**Successful Management Adapted to a Mobile, Polyphagous Whitefly Pest in a Diverse Cropping System**

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University of Arizona

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**What Am I Doing Here?**

- Vegetables?
- Dispersal?

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**Bemisia tabaci, Biotype B**

- 33 µg
- > 600 hosts
- Mobile adult form
- Introduced to U.S. in late 1980’s and AZ in early 1990’s
- Reduces yields, contaminates with honeydew & vectors viruses

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**Dispersal and IPM**

- Description of System
  - Damage potential & economic impact
  - Intercrop interactions
- Bemisia movement
- IPM System
  - Impact of dispersal
  - Cross-commodity management

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**Veggie Losses**

- Reduced Yields
  - Leaf necrosis
  - Fruit size
  - Plant vigor
  - Maturity
- Reduced Quality
  - Chlorosis
  - Low sugars
  - Sooty mold
Biological Defoliation (UTC, 1992)

Yield Loss

Damage to Cotton: Direct, Yield Loss

Excreted Sugars Host Sooty Molds
Quality Loss

$100M Problem
Sticky cotton could not be sold at a premium price after outbreaks in 1992 & 1995.

Arizona Cotton Insect Losses (1990–2004)

- Whitefly
- Pink bollworm
- Lygus bugs
- Other

IGRs, Bt cotton, & AZ IPM Plan introduced
Intercrop Interactions

Spring Melons

Winter Vegetables

Fall Melons

Cotton

Mass Movement

One Man’s White-Fly…

Whitefly Movement & Dispersal

What Do We Know?

• Longer flights during morning hours in females, though flight is possible all day
• Females have greater rates of climb

• < 1 d old or > 7 d. old, flight muscles not adequately developed for flight
• Longer duration flights at 3 – 5 d of age
• Gravid females do fly, though > 4 eggs inhibits long-duration flights

Short-Range Migration

• < 5% have sustained flights > 2 hrs
• Ca. 6% exhibit behaviors consistent with migration
• After which, sustained flight (> 15 min.) required to respond to visual cues

• Heavily dependent on wind direction
• Mark / recapture of individuals up to 2.7 km
• Bimodal distribution with majority near source (“trivial” flyers) & some at ca. 2.2 km (“migrants”)
Whitefly IPM...

...depends on 3 basic keys

Unstable

Missing elements of “Avoidance”, e.g., “Areawide Impact”
Areawide Impact

...depends on stable systems of management to be in place for all sensitive crops in order to reduce area-wide pressure or movement.

Whitefly IPM

Selective & Effective Chemistry

...the insect growth regulators (for cotton) & Admire (for veggies) sit at the center of our pyramid.

Overwhelming Pressure

Areawide Pressure

Intercrop Interactions

Dome Valley

Admire 1st used

Widespread use of Admire

IGRs in cotton introduced

Admire standard

Untreated

Palumbo, in press

Winter Vegetables

Spring Melons

Fall Melons

Cotton
Whitefly IPM

...depends on cooperation among grower’s of cotton, spring & fall melons, & vegetables.

**Neonicotinoids: A Major Class**

<table>
<thead>
<tr>
<th>A.I.</th>
<th>Product</th>
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**Risks by Community**

- Complex cropping system
- 3 major whitefly host crops
- 4 major production windows
  - Winter vegetables
  - Spring melons
  - Summer cotton
  - Fall melons

*Cross-commodity Guidelines for Neonicotinoid Insecticides in Arizona*

IRAC Symposium • Saturday at 9:30A
Paper 0722 — John C. Palumbo
“Grower Initiated Model for Sustaining Neonicotinoid Efficacy Across Commodities”
Risks by Community

- Simple cropping system
- 1 major whitefly host crop
- 1 production window
  - Summer cotton

(Other crops grown but not major hosts for whiteflies: alfalfa, wheat, barley, sudan grass, corn)

Three Common Communities

- Cotton-Intensive, Multi-Crop, and Cotton / Melon

Spatial Considerations

- Whiteflies residential in-season
- Opportunity for 3 – 4 “transfers” per year
- 2.2 km range for < 5% of population, annual range of 6.6 – 8.8 km
- Whitefly “communities” = all those sensitive host crops grown within a 2-mile radius annually

Communities Defined by Principal Treated WF Hosts

- Cotton
- Vegetables
- Melons

Sharing Neonicotinoids

**Neonicotinoid** Limitations: Maximum usage by crop per season

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<th>Melons</th>
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<tr>
<td>Multi-Crop</td>
<td>0</td>
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<td>1</td>
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<tr>
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<td>Cotton-Intensive</td>
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*Seed, Soil, or Foliar*

Cross-Commodity Agreements on Neonicotinoid Use

Palumbo et al. 2003
Group Adoption
- Section level pesticide records (1 mile square)
- Measure temporal & spatial changes in adoption
- E.g., neonicotinoid usage

Dispersal & Mgt. of Bemisia
- While ostensibly a sedentary insect through most of its life cycle, whiteflies can and do effectively move through our agroecosystem.
- Careful consideration of the consequences of this movement by stakeholders and researchers has led to the development of a refined IPM strategy.
- These refinements consider the spatial risks (e.g., for outbreak conditions & for resistance) and should help sustain cross-commodity management of this pest areawide.

Arizona Pest Management Center
APMC
http://cals.arizona.edu/crops