Evolving pest complexes and IPM strategies for cotton in the Midsouth and Southeast

Lygus lineolaris

Scott Stewart and my colleagues
IPM – Some Factors Causing Shifts

- Technological advances
  - Boll weevil eradication, Bt cotton, New insecticides
- Insecticide resistance, cancellation or regulation
- Changes in production systems
  - Tillage, planting dates, variety maturity, crop ratios, non-crop ratios such as CRP, etc.
- Perception and knowledge - increased “appreciation” for potential impact of emerged pests

Cotton Insect Losses, 1991 – 2011 (Mike Williams)
http://www.entomology.msstate.edu/resources/tips/cotton-losses/data/
Boll Weevil Eradication
Insecticide Applications by Growers

Number per Acre

- TN
- MS
- GA
Adoption of GMO Technologies, USA

% of Acres

Source: Fernandez-Cornejo, USDA ERS

But higher adoption in Midsouth and Southeast
Bt Cotton (WideStrike) vs. Non-Bt

G. Lorenz (University of Arkansas)
The Heliothine Decline
Insecticide Applications

Number per Acre


1996

1996 B T 1

2003

2003 B T 2

TN

MS

GA
Yield Loss Caused by Arthropod Pests

More stability (and yields have increased)
The Plant Bug Incline
Insecticide Applications

Number per Acre

Lygus lineolaris


TN
MS
GA
Stink Bugs Too
Insecticide Applications

Number per Acre


TN
MS
GA
Plant Bugs and Stink Bugs
Insecticide Applications

Number per Acre

Hemipteran pests filling the void

- TN
- MS
- GA
Total Insecticide Applications

All Pests

Number per Acre

Majority targeting hemipteran pests

- TN
- MS
- GA
Hemiptera ... potential impacts on yield
Tarnished plant bug and stink bugs

5 applications for complex of plant bugs and stink bugs (2010)

Lint Yield / Acre

Foliar Insecticides: 1778 Lbs
Not Treated: 776 Lbs

Gross Crop Value ($/Acre)

Foliar Insecticides: $1244
Not Treated: $543
What’s the Solution?

- Core of IPM Program will rely on insecticides
  - Must use in the best possible way
  - Increased resistance to existing insecticides
    - Great need for new modes of action
      - Diamond (novaluron), Transform (sulfoxaflor)

- Early planting and early maturing cotton varieties
  (B. Adams, et al.)
  - Other cultural controls also have some value

- Biological control and host plant resistance have mostly been a bust
  - Transgenic cotton with resistance to Lygus ??
Tarnished Plant Bug Insecticide Resistance
Orthene and Bidrin, Midsouthern states (J. Gore, MSU)

Data from 123 tests from Arthropod Management Tests, 1994-2008

And generally higher rates

Synthetic Pyrethroids
Size matters ... Size matters ... Size matters ... Size matters

Tarnished Plant Bug (Tennessee, 2010)

Even a decent treatment can “fail”
Product Selection and Rates Matter

Tarnished Plant Bug (Tennessee, 2010)

- Fanfare 3 oz
- Fanfare 6 oz
- Acephate 8 oz
- Acephate 16 oz

Untreated = 49 per 10 Row Ft
2010 Regional TPB Efficacy Trials
Tarnished Plant Bug, Averaged Across 7 Locations

Numbers / 10 Row Ft

5-10 DAT2

Some geographical variation
New Chemistries and Rotation

Tarnished plant bugs + a few stink bugs and CEW (TN, 2012)

Lint Yield (LB/Acre)

<table>
<thead>
<tr>
<th>Insecticide</th>
<th>1st Insecticide</th>
<th>P = 0.003</th>
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</thead>
<tbody>
<tr>
<td>Transform</td>
<td>Transform</td>
<td>A</td>
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<tr>
<td>Transform</td>
<td>Transform</td>
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<tr>
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<tr>
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<td>Diamond</td>
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<td>Endigo</td>
<td>untreated</td>
<td>a</td>
</tr>
<tr>
<td>Endigo</td>
<td>untreated</td>
<td>Bb</td>
</tr>
</tbody>
</table>

Transform (1.5 oz)
Diamond (9 oz)
Endigo ZC (5 oz)
Spray Intervals vs. High Pest Pressure
Tarnished Plant Bug (Jeff Gore, MSU)

Re-treatment interval

<table>
<thead>
<tr>
<th>No. of TPB 4 DAT with Orthene</th>
<th>Pre-treatment</th>
</tr>
</thead>
<tbody>
<tr>
<td>23</td>
<td></td>
</tr>
</tbody>
</table>

Pre-Test Counts

Percent Control

Nymphs / 6 Row Feet

Percent

<table>
<thead>
<tr>
<th>4 Days</th>
<th>5 Days</th>
<th>6 Days</th>
<th>7 Days</th>
</tr>
</thead>
<tbody>
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<td></td>
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</tbody>
</table>

4 Days: 23
5 Days: 8
6 Days: No. of TPB 4 DAT with Orthene
7 Days: No. of TPB 4 DAT with Orthene
Tank mixes for improved control

Tennessee, 2010

6 DAT#2

Number / 10 Row Ft

- Untreated
- Baythroid XL 1.9 oz
- Dimethoate 6 oz
- Bayth. XL 1.9 + Bidrin 2
- Karate 1.9 + Dimeth. 6

- Tarnished Plant Bug
- Green Stink Bug
New insecticides will often require a tank mix or rotation strategy

Tarnished plant bugs per 10 Row Feet

<table>
<thead>
<tr>
<th>Treatment</th>
<th>5 DA-B</th>
<th>8 DA-C</th>
</tr>
</thead>
<tbody>
<tr>
<td>Transform (1 oz)</td>
<td>BC b</td>
<td>5</td>
</tr>
<tr>
<td>Transform (1.5 oz)</td>
<td>C b</td>
<td>10</td>
</tr>
<tr>
<td>Trans. (1 oz) + Brig. (5 oz)</td>
<td>BC b</td>
<td>15</td>
</tr>
<tr>
<td>Brigade (5 oz)</td>
<td>A a</td>
<td>20</td>
</tr>
<tr>
<td>Endigo (5 oz)</td>
<td>B b</td>
<td>25</td>
</tr>
<tr>
<td>Untreated</td>
<td>A A</td>
<td>30</td>
</tr>
</tbody>
</table>

LSD (P < 0.05)
Tank mixes for a broader spectrum
Tennessee (2012)

Total Number of **Stink Bugs** on Drop Cloth Samples

<table>
<thead>
<tr>
<th>Treatment</th>
<th>LSD (P &lt; 0.05)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Transform (1 oz)</td>
<td>a</td>
</tr>
<tr>
<td>Transform (1.5 oz)</td>
<td>ab</td>
</tr>
<tr>
<td>Trans. (1 oz) + Brig. (5 oz)</td>
<td>b</td>
</tr>
<tr>
<td>Brigade (5 oz)</td>
<td>b</td>
</tr>
<tr>
<td>Endigo (5 oz)</td>
<td>b</td>
</tr>
<tr>
<td>Untreated</td>
<td>a</td>
</tr>
</tbody>
</table>

LSD (P < 0.05)
Why tank and pre-mixes are used ...

Tennessee (2012)

Lint Yield (LB/Acre)

<table>
<thead>
<tr>
<th>Treatment</th>
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</thead>
<tbody>
<tr>
<td>Transform (1 oz)</td>
<td>cd</td>
</tr>
<tr>
<td>Transform (1.5 oz)</td>
<td>abc</td>
</tr>
<tr>
<td>Trans. (1 oz) + Brig. (5 oz)</td>
<td>a</td>
</tr>
<tr>
<td>Brigade (5 oz)</td>
<td>bcd</td>
</tr>
<tr>
<td>Endigo (5 oz)</td>
<td>ab</td>
</tr>
<tr>
<td>Untreated</td>
<td>d</td>
</tr>
</tbody>
</table>

LSD (P < 0.05)
Cotton’s Future in the Midsouth

- The continued decline of lepidopteran pests?
  - Next generation Bt cottons and Bt corns
  - Bt soybean are being considered

- The tarnished plant bug will remain the key pest of cotton
  - Are we on the pesticide treadmill because of Lygus?
    - Secondary outbreaks of spider mites, aphids, etc.
    - Neonicotinoid resistant aphids

- Shift away from cotton in the Midsouth