Sustained Insecticide Performance Against Whiteflies in Multi-Cropping Systems: Past Success and New Challenges

Sweetpotato Whitefly

*Bemisia tabaci* – B biotype

- Polyphagous pest
- Multivoltine pest
- Adults very mobile
Whitefly “cloud” over newly established produce field
Imperial Valley – Fall 1991

Shared Whiteflies, Shared Chemistries

Winter Vegetables
Spring Melons
Fall Vegetables and Melons
Cotton

Synergized Pyrethoids
Imidacloprid  Admire®

Ideal WF Control in Vegetables / Melons

Section 18 Registrations - 1993

- At-plant soil application
- Immediate plant protection
- 45-60 d residual control

Synergized Pyrethroid Resistance in Cotton -1995

- Documented reduction in susceptibility
- Reports of poor field performance
- Section 18 registrations of IGRs in 1996
- 1 use of buprofezin and pyroproxyfenin
- Cotton IRM Program established
Whiteflies have not had a significant economic impact on the Yield or Quality of vegetables or melons in Arizona for the past 14 years.

Passive “de facto” Management

Cropping system
- Large acreages of untreated host plants serve as refugia
- Alfalfa, seed crops, weeds, ornamental landscape

Whitefly biology and ecology
- Polyphagy, mating behavior, and dispersal capability

IPM Practices
IPM Practices

- Avoid Problems through Cultural Controls
- Scouting, Sampling and Detection
- Effective Chemical Use

Ellsworth 2001

Effective Chemical Use
Limitation and Segregation of Chemistries

1 soil use of Admire
1 soil use of Admire
1 soil use of Admire
1 foliar use of Buprofezin
1 foliar use of Pyriproxyfen

No Neonicotinoids used
**Product Efficacy Management**

Because of heavy reliance on Admire™ for whitefly and aphid control on vegetables in the lower desert region of Arizona, sustaining product efficacy is of great concern.

- Consider using foliar materials for whitefly control under low risk situations.
- If possible, avoid using any formulation of imidacloprid (Admire™ or Provado™) in cotton.
- If by the thinning and heading stages, whiteflies are building up on fall produce or fall melons, consider applying a non-imidacloprid foliar material to eliminate possible tolerant individuals.
- Avoid using Admire™ after whitefly pressure subsides for aphid control in produce scheduled for harvest before aphid populations traditionally develop.

---

**Expansion of the Neonicotinoid Chemistry**

1) **New Product Registrations - 2006**
   - *Centric / Platinum*: cotton, melons
   - *Intruder / Assail*: cotton, leafy vegetables
   - *Venom*: cotton, melons and leafy vegetables

2) **Documented cross-resistance**
3) **Multiple applications allowed by labels**
4) **Risk of increased selection pressure**

“*We can’t rely on a de facto system anymore*”
Proactive Resistance Management

Cross-commodity Guidelines for Neonicotinoid Insecticides in Arizona

John C. Palumbo1, Peter C. Ellisworth1, Timothy J. Dennehy, Robert L. Nichols2
1University of Arizona, 2Cotton Incorporated

Developed in collaboration with and endorsed by
Arizona Crop Protection Association
Arizona Cotton Growers Association
Cotton Incorporated
Western Growers Association

Risk Associated with Cropping Systems

- Insecticide Use Patterns
- Seasonal Crop Diversity
- WF Population Dynamics

Palumbo et al. 2001
Defining a Crop Community

1) **Multi-crop Community**
   - Cotton
   - Melons
   - Vegetables
   
   “Crops grown within a 2 mile radius of each other during year”

2) **Cotton Intensive**

3) **Melon / Cotton Intensive**

---

**1. Limit Neonicotinoid Uses**

**Summary Guidelines:** Maximum number of uses per crop season for neonicotinoids in three different cropping communities.

<table>
<thead>
<tr>
<th>Community</th>
<th>Cotton</th>
<th>Melons</th>
<th>Vegetables</th>
</tr>
</thead>
<tbody>
<tr>
<td>Multi-Crop</td>
<td>0</td>
<td>1*</td>
<td>1**</td>
</tr>
<tr>
<td>Cotton / Melon</td>
<td>1</td>
<td>1*</td>
<td>—</td>
</tr>
<tr>
<td>Cotton-Intensive</td>
<td>2</td>
<td>—</td>
<td>—</td>
</tr>
</tbody>
</table>

*Soil only; **Soil or Foliar*
Multi-Crop Communities………..additional guidelines

- No more than 1 use per crop in melons and vegetables
- Soil at-planting recommended.
- Split applications are not recommended
- Do not apply foliar neonicotinoid following the use of a soil applied neonicotinoid
- Do not apply any neonicotinoid product to cotton

Resistance Risks with Shared Neonicotinoid Uses in a MCC
(eg., Yuma – potential usage)

<table>
<thead>
<tr>
<th>Spring/Fall Melons</th>
<th>Neonicotinoid</th>
</tr>
</thead>
<tbody>
<tr>
<td>Leafy Vegetables</td>
<td></td>
</tr>
<tr>
<td>Cotton</td>
<td></td>
</tr>
</tbody>
</table>

Not Sustainable

Relative Whitefly Population Abundance

J F M A M J J A S O N D
Preserve a **Neonicotinoid-free Period** in Multi-Crop Communities

<table>
<thead>
<tr>
<th>Season</th>
<th>Sector</th>
<th>Treatment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Spring/Fall Melons</td>
<td>Neonicotinoid</td>
<td></td>
</tr>
<tr>
<td>Leafy Vegetables</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cotton</td>
<td>Cotton IRM Program</td>
<td>IGRs Non Pyr III Pyr</td>
</tr>
</tbody>
</table>

Relative Whitefly Population Abundance

Will Adoption of these Guidelines

Passive "De facto" IRM

Proactive IRM

Sustain the efficacy of **Neonicotinoids** in Multi-Crop Communities

???
**Grower / PCA Assessment**

**Anecdotal Evidence**

- Since 2003 Guidelines have definitely created awareness of the issue

“I apologize, I sprayed some Intruder on my cotton today”

*Yuma PCA – July 2003*

**Grower Survey Data**

- 2005 Cotton Insect Losses Workshop
  - Yuma Co., 8 PCAs responded (4987 acres)
    - 4 had used Intruder on cotton
    - ~ 27% of the acres, 1.3 sprays

**2006 Head Lettuce Insect Losses Workshop**

- Do not apply a foliar neonicotinoid following a soil use
Measurement of Group Adoption of Guidelines

- Compliance is voluntary
- Section level pesticide records (1080 - pesticide use reporting)
- Measure temporal & spatial changes in adoption
- Neonicotinoid usage in cotton within Multi-crop Communities

Summary Guidelines: Maximum number of uses per crop season for neonicotinoids in three different cropping communities.

<table>
<thead>
<tr>
<th>Community</th>
<th>Cotton</th>
<th>Melons</th>
<th>Vegetables</th>
</tr>
</thead>
<tbody>
<tr>
<td>Multi-Crop</td>
<td>0</td>
<td>1*</td>
<td>1**</td>
</tr>
<tr>
<td>Cotton / Melon</td>
<td>1</td>
<td>1*</td>
<td>—</td>
</tr>
<tr>
<td>Cotton-Intensive</td>
<td>2</td>
<td>—</td>
<td>—</td>
</tr>
</tbody>
</table>

'Soil only: "Soil or Foliar

Crop Community
- GIS-geo referenced
- 9-section clusters
- 2 mile radius
- CI, CM, MCC

Analysis (2001-2005)
- Pesticide use data overlaid on GIS maps
  - N sections sampled randomly
- Hypothesis:
  - Use in cotton
    - MCC = 0
    - CI > MCC

Hypothesis: Use in cotton
- MCC = 0
- CI > MCC

1.5 miles
2.1 miles
Challenges and Constraints to Sustained Efficacy

A. **Generic imidacloprid**
   - Lower $ cost = higher use rates
   - Confusion in class recognition (*foliars*)

B. **Expansion of neonicotinoid labels**
   - New Crop Labels - on melons and leafy vegetables
   - Home / Garden / Ornamental - *imidacloprid*
   - Alfalfa/Seed Crops - *future registrations*

C. **Market forces**
   - Promote Neonicotinoid use in Cotton
   - Leafy Vegetables / Melons
Challenges and Constraints to Sustained Efficacy

D. **New Chemistry in the Pipeline**
   - Trends toward more selective chemistries
   - Grower attitudes:
     “Industry always comes through with new technology”
   - Industry attitudes:
     “Resistance is a source of innovation”

E. **Complacency and apathy**
   - “Little Suzy needs new shoes”
   - Reduced rates / split (multiple) applications
   - Sloppy soil applications on vegetables and melons