INSECT PEST MANAGEMENT
ISSUES IN ALFALFA--APHIDS
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Overview

• Recent challenges in alfalfa IPM
  ▪ Lep. larvae
  ▪ Cowpea aphids
  ▪ Alfalfa weevil
  ▪ Alfalfa stem nematode

• 2013-14 alfalfa IPM
  ▪ Egyptian alfalfa weevil/alfalfa weevil
  ▪ Blue alfalfa aphid
  ▪ Other aphid species
Pest Management in Alfalfa

2013-14
Origin of Integrated Pest Management (IPM)

• basic ideas setting the groundwork for IPM
• some of these came from observations in the alfalfa system
Weevil Concerns
Difficulties Controlling Alfalfa Weevil
Multiple Generations of Alfalfa Weevil
Aphids in Alfalfa

Blue Alfalfa Aphid Outbreak
2013-14
Aphids in Alfalfa

Spotted Alfalfa Aphid populations
2013
Aphid Biology

• Many species do not require sexual reproduction

• Rapid generation turnover
  – “Telescoped generations”
  – Viviparous female
  – Live birth

• Phloem feeders
  – Extract nitrogen
  – Concentrate sugars in excrement (honeydew)
Seasonal Occurrence of Aphids in Alfalfa

- **Pea Aphid**
  - Desert
  - Central Valley
- **Blue Alfalfa Aphid**
  - Desert
  - Central Valley
- **Spotted Alfalfa Aphid**
  - Desert
  - Central Valley
- **Cowpea Aphid**
  - Desert
  - Central Valley
Common Aphids in Alfalfa

• **Blue Alfalfa Aphid**
  – Antenna uniformly brown

• **Pea Aphid**
  – Narrow dark bands at tip of each segment
Common Aphids in Alfalfa

• **Cowpea Aphid**
  – Adult: shiny black
  – Nymph: slate grey

• **Spotted Alfalfa Aphid**
  A small, pale-yellow or grayish aphid with four to six rows of spined black spots on its back
Which of These Aphids is Blue Alfalfa Aphid?

- Blue Alfalfa
- Cowpea
- Pea Aphid
- Pink Form Pea
How Would You Know?

• Alfalfa Blog, UC Davis -  
  http://ucanr.edu/blogs/Alfalfa/index.cfm

• IPM Identification Tips in Alfalfa PMG

• Additional Guides:
  – Barlow & Godfrey  Aphid Guide
  – http://ucanr.edu/sites/CottonIPM/Useful_Resources/
Antennal Difference Between Aphids

Pea Aphid

Blue Alfalfa
### Pea Aphid – *Acyrthosiphon pisum*

- Antenna have a dark band at the tip of each segment
- Spring and Fall populations
- More widely distributed on plant
- Feeding does NOT result in stunting

### Blue Alfalfa – *Acyrthosiphon kondoi*

- Antenna are uniformly dark brown in color
- Late winter or spring only
- More tolerant of cool temperatures
- Prefers terminal area of plant
- Injects feeding toxin, stunts plants, especially young plants
## Action Thresholds
### Aphids per Stem

<table>
<thead>
<tr>
<th>Plant Height</th>
<th>Pea Aphid</th>
<th>Blue Alfalfa Aphid</th>
<th>Cowpea Aphid</th>
</tr>
</thead>
<tbody>
<tr>
<td>Under 10 in.</td>
<td>40 to 50</td>
<td>10 to 12</td>
<td>10 – 12</td>
</tr>
<tr>
<td>10 to 20 in.</td>
<td>70 to 80</td>
<td>40 to 50</td>
<td>40 - 50</td>
</tr>
<tr>
<td>Over 20 in.</td>
<td>100 +</td>
<td>40 to 50</td>
<td>40 - 50</td>
</tr>
</tbody>
</table>
Aphids Can Inject **Toxins** and Produce **Honeydew**

- Spotted Alfalfa Aphid
  - Very Potent
  - Copious Amounts

- Cowpea Aphid

- Blue Alfalfa Aphid
  - Less Potent

- Pea Aphid
  - Less Honeydew
History - Aphids in Alfalfa

• Pea Aphid - in the western U.S. for 100+ years
• Spotted Alfalfa Aphid – first found in 1950’s
• Blue Alfalfa Aphid - first found in CA in Kern Co. near Bakersfield in 1974 and Imperial Co. in 1975
• Cowpea Aphid – started damaging alfalfa ~10 years ago
# Management - Aphids in Alfalfa

<table>
<thead>
<tr>
<th></th>
<th>Insecticides</th>
<th>Cultural</th>
<th>Biological</th>
<th>Host Plant Resistance</th>
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</thead>
<tbody>
<tr>
<td>Pea Aphid</td>
<td>X</td>
<td></td>
<td>XX</td>
<td></td>
</tr>
<tr>
<td>Blue Alfalfa Aphid</td>
<td>X</td>
<td></td>
<td>XX</td>
<td>XX</td>
</tr>
<tr>
<td>Spotted Alfalfa Aphid</td>
<td>X</td>
<td></td>
<td>X</td>
<td>XX</td>
</tr>
<tr>
<td>Cowpea Aphid</td>
<td>XX</td>
<td></td>
<td>X</td>
<td></td>
</tr>
</tbody>
</table>
Blue Alfalfa Aphid Outbreak
2013-14
EAW & Aphid Trial, Davis
March 2013

Treated 13 March

Source: Larry Godfrey
EAW & Aphid Trial, Davis
March 2013

Source: Larry Godfrey
EAW & Aphid Trial, Davis
March 2013

Source: Larry Godfrey
EAW & Aphid Trial, Imperial Valley 28 February 2013

Source: Eric Natwick
Aphid Trial, Imperial Valley
17 January 2013

Percent of Check, Post Treatment Average

Source: Eric Natwick
Outbreaks Are Complex Events

- **Aphids**
  - Development of Tolerance
  - Change in behavior

- **Conditions Favorable for Outbreak**
- **Conditions not favorable for cutting or treating**
- **Reduced Natural Enemy Activity**

- **Variety Selection**
- **Host Plant Resistance**
- **Production Practices**
- **Insecticide Use & Pattern**

- **Conditions Favorable for 1st Cutting**
- **Enhanced Natural Enemy Activity**

- **Us**
- **Environment**
Characteristics of BAA Outbreak

• Resurgence of BAA, 1-2 weeks post weevil
• Retreatment required
• Control difficult, residual control lacking
• **Spotty, not widespread, not every field**
• Timing of outbreak varies by location
• Some noted low abundance of ladybird beetles
• Damage substantial in some cases
• Lingering effect of toxin into next cutting
Outbreaks Reported 2013-14
Outbreaks Are Complex Events

Aphids

Development of Tolerance
Change in behavior

Variety Selection
Host Plant Resistance
Production Practices
Insecticide Use & Pattern

Conditions Favorable for Outbreak
Conditions not favorable for cutting or treating
Reduced Natural Enemy Activity

Conditions Favorable for 1st Cutting
Enhanced Natural Enemy Activity

Us

Environment
Environment –
Fungus in Aphid Population
Environment – Natural Enemies

- Slow Development of Biological Control
  - Dry winter
  - Windy spring

- Absence of Big-eyed bugs??

<table>
<thead>
<tr>
<th></th>
<th># per 50 sweeps</th>
</tr>
</thead>
<tbody>
<tr>
<td>2012</td>
<td>2013</td>
</tr>
<tr>
<td>BEB adults</td>
<td>6.25</td>
</tr>
<tr>
<td>BEB nymphs</td>
<td>1.0</td>
</tr>
</tbody>
</table>
“Numbers Game”
Change in the Aphid

- Insecticide Resistance
- New Biotype of Aphid
- Failure of Host Plant Resistance
Is There Resistance?

- Dow AgroSciences conducted quick “dip assay’
  - No evidence of increased tolerance to chlorpyrifos
- Field trials - limited evidence of resistance
- Need colony of “untreated” BAA
What Are People Speculating Was the Cause of Outbreak?

- Insecticide Resistance - Evidence Not Apparent
- New Biotype
  - “Nebraska”
  - pursued lead but found no evidence
- Failure of Host Plant Resistance
  - usually happens more gradually
  - is a report of this same aphid overcoming host plant resistance in Australia
- RR alfalfa
  - No evidence
What Are People Speculating Was the Cause of Outbreak?

• Failure of Host Plant Resistance

• Mainstay of management since BAA and SAA introductions
  ❖ Host Plant Resistance - antibiosis is involved
  ❖ Resistance is virtually lost at 60 °F
  ❖ Most active under hot conditions
  ❖ Aphids attempt to “evolve” to overcome resistance
Host Plant Resistance to Blue Alfalfa Aphid

Source: NAFA 2013
Host Plant Resistance to Blue Alfalfa Aphid

Source: NAFA 2013
Host Plant Resistance to Blue Alfalfa Aphid
Host Plant Resistance to Blue Alfalfa Aphid
What People Were Using to Control Pests

• Weevil
  – Warrior (or other lambda cyhalothrin)
  – Steward
  – Cobalt (chlorpyrifos & lambda cyhalothrin, premix)

• Aphid
  – Chlorpyrifos, malathion with weevil treatment
  – Dimethoate second treatment
  – Lannate in worst conditions
It’s a Numbers Game

- 95% efficacy may leave too many aphids, especially if being concentrated in windrows (e.g. “early cutting”)
- Use of broad spectrum insecticides reduce your biocontrol assets in the field
- Population more likely to rebound
Damage: stunting, reduced vigor

Dos Palos, Merced Co

9 inches tall
30 days post 1st cutting

High Desert, Lancaster, CA
# What Losses Did People Report Due to BAA?

<table>
<thead>
<tr>
<th>Region</th>
<th>Acres Infested</th>
<th>Loss</th>
<th>Stand Age</th>
<th>Damage Severity Ranking</th>
</tr>
</thead>
<tbody>
<tr>
<td>Imperial Valley</td>
<td>&gt; 1000 acres</td>
<td>$70/ac, 1/3 ton</td>
<td>3\textsuperscript{rd} Year</td>
<td>4</td>
</tr>
<tr>
<td>Dos Palos</td>
<td>500-1000 acres</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dos Palos</td>
<td>&gt;1000 acres</td>
<td>$250/ac for 2 cuttings</td>
<td>3\textsuperscript{rd} Year</td>
<td>5</td>
</tr>
<tr>
<td>Dos Palos</td>
<td>$150/acre</td>
<td></td>
<td>2\textsuperscript{cd} Year</td>
<td>5</td>
</tr>
<tr>
<td>Buttonwillow</td>
<td>&gt;1000 acres</td>
<td>½ - ¾ bale</td>
<td>2\textsuperscript{cd} &amp; 3\textsuperscript{rd} Year</td>
<td>3</td>
</tr>
<tr>
<td>Dos Palos</td>
<td>85 acres</td>
<td>$90/ac</td>
<td>second</td>
<td>5</td>
</tr>
<tr>
<td>Dos Palos</td>
<td>100-500</td>
<td>40% reduction</td>
<td>3-5\textsuperscript{th}</td>
<td>4</td>
</tr>
<tr>
<td>Palo Verde Valley</td>
<td>&gt; 1000</td>
<td>$100/acre</td>
<td>2 months to 3\textsuperscript{rd} Year</td>
<td>5</td>
</tr>
<tr>
<td>Palo Verde</td>
<td>&gt; 1000</td>
<td>$125/acre</td>
<td>4\textsuperscript{th} Year</td>
<td>5</td>
</tr>
</tbody>
</table>
So What Do We Know?

- Cause of outbreak unknown
- OPs did not sufficiently control BAA
- Low aphid densities were allowed to get into second cutting
- Distribution pattern is odd
  - First year fields, no insecticides (winged)
  - Very spotty
- Damage and loss occurred
Where We Going?

• 24c label for Beleaf 50SG – 62 day preharvest interval

• three other new insecticides with activity on aphids nearing registration

• need for research to provide answers to some of the outstanding questions