread resistance
  - Cry1Ac
  - Cry2Ab2
- Vip3A appears highly toxic

Conclusions

- No Bt cotton variety or technology is immune to unacceptable bollworm injury.
- Scout your cotton.
- 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% injured fruit depending on price of cotton and crop yield expectation; **6% damage is a good middle of the road threshold.**
- Do not let the worms get big and into the bolls.
- Select the right insecticide.
  - Pyrethoids are inexpensive but resistance is an issue in many area.
  - Pyrethroids are weak on FAW and hard on beneficials.
  - Prevathon (soft) or Besiege (hard) are highly effective and usually provide about 3 weeks control.
  - Blackhawk is effective, soft of beneficials but has a short residual.
  - Pyrethroids and to a lesser extent Prevathon/Besiege are not as efficacious on deep canopy larvae.

Contact Information

David Kerns
Texas A&M University
College Station, TX
Cell: 318-439-4844
Email: DLKerns@tamu.edu

MSEWG
Mid-South Entomologist Working Group

Texas A&M AgriLife Extension

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