13 IPM Agents/6 Program Specialists
Mostly MS as Last Degree
Currently 11 IPM Agents with less that 5 years of service (58%)
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
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

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
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
<table>
<thead>
<tr>
<th>Company</th>
<th>1st generation (single gene)</th>
<th>2nd generation (dual gene)</th>
<th>3rd generation (multi-gene)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Monsanto</td>
<td>Bollgard (Cry1Ac)</td>
<td>Bollgard 2 (Cry1Ac+Cry2Ab)</td>
<td>Bollgard 3 (Cry1Ac+Cry2Ab+Vip3A)</td>
</tr>
<tr>
<td>Dow</td>
<td></td>
<td>WideStrike (Cry1Ac+Cry1F)</td>
<td>WideStrike 3 (Cry1Ac+Cry1F+Vip3A)</td>
</tr>
<tr>
<td>Bayer</td>
<td></td>
<td>TwinLink (Cry1Ab+Cry2Ae)</td>
<td>TwinLink Plus (Cry1Ab+Cry2Ae+Vip3A)</td>
</tr>
</tbody>
</table>

- **Cry1Ac**
- **Cry2A**
- **Cry1F**
- **Vip3A**
Difference in Fruit Injury

College Station, TX - July 10, 2017

% Damage

<table>
<thead>
<tr>
<th>Species</th>
<th>Squares</th>
<th>Bolls</th>
</tr>
</thead>
<tbody>
<tr>
<td>DP 1441 RF</td>
<td>A</td>
<td></td>
</tr>
<tr>
<td>PHY 333 WRF</td>
<td>B</td>
<td></td>
</tr>
<tr>
<td>PHY 330 W3FE</td>
<td>B</td>
<td></td>
</tr>
<tr>
<td>ST 4946 GLB2</td>
<td>B</td>
<td></td>
</tr>
<tr>
<td>ST 4949 GTL</td>
<td>B</td>
<td></td>
</tr>
</tbody>
</table>
**Difference in Fruit Injury**

College Station, TX - July 17, 2017

- **DP 1441 RF**: A
- **PHY 333 WRF**: AB
- **PHY 330 W3FE**: BC
- **ST 4946 GLB2**: C
- **ST 4949 GTL**: BC

<table>
<thead>
<tr>
<th>% Damage</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
</tr>
</tbody>
</table>

- Squares
- Bolls

6%
Difference in Fruit Injury
Spray vs No Spray

College Station, TX - July 17, 2017

% Damage

Squares
Bolls

5 DAT

6%
Spray vs No Spray
Spray vs No Spray

College Station, TX - July 25, 2017

13 DAT

% Damage

Squares
Bolls

DP 1441 RF
DP 1441 RF + Prev
PHY 333 WRF
PHY 333 WRF + Prev
PHY 330 W3FE
PHY 330 W3FE + Prev
ST 4946 GLB2
ST 4946 GLB2 + Prev
ST 4949 GTL
ST 4949 GTL + Prev

Spray conditions compared to no spray conditions at 13 DAT.
Percentage Sites with >5% Yield Differences
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.
- Deltapine Cotton Seed

2nd Gen.
- TwinLink - 2014

3rd Gen.
- Widestrike 3
- TwinLink + Bollgard 3

Good: BG, WS

Best: TL+, BG3, WS3
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

Toxin 1 expression
Multi-toxin resistant
Toxin 2 expression
Single toxin resistant
Susceptible

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15
<table>
<thead>
<tr>
<th>Insect strain</th>
<th>Generation</th>
<th>LC$_{50}$ (95% CL) (µg/g)</th>
<th>Resistance ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>USDA-SS</td>
<td>/</td>
<td>0.265 (0.207, 0.339)</td>
<td>1</td>
</tr>
<tr>
<td>WB-LA</td>
<td>G1</td>
<td>1.340 (1.038, 1.738)</td>
<td>5.1</td>
</tr>
<tr>
<td>BR-LA</td>
<td>G2</td>
<td>&gt; 10</td>
<td>&gt; 37.7</td>
</tr>
<tr>
<td>AD-LA</td>
<td>G2</td>
<td>&gt; 10</td>
<td>&gt; 37.7</td>
</tr>
<tr>
<td>SV-MS</td>
<td>G1</td>
<td>&gt; 10</td>
<td>&gt; 37.7</td>
</tr>
<tr>
<td>SD-MS</td>
<td>G2</td>
<td>6.760 (3.856, 15.443)</td>
<td>25.5</td>
</tr>
<tr>
<td>MT-AR</td>
<td>G2</td>
<td>1.291 (1.024, 1.655)</td>
<td>4.9</td>
</tr>
</tbody>
</table>

**Susceptibility of CBW to Cry1Ac Protein in Diet-incorporated - 2015**
<table>
<thead>
<tr>
<th>Insect strain</th>
<th>( \text{LC}_{50}-1 \ (95% \ CL) ) (( \mu g/cm^2 ))</th>
<th>RR-1</th>
<th>( \text{LC}_{50}-2 \ (95% \ CL) ) (( \mu g/cm^2 ))</th>
<th>RR-2</th>
</tr>
</thead>
<tbody>
<tr>
<td>BZ-SS</td>
<td>0.027 (0.023, 0.031)</td>
<td>1.0</td>
<td>0.015 (0.012, 0.017)</td>
<td>1.0</td>
</tr>
<tr>
<td>LA-AD</td>
<td>0.942 (0.575, 1.611)</td>
<td>34.9 *</td>
<td>0.412 (0.270, 0.620)</td>
<td>27.5 *</td>
</tr>
<tr>
<td>TN-JN</td>
<td>0.202 (0.096, 0.394)</td>
<td>7.5</td>
<td>0.086 (0.038, 0.163)</td>
<td>5.7</td>
</tr>
<tr>
<td>TN-BG2</td>
<td>0.237 (0.193, 0.292)</td>
<td>8.8</td>
<td>0.143 (0.109, 0.185)</td>
<td>9.5</td>
</tr>
<tr>
<td>MS-LD</td>
<td>1.341 (0.967, 1.930)</td>
<td>49.7 *</td>
<td>0.725 (0.534, 1.004)</td>
<td>48.3 *</td>
</tr>
<tr>
<td>AR-TK</td>
<td>0.057 (0.041, 0.075)</td>
<td>2.1</td>
<td>0.024 (0.013, 0.038)</td>
<td>1.6</td>
</tr>
<tr>
<td>Insect strain</td>
<td>LC$_{50}$-1 (95% CL) ($\mu$g/cm$^2$)</td>
<td>LC$_{50}$-2 (95% CL) ($\mu$g/cm$^2$)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>---------------</td>
<td>----------------------------------</td>
<td>----------------------------------</td>
<td></td>
<td></td>
</tr>
<tr>
<td>BZ-SS</td>
<td>$&gt;$ 4.00</td>
<td>$&gt;$ 4.00</td>
<td></td>
<td></td>
</tr>
<tr>
<td>LA-AD</td>
<td>$&gt;$ 4.00</td>
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<td></td>
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<td></td>
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<tr>
<td>TN-BG2</td>
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<td>MS-LD</td>
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<td></td>
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<td>AR-TK</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Insect strain</td>
<td>LC$_{50}$-1 (95% CL) (µg/cm$^2$)</td>
<td>RR-1</td>
<td>LC$_{50}$-2 (95% CL) (µg/cm$^2$)</td>
<td>RR-2</td>
</tr>
<tr>
<td>---------------</td>
<td>---------------------------------</td>
<td>------</td>
<td>---------------------------------</td>
<td>------</td>
</tr>
<tr>
<td>BZ-SS</td>
<td>0.13 (0.10, 0.17)</td>
<td>1.0</td>
<td>0.09 (0.07, 0.11)</td>
<td>1.0</td>
</tr>
<tr>
<td>LA-AD</td>
<td>6.03 (4.32, 8.59)</td>
<td>46.4 *</td>
<td>3.21 (2.19, 4.59)</td>
<td>35.7 *</td>
</tr>
<tr>
<td>TN-JN</td>
<td>17.34 (12.42, 26.71)</td>
<td>133.4 *</td>
<td>12.00 (9.00, 16.55)</td>
<td>133.3 *</td>
</tr>
<tr>
<td>TN-BG2</td>
<td>1.78 (1.35, 2.42)</td>
<td>13.7 *</td>
<td>0.36 (0.30, 0.43)</td>
<td>4.0</td>
</tr>
<tr>
<td>MS-LD</td>
<td>1.36 (0.94, 2.06)</td>
<td>10.5 *</td>
<td>0.77 (0.56, 1.07)</td>
<td>8.6</td>
</tr>
<tr>
<td>AR-TK</td>
<td>0.31 (0.21, 0.47)</td>
<td>2.4</td>
<td>0.09 (0.06, 0.12)</td>
<td>1.0</td>
</tr>
<tr>
<td>Insect strain</td>
<td>LC$_{50}$-1 (95% CL) (µg/cm²)</td>
<td>RR-1</td>
<td>LC$_{50}$-2 (95% CL) (µg/cm²)</td>
<td>RR-2</td>
</tr>
<tr>
<td>---------------</td>
<td>-------------------------------</td>
<td>------</td>
<td>-------------------------------</td>
<td>------</td>
</tr>
<tr>
<td>BZ-SS</td>
<td>0.97 (0.85, 1.11)</td>
<td>1.0</td>
<td>0.82 (0.69, 0.97)</td>
<td>1.0</td>
</tr>
<tr>
<td>LA-AD</td>
<td>0.19 (0.15, 0.24)</td>
<td>-5.1</td>
<td>0.12 (0.10, 0.14)</td>
<td>-6.8</td>
</tr>
<tr>
<td>TN-JN</td>
<td>0.16 (0.12, 0.21)</td>
<td>-6.1</td>
<td>0.13 (0.09, 0.17)</td>
<td>-6.3</td>
</tr>
<tr>
<td>TN-BG2</td>
<td>0.18 (0.13, 0.23)</td>
<td>-5.4</td>
<td>0.12 (0.09, 0.16)</td>
<td>-6.8</td>
</tr>
<tr>
<td>MS-LD</td>
<td>0.14 (0.12, 0.16)</td>
<td>-6.9</td>
<td>0.11 (0.09, 0.12)</td>
<td>-7.5</td>
</tr>
<tr>
<td>AR-TK</td>
<td>0.17 (0.13, 0.23)</td>
<td>-5.7</td>
<td>0.13 (0.10, 0.17)</td>
<td>-6.3</td>
</tr>
</tbody>
</table>
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.
  – Pyrethroids 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

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