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# *Maps Provide Directions for Resistance!*

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Whiteflies (*Bemisa tabaci* MEAM1) are a perennial issue for Arizona agriculture. Over-reliance on any one mode of action to control whiteflies in a local area will lead to resistance development. Remembering and implementing the first principles of resistance management (limiting, diversifying, and partitioning chemistry through time and space) is critical to prevent the development of resistances (Pier et al. 2015). **Chemical use maps that detail recent whitefly insecticide use patterns across multiple crops are a tool that can help you put these first principles into practice.**

**How do you think about your system?**

Think about your unique management situation not only at the field level, but at an area wide level. Previous studies with Knack® (Carrière et al. 2012) indicate that a 3 km radius (or ≃ 3 x 3 Section area) is the region over which resistances are related to local insecticide use patterns (green box in Figure 1). In this case, whitefly resistance increases and decreases along with the amount of Knack-sprayed and Knack-unsprayed cotton in an area, respectively. Research is ongoing to determine if similar patterns hold for other insecticides and for use patterns that occur in multiple crops.

**What are the chemical use maps?**

The maps give a visual representation of insecticide use patterns for 21 active ingredients, represented by 6 different whitefly modes of action (Table 1) in a given area. **Six levels of pesticide use intensity are defined on the color-coded maps, including areas of no use, which are unshaded. The darker the shading the greater the use (Figure 1).**

The maps are created using the pesticide use data reported to the state on form L-1080. Not all applications are represented on the maps as not all uses are necessarily reported.

**How to read the maps?**

The information presented in these maps will ultimately provide you with the knowledge to make educated management decisions.

Depending on an individual's needs and use patterns in sections surrounding the field, one of several actions may be taken.

1) ***Low risk areas*** Continue to use a given chemistry at the same frequency
2) ***High risk areas*** Refrain completely from using a chemistry
3) ***Intermediate risk areas*** Only use a chemistry when the situation dictates it; do not rely heavily on a chemistry when there are alternatives

In multi-crop areas, it may be possible to reduce usage by curtailing sprays of a particular chemistry in cotton (Palumbo et al. 2003). This will allow for the creation of the critical spatial and temporal refuges (areas or time periods not sprayed) that reduce selection pressures.

The chemical use maps are part of an advanced "landscape" management approach. Grower communities can benefit from open discussion and cross-commodity cooperation, including farmer-to-farmer sharing of information (1080s and crop maps). **This provides the information to make effective management decisions to reduce risk of whitefly resistance, which will benefit the industry at an area wide level. Sound decisions at the individual and community levels can help prevent loss of management options over time.**

***Table 1.*** Seven products representing the 6 modes of action and 7 of the active ingredients used in controlling whiteflies.

| Mode of Action or Name & Group Number | | Active Ingredient | Example Products |
|---|---|---|---|
| Pyrethroids | 3A | fenpropathrin | Danitol |
| Neonicotinoids | 4A | acetamiprid<br>imidacloprid | Intruder<br>Admire Pro |
| Juvenoid (IGR) | 7C | pyriproxyfen | Knack |
| Chitin Inhibitor (IGR) | 16 | buprofezin | Courier |
| Lipid Synthesis Inhibitors | 23 | spiromesifen | Oberon |
| Diamides | 28 | cyantraniliprole | Exirel |

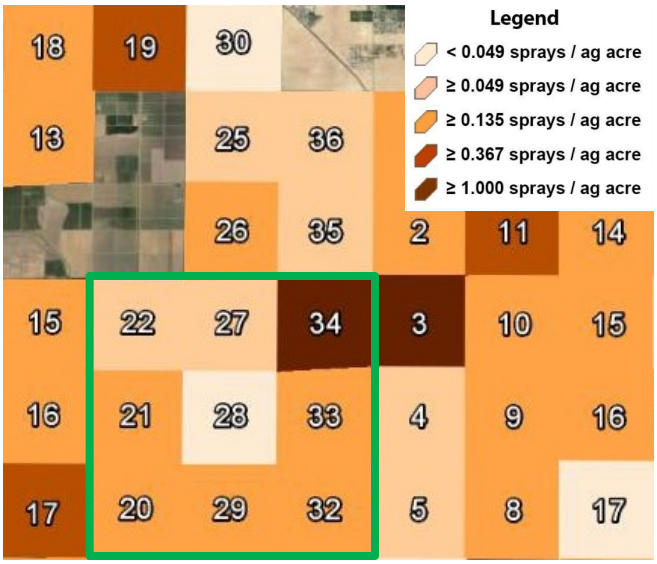


***Figure 1.*** An example of a usage map showing all six levels of pesticide usage in numbered sections, including sections with no use (unshaded portion). The 3 x 3 Section area outlined in green indicates the region over which resistances are related to local insecticide use patterns for Knack. These maps allow decision makers to make informed management choices.

***Also See:***

Pier N., L. Brown, P. Ellsworth, J. Palumbo, Y. Carrière, A. Fournier, S. Castle, N. Prabhaker. 2015. First Principles of Resistance Management. University of Arizona Cooperative Extension IPM Short. URL: http://cals.arizona.edu/crops/cotton/files/1stPrinciples.pdf

Carrière, Y., C. Ellers-Kirk, K. Hartfield, G. Larocque, B. Degain, P. Dutilleul, T.J. Dennehy, S.E. Marsh, D.W. Crowder, X. Li, P.C. Ellsworth. Large-scale, spatially-explicit test of the refuge strategy for delaying insecticide resistance. Proc. Natl. Acad. Sci. 2012 Jan 17;109(3):775-80.

Palumbo, J.C., P.C. Ellsworth, T.J. Dennehy, R. L. Nichols. 2003. Cross-commodity guidelines for neonicotinoid insecticides in Arizona. IPM Ser. 17 Pub. AZ1319. URL: http://cals.arizona.edu/pubs/insects/az1319.pdf

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