Cross-commodity Guidelines and Resistance Management:

Is There a Correlation ?

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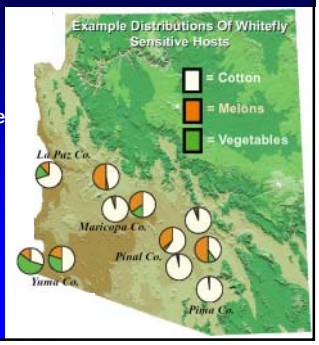
Cross-commodity Guidelines for Neonicotinoids in Arizona

Our Goal: Given the tremendous value of this insecticide class to all parties involved, secure the long-term efficacy of the neonicotinoids and protect growers' interests in sustainable and economical whitefly management.

Defining a Crop Community

1) Multi-crop
2) Cotton Intensive
3) Melon/Cotton Intensive



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

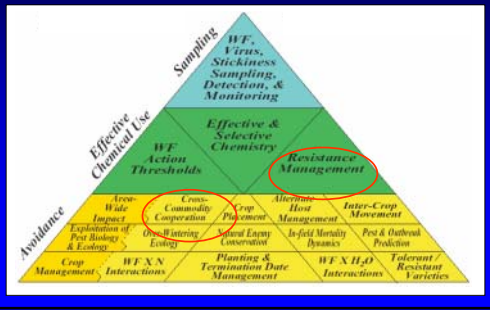
Community	Cotton	Melons	Vegetables
Multi-Crop	0	1*	1**
Cotton / Melon	1	1*	—
Cotton-Intensive	2	—	—

**Soil only; **Soil or Foliar*

http://ag.arizona.edu/crops

Fundamentals of Pest Management

Fundamental to any insect pest management program is a practical insecticide resistance management program



Will Following the Cross-commodity Guidelines

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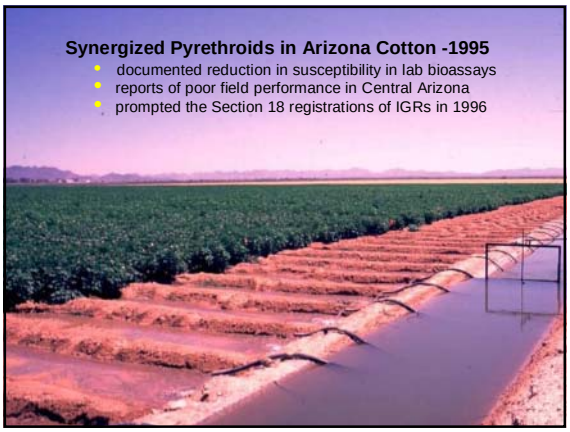
Sustained long-term efficacy of *Neonicotinoids* in our complex cropping communities

?

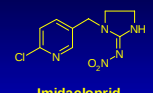
Resistance to Conventional Insecticides by the end of the 1980s

	Resistance Ratio (cotton)				
	OP	PYR	Fen/Bif	Aldicarb	Endo
Sudan	60-660	30-38	1-3	3	11
Turkey	19-300	29-208	6-8	2	5
Guatemala	28-400	760-2000	300-460	9	14

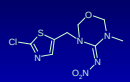
Source: Dittrich et al. 1990



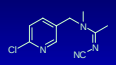
Neonicotinoid Chemistry



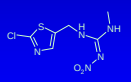
Imidacloprid
(Bayer)
Ist used in AZ in 1993



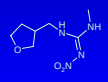
Thiamethoxam
(Syngenta)



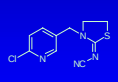
Acetamiprid
(Nippon Soda)



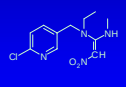
Clothianidin
(Bayer/Takeda)



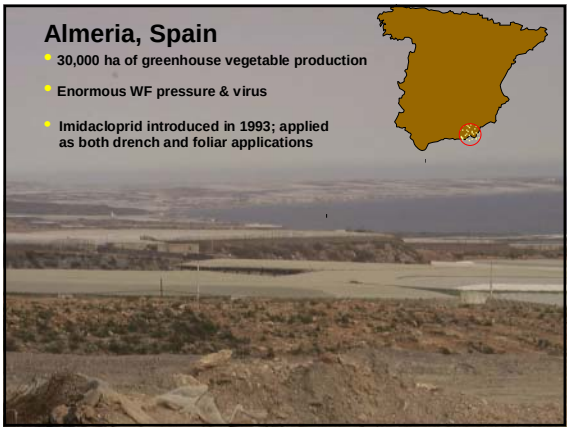
Dinotefuran
(Mitsui Toatsu)



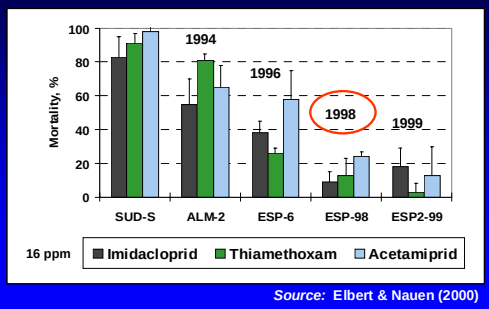
Thiacloprid
(Bayer)



Nitenpyram
(Takeda)

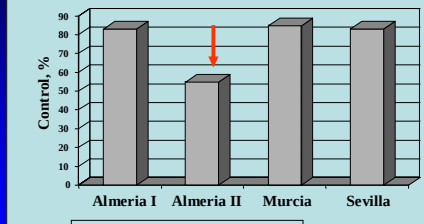


Response of whiteflies from Almeria Spain to neonicotinoids (16 ppm) in systemic bioassays compared to a suceptible strain (SUD-S)



Source: Elbert & Nauen (2000)

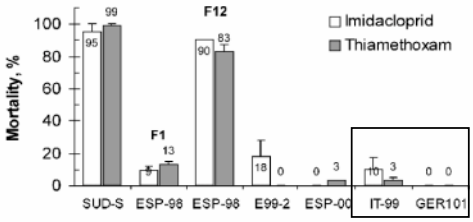
Field Performance of Imidaclorpid (foliar applied) in Almeria, Spain 1998



Source: Elbert & Nauen (2000)

Neonicotinoid Resistance found in WF collected from greenhouses In Germany and Italy -1999-2000

Source: *Nauen et al. 2002*

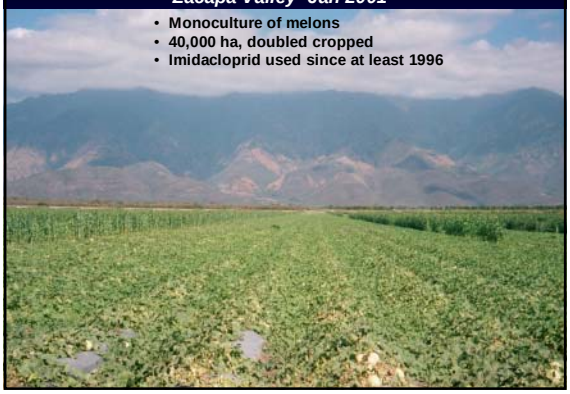


Guatemala

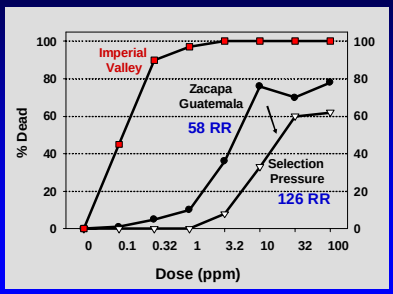
Zacapa Valley - Mar 2000

Zacapa Valley- Jan 2001

- Monoculture of melons
- 40,000 ha, doubled cropped
- Imidacloprid used since at least 1996



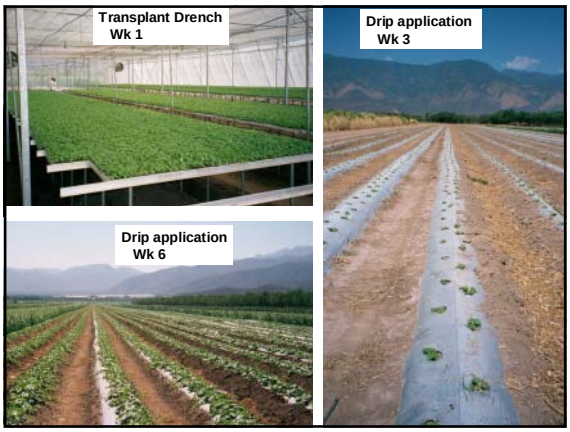
Susceptibility of *Bemisia* Whiteflies to Imidacloprid Collected on melons from Guatemala (2000)



Source: Steve Castle, USDA-ARS

Why Did Resistance Develop ?

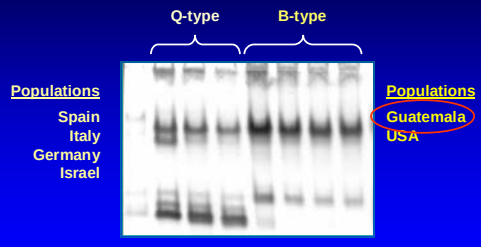
- Lack of Chemical Diversity
- Excessive Chemical Use
- Lack of Alternative IPM tactics
- Cropping System
- Whitefly Genetics



Neonicotinoid Foliar Application
Zacapa Valley, Guatemala 2001

Whitefly Genetics

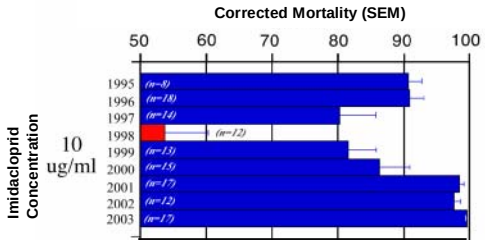
Bemisia tabaci



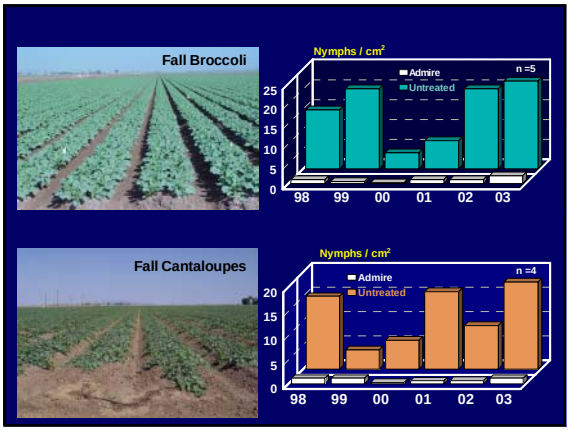
* Resistance is stable in Q biotype

Whiteflies have not affected *Yield or Quality* of vegetables in Yuma where Admire has been used properly for the past 11 years.

Susceptibility to imidacloprid (Admire®/Provado®) of Arizona whiteflies collected from cotton



Source: *Dennehy et al. 2004*



Thus the question ?

" Given the situations in Spain & Guatemala, and the extensive use of Admire in Arizona Since 1993"

Why are the neonicotinoids still effective In Desert Cropping Communities?

De facto Resistance Management

- **Cropping systems**
- **IPM practices**
- **Whitefly ecology & biology**

Contributing Factors to the Sustained Efficacy of the Imidacloprid in AZ

- **Segregation of neonicotinoids in vegetables and melons / IGRs in cotton**
- **Limitation of IGR uses (1 /crop) and Imidaclorpid (single soil or foliar use, not both)**
- **Spatial and Temporal Insecticide Rotations**
- **Exposure to and alternation with unrelated chemistries used for management of other key pests (ie., Endosulfan, Pyrethroids, Orthene)**

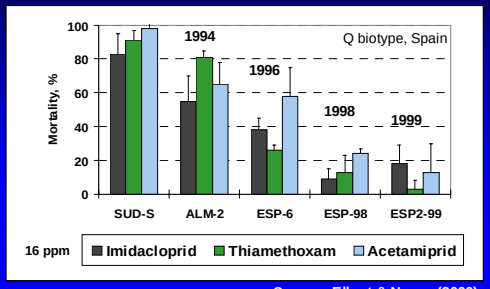
Contributing Factors ……

- **Untreated host plants serve as refugia for unselected individuals (alfalfa, ornamentals)**
- **High WF population dispersal and mating to and from key crops - chemistries**
- **Bio-residual in Cotton with IGR's; and to a lesser extent in melons with Admire.**
- **Inherent toxicity of soil-applied Imidacloprid**

So what's to be concerned about ?

1) **Expanded registrations of neonicotinoids**:
   - Admire/Provado: *melons, leafy vegetables*
   - Centric / Platinum: *cotton, melons*
   - Intruder / Assail: cotton, leafy vegetables
   - Dinotefuron: pending on numerous crops
2) **Multiple applications allowed by labels.**
3) **Risk of increased selection pressure on whiteflies**

Strong evidence for cross-resistance among neonicotinoids has been documented



Source: Elbert & Nauen (2000)

Pro-active Resistance Management

The University of Arizona Cooperative Extension

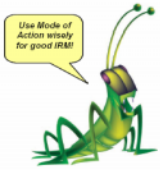
Cross-commodity Guidelines for Neonicotinoids in Arizona

IRAC Mode of Action Classification v 3.3 October 2003 1

IRAC

Insecticide Resistance Action Committee

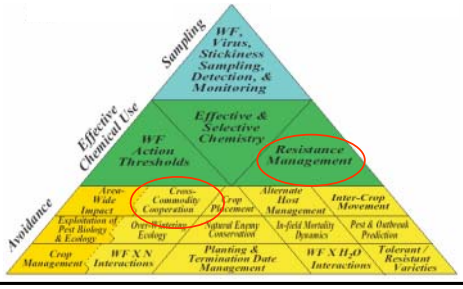
IRAC
Mode of Action
Classification v 3.3
Revised and re-issued,
October 2003



http://www.irac-online.org/documents/moa/moa.pdf

1. **Based on IPM Principles**

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



2. **Limit insecticide use**
   *** No more than 2 uses per year**

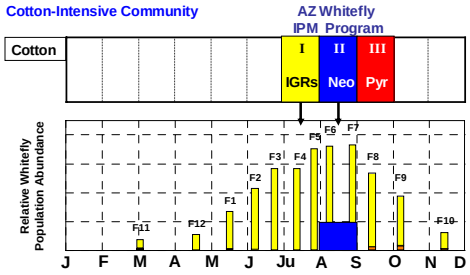
***Summary Guidelines**: Maximum number of uses per crop season for neonicotinoids in three different cropping communities.*

Community	Cotton	Melons	Vegetables
Multi-Crop	0	1*	1**
Cotton / Melon	1	1*	—
Cotton-Intensive	2	—	—

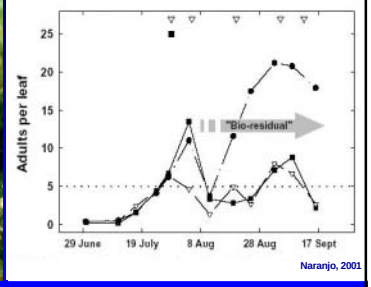
*Soil only; **Soil or Foliar

→ **Resistance in Spain and Europe occurred where foliar sprays used in addition to soil drenches.**

3. Diversify Chemical Use
* Alternation of chemistries

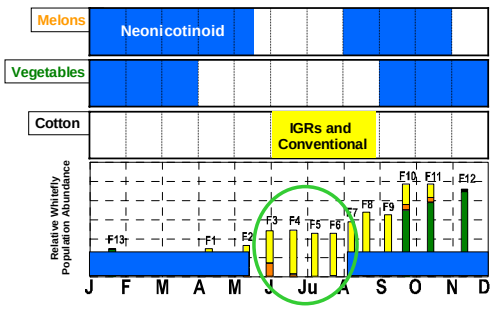


IGRs
Conservation of natural enemies
BioResidual



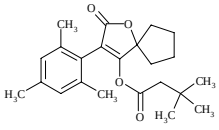
Naranjo, 2001

3. Diversify Chemical Use
* Exclusion (Neonicotinoid–Free Period)

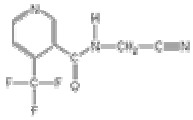


3. Diversify Chemical Use
* New chemistries in the near future

Oberon (spiromesifen)



Flonicamid



- **There are several other promising chemistries in the pipeline**

Will Following the Cross-commodity Guidelines

Passive "*defacto*" IRM

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Pro-Active IRM

Sustained long-term efficacy of *Neonicotinoids & IGRs* in our complex cropping communities

Is This Pro-active Approach Important to Arizona Growers ?

If so, how do we measure Success ?