



Arizona enjoys a sustained recovery from the devastating whitefly outbreaks of the early 1990's. This success is built on an IPM strategy that includes the use of selective and effective chemistry. *Admire*[®] has been a key soil insecticide protecting vegetables and produce throughout Arizona and is the first member of a burgeoning class of chemistry known as the neonicotinoids. New members of this valuable, reduced-risk, class of chemistry are now available to agricultural producers, placing a burden on users of these compounds to adopt science-based plans for sustaining their efficacy. This consensus document represents our best efforts to share this chemistry among different agricultural interests. Our goal is to preserve the long-term efficacy of the neonicotinoids and protect growers' interests in sustainable and economical whitefly management. Through identification of crop communities (i.e., 'multi-crop', 'cotton-intensive', and 'cotton / melon') common to Arizona agriculture, we have designed sensible plans of use that should allow access to this valuable chemistry for everyone, while protecting it from resistance.

John C. Palumbo¹, Peter C. Ellsworth¹, Timothy J. Dennehy¹, Robert L. Nichols²

¹University of Arizona, ²Cotton Incorporated



Developed in collaboration with and endorsed by
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Cotton Incorporated
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these management practices may be difficult to implement and even occasionally run counter to strictly short-term interests; however, more disciplined use will now be necessary to accommodate new products and contribute to long-term sustainability of the neonicotinoid chemistry on desert crops.

Cross-commodity Guidelines for Neonicotinoid Insecticides in Arizona

Neonicotinoids & Whitefly Management

During the past decade, the silverleaf whitefly (*Bemisa tabaci*, Biotype B) has been relegated to a managed pest in Arizona. This was achieved through the de-

velopment, adoption and implementation of management programs in a partnership between the University and growers. Growers are quick to adopt new guidelines that have been developed in response to pest crises and other significant events.

The recent registration of several new neonicotinoid compounds on cotton, melons and vegetables has expanded the number of compounds available for whitefly control on these crops. *Admire*[®] (imidacloprid), the first compound registered within this class of chemistry, has been used effectively in melons and vegetables for whitefly and aphid control since 1993. The sustained efficacy of *Admire* over the past 10 years exceeds the expectations of many who speculated that whiteflies would quickly evolve resistance. However, no field failures have been reported so far, in part perhaps, because imidacloprid has been used sparingly in cotton and other summer crops. The recent registration of new members of this class of chemistry, *Intruder*[®] (acetamiprid) and *Centric*[®] (thiamethoxam), may lead to much greater use of this class in cotton against whiteflies. If not used judiciously,

successive whitefly generations could be exposed to several neonicotinoid compounds on a variety of different crops throughout the year. Such a scenario places increased selection pressure on exposed whitefly populations and thereby increases the risk of resistance.

All interested parties including agrochemical industry, University researchers, growers, and pest

control advisors (PCAs) have worked together to outline below some common-sense guidelines that take into account the use patterns of neonicotinoids for whitefly control and the cropping communities in which they will be used.

The objective of these guidelines is to optimize frequency of insecticide use (e.g., number of applications / season or year) to avoid sequential exposure of multiple generations of whiteflies across commodities. Ideally, these strategies will enhance whitefly management and maximize the longevity of all compounds used for their control. We recognize in certain situations

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.

Suggested Minimum Rates & Crop Uses for Neonicotinoid Insecticides Registered in AZ

Active Ingredient	Product Name	Type of Application	Minimum Rate	Control Interval	Registered Crops
<i>acetamiprid</i>	<i>Intruder</i>	Foliar	2 oz	14–28 d	Cotton
<i>imidacloprid</i>	<i>Admire</i>	Soil	16–20 oz	45–60 d	Melons, Lettuce, Cole
<i>imidacloprid</i>	<i>Provado</i>	Foliar	3.75 oz	7–10 d	Lettuce, Cole (aphids)
<i>thiamethoxam</i>	<i>Actara</i>	Foliar	4 oz	7–14 d	Lettuce, Cole
<i>thiamethoxam</i>	<i>Centric</i>	Foliar	2 oz	7–14 d	Cotton
<i>thiamethoxam</i>	<i>Platinum</i>	Soil	8 oz	45–60 d	Melons, Lettuce, Cole

Defining a Crop Community

A crop community can be defined by its production of whitefly-sensitive host-crops over an annual cycle. Whiteflies depend on this annual sequence of host plants to survive over generations. Sequential exposure of these generations to insecticides can accelerate the development of resistance. Because of the diversity of systems and needs across the state, there are specific guidelines for neonicotinoid use for each crop community:

- **Multi-Crop Community.** A diversity of whitefly host-crops is grown within the same growing area or location. Good examples include the Yuma, Gila, and Dome Valley areas of Yuma County, where cotton, melons, cole crops, lettuce, and other vegetable crops are grown within 2 miles of each other during the course of a year.

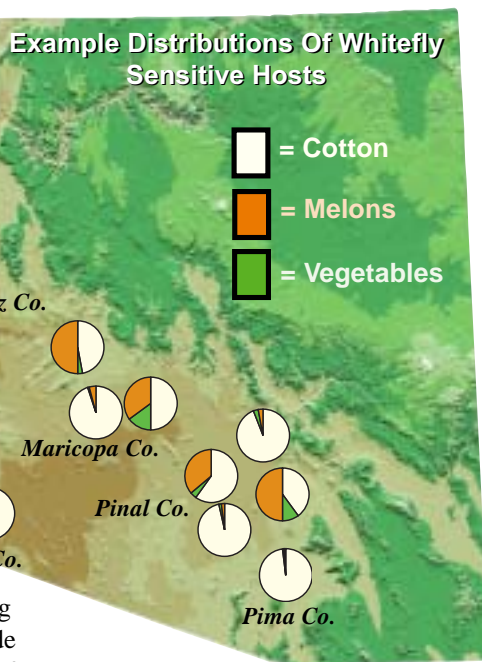
- **Cotton / Melon Cropping Community.** Cotton and melons are grown within 2 miles of each other during the course of a year. Examples include areas within western Maricopa and Pinal Counties.

- **Cotton-Intensive Community.** Cotton is the dominant whitefly host-crop grown during the course of a year. An example of this community would be areas such as the Buckeye Valley and Pima County.

Neonicotinoid Use Guidelines for Each Crop Community

These guidelines balance the immediate need for pest control with the long-term need to conserve effective chemistry. Not all guidelines are popular, but do represent our best attempts at advising grower usage of this valuable chemical class. Benefits are maximized for everyone, just like in whitefly management currently, if everyone adopts these guidelines together.

Cotton-Intensive Community: These guidelines apply to crop communities in central Arizona (e.g., Buckeye, Marana) or wherever cotton production is isolated



from both melons and vegetables. The insect growth regulators (IGRs; Knack® and Courier®), non-pyrethroids, and pyrethroid combinations have usually been used for whitefly management in these areas.

- No more than two neonicotinoid uses per cotton crop [soil, foliar or seed (e.g., Gaucho® or Cruiser®) treatment].
- Foliar neonicotinoid sprays should usually be used in Stage II of the Arizona Whitefly IPM Program (following a Stage I, IGR application; Ellsworth et al. 1996) to maximize the IGR chemical and biological residual, which provides economic benefits in

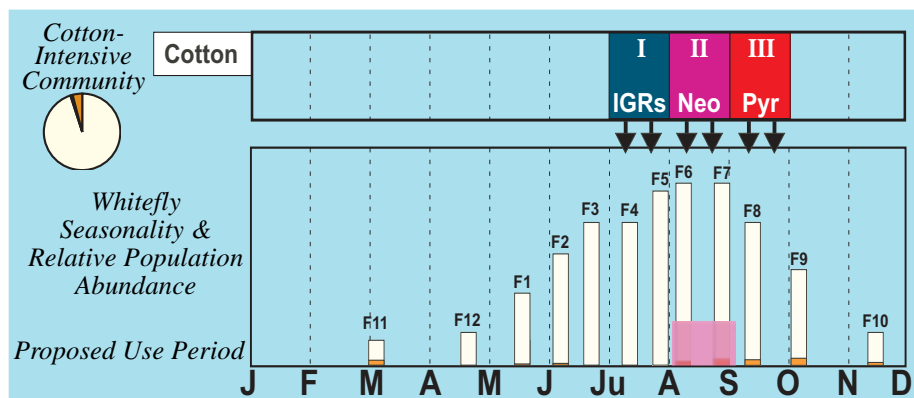
controlling whiteflies long-term while suppressing other pest insects.

- Sprays should not to be applied consecutively, but rotated with alternate chemistries (other Stage II non-pyrethroid combinations, or Stage III pyrethroid combinations).
- Under conditions where a July (or earlier) use of an IGR is not required (i.e., due to low and late pressure), a neonicotinoid (Stage II) may be used prior to or instead of an IGR.
- When thresholds are reached in July (or earlier), a Stage I IGR should be used, followed by Stage II non-pyrethroids (including neonicotinoids), and Stage III pyrethroid combinations, if necessary.

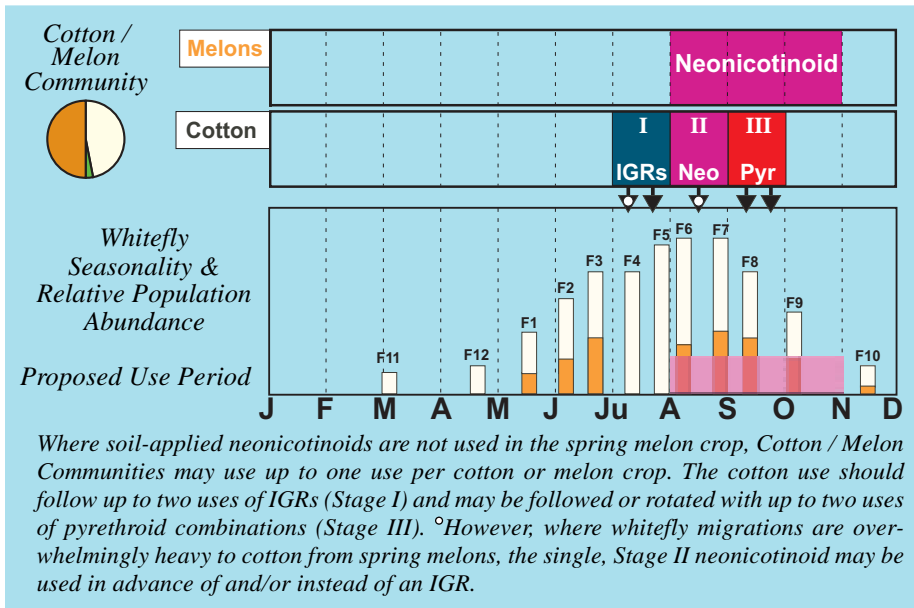
Cotton / Melon Community: The following recommendations apply for crop communities in central Arizona (e.g., Aguila, Harquahala, Waddell / Litchfield and parts of Pinal County) or wherever melon crops coincide with cotton production (i.e., within 2 miles of each other). These guidelines specifically apply to communities where soil applied neonicotinoids (Admire or Platinum®) are not used on spring melons, but are used on fall melons. IGRs and conventional combinations are used in cotton.

Melons:

- Use a foliar neonicotinoid spray no more than once in spring melons, if



A new use period for neonicotinoids (in Stage II) is proposed for Cotton-Intensive Communities, where up to two, non-consecutive foliar uses are permitted per cotton season. These uses should follow up to two uses of IGRs (Stage I) and may be followed or rotated with up to two uses of pyrethroid combinations (Stage III).



Cotton:

- Do not apply any neonicotinoid product to cotton (Centric, Intruder, Pro-vado®, or Leverage®).

Melons & Vegetables:

- Not more than one neonicotinoid use (soil or foliar) per crop. Soil at-planting uses are recommended for fall vegetables and all melon crops. Split applications are not recommended.
- Do not apply a foliar neonicotinoid spray following the use of a soil application of Admire (imidacloprid) or Platinum (thiamethoxam).
- As long as other effective active ingredients are available (i.e., endosulfan, Orthene®, Capture, Fulfill®, dimethoate, Metasystox-R®), do not apply more than one foliar neonicotinoid spray per crop for aphid control on spring lettuce and cole crops planted in the absence of Admire or Platinum.
- Neonicotinoids (soil or foliar) should not be applied in Yuma County after April 1 or before August 1.

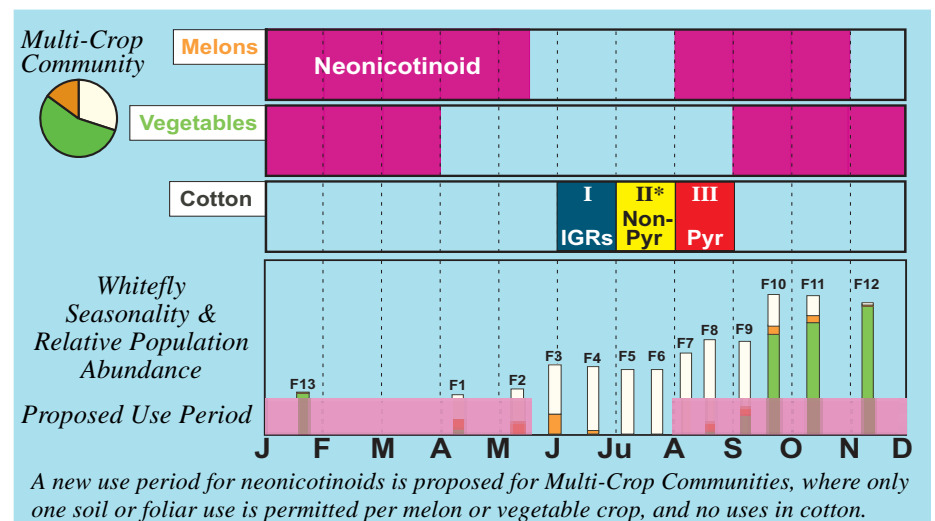
allowable. Alternate between Courier (8 oz / A; buprofezin) and a pyrethroid (Capture® @ 6 oz / A or Danitol® @ 10 oz / A) plus endosulfan (1 qt / A), if necessary.

I, IGR may follow the single use of a foliar neonicotinoid (Stage II). Furthermore, if Courier (buprofezin) or pyrethroid mixtures with endosulfan are used in the spring melons, the first spray in cotton should be either Knack (Stage I, IGR) or, if adult levels are overwhelming, a foliar neonicotinoid (Stage II, non-pyrethroids).

Cotton:

- No more than one neonicotinoid use per cotton crop (soil, foliar or seed treatment).
- Foliar neonicotinoid sprays should be used only in Stage II of the Arizona Whitefly IPM Program (i.e., following an IGR application; but see next paragraph) to maximize the biological benefits and chemical residual of the IGRs and minimize the number of whitefly generations potentially exposed to neonicotinoids. This use will often completely or mostly overlap with fall melon uses of a soil neonicotinoid, and thus minimize resistance risks.
- Migrations of whiteflies out of nearby spring melons present unusual problems for cotton growers. For cotton near melons not using a soil neonicotinoid, one foliar neonicotinoid may be used early in cotton (i.e., June or early July) to provide effective control of adults. In these cases, a Stage

Multi-Crop Community: These guidelines apply to multi-crop communities similar to Yuma Valley where Admire (imidacloprid) has been the primary insecticide used for whitefly management on vegetables and melons, and whitefly insect growth regulators (IGRs), non-pyrethroids*, and pyrethroid combinations have been used in cotton.



Don't Forget the Fundamentals

Never forget the fundamentals of pest management. When control of pests requires chemicals, selection pressure is inevitable. As a result, every effort should be made to limit the use of all whitefly chemistry by making use of proven guidelines for whitefly management. This approach saves money, protects our environment, and reduces risks of resistance.

Avoid Problems Through Cultural Controls

- Actively invest in crop sanitation, crop sequence, and crop placement tactics.
- Maintain crop health and adequate plant-water relations.
- Promptly remove all post-harvest residues in all crops.

Scouting, Sampling and Detection

- Use research-based sampling procedures and action thresholds.
- Apply insecticides only when necessary.

Ensure Effective Chemical Use

- No more than 2 uses of any compound (i.e., active ingredient) per season.
- No more than 2 uses of the pyrethroid chemical class per crop season.
- No more than 2 uses of the neonicotinoid chemical class per year within

a cropping region.

- No more than 1 use each of buprofezin and pyriproxyfen (IGRs) per season.
- Apply insecticides by directed ground sprays to optimize spray deposition whenever possible.
- Do not apply insecticides below labeled or recommended rates. Application of sub-lethal rates of any insecticide may result in poor product performance, insect damage, and an increased risk of resistance.
- Use only recommended neonicotinoid products and rates necessary to accomplish desired control.

Sensible Limits

Guidelines for the sensible limits on a valuable new class of chemistry, the neonicotinoids, are provided for three different crop communities that exist in Arizona. These guidelines are flexible and allow grower access to this effective group of insecticides, while providing prudent measures for preserving their efficacy indefinitely. With areawide adoption of these guidelines, growers should have even more options for pest control while minimizing the risks of resistance. Each cropping community, as defined by the prox-

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

imity and diversity of crops grown within 2 miles of each other, has access to up to two uses of the neonicotinoid class per year. These voluntary limits should provide for at least 4 generations of whiteflies annually that are not exposed to the neonicotinoid class. Through areawide implementation of this refugia strategy, whiteflies may remain susceptible to the neonicotinoid class for the foreseeable future. This will pay dividends to growers of all crops in Arizona for many years to come.

Reference

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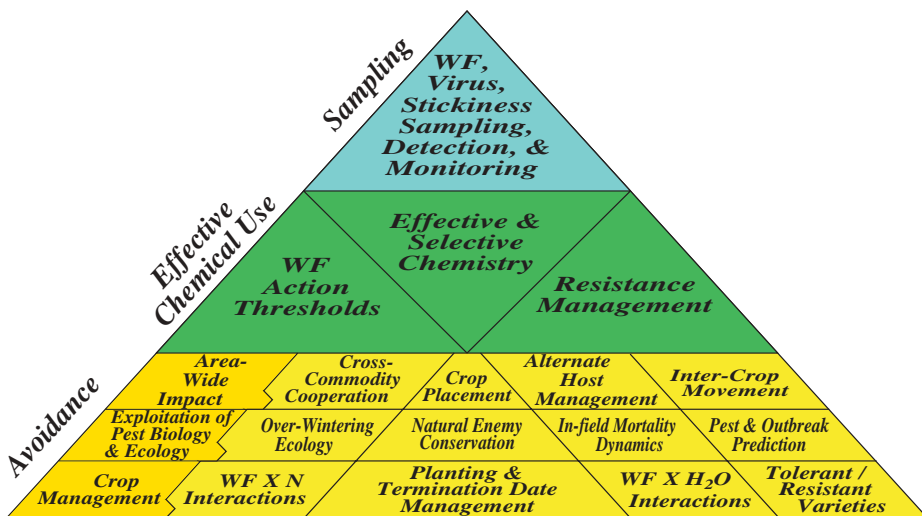
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This and other documents of interest relating to crop production / protection are available on the Arizona Crop Information Site at <http://cals.arizona.edu/crops>



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Whitefly management can be viewed conceptually as a pyramid-like structure of sampling and effective chemical use built upon a solid foundation of avoidance practices. Important among these avoidance practices is the element of areawide impact, which depends, in part, on cross-commodity cooperation in efforts such as resistance management.