

Commercial-Scale Evaluation of Replacement Strategies for Management of Q-biotype Whitefly

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Critical Issue: The sweetpotato whitefly, *Bemisia tabaci* (Gennadius) is a pest of worldwide significance causing damage to many field and horticultural crops. In the southwestern United States this insect has been a key pest of cotton and vegetable crops since the early 1990's. Historically, *B. tabaci* has been difficult to control with insecticides and has developed resistance to multiple classes of insecticides. The sweetpotato whitefly is represented by an array of biotypes worldwide with each biotype having subtle individual characteristics (host range, virus vector differences, insecticide sensitivity). The B-biotype is the most widely distributed variant and the target of current management strategies in Arizona. Within the last decade a Q-biotype was described from southern Spain in an area of intense protected agricultural production. Some populations of the Q-biotype have shown resistance to many registered insecticides, most notably the neonicotinoids and the insect growth regulator pyriproxyfen. These insecticides form the foundation of management strategies for *B. tabaci* in Arizona cotton and vegetable production. In late 2004 on-going surveys by EARML intercepted what appeared to be Q-biotype whiteflies on poinsettias from a local garden center in Tucson. Molecular testing has since verified these insects as the Q-biotype. It is too soon to know if this biotype will become established in Arizona, however, it is known to have invaded other parts of the world such as Israel, presumably from movement of plant stock from protected agriculture. Furthermore, Arizona Department of Agriculture has just announced another positive detection of this new biotype at a second location (New River, Maricopa Co.). The threat of establishment is real, and preemptive strategies for dealing with this new whitefly variant are urgently needed.

Beginning in 1996, when the insect growth regulators (IGRs) buprofezin and pyriproxyfen were approved for use in Arizona cotton under an emergency exemption, a three-stage resistance management strategy was developed for cotton in partnership with the University of Arizona, USDA-ARS, and industry. This strategy relies on threshold-based applications of insecticides in three sequential stages beginning with selective IGRs (Stage I) followed by non-pyrethroid mixtures (Stage II), and finally pyrethroid mixtures (Stage III) near the end of the growing season. Because of the high efficacy and selectivity of the IGRs, this IRM as part of an overall IPM strategy ensures that the activity of natural enemies, primarily arthropod predators, is maximized during a substantial portion of the growing season. ***Since the introduction of this strategy, insecticide use in Arizona cotton declined nearly 85%.*** The success of this management strategy was predicated on research-based guidelines for sampling and thresholds, effective and selective chemistry, and a comprehensive Extension education campaign. Management strategies for *B. tabaci* in Arizona cotton have continually adapted as new

sampling methods, thresholds, insecticides, and resistance management systems have become available and helped to stabilize the management of whiteflies across multiple crops over our entire agricultural landscape. These evolving strategies have also progressively fostered the increasing role of other tactics such as cultural control, areawide implementation, and conservation biological control as components of robust IPM. Past research has shown that selectivity is a key ingredient to whitefly management and one that allows an extended “bioresidual” (natural enemies and other natural forces) to contribute to pest control many weeks after an initial application. However, new insecticides continue to be introduced and changing economics, shifts in grower practices, and the ever-present issue of reduced susceptibility to current insecticides by *B. tabaci* require that new potential management scenarios be tested and evaluated. ***The potential establishment of the Q-biotype in Arizona represents a critical threat to the cotton and vegetable industries in the state because current management strategies are unlikely to be fully effective in controlling this pest.*** The preemptive development and testing of new strategies is paramount to preventing potential disruption in the production of major agricultural commodities in Arizona.

Outcomes: The results of this study will have immediate and positive impacts on the cotton and vegetable industries in Arizona and elsewhere through the development and commercial-scale demonstration of alternative systems for the effective management of *B. tabaci*, a key pest of cotton. More importantly, these applied research and outreach activities will provide immediate benefit to the cotton and vegetable industries by providing effective, safe, and field-tested strategies for dealing with the potential establishment of the Q-biotype in Arizona. Such preemptive testing will provide growers with confidence that the threat of a new pest does not equate to economic loss. In the medium term, this project will underpin future enhancements to an already successful management system for whiteflies and provide growers with additional options for effective pest management. In addition the project will evaluate a putatively selective insecticide that will contribute to reduced risks of environmental contamination and human health consequences.

This project will facilitate a strategic response should the Q-biotype become established in our agricultural system. We will communicate any new guidelines for whitefly management (B or Q-biotype) that are developed as a result of this project at Extension meetings, other venues, and through liberal use of the Arizona Crop Information Site (ACIS). Extension fact sheets, CALS commodity reports, and other written communications will be distributed through County Extension Agents and via the web.

Plan for Evaluation: Data will be collected on whitefly population dynamics and on resulting yield and quality. We will also examine the dynamics of about two dozen species of natural enemies in order to evaluate and contrast the selectivity of Oberon to the current known selective strategy founded upon the IGRs. These data will enable a robust evaluation of the outcomes of this study and will be useful in the assessment of our replacement IPM strategy. Because the new strategy will likely require new technologies, we will also be able to evaluate user adoption of our plan by the quantification of the penetration of any new technologies. Our work will dovetail with existing efforts of the

Crop Insect Loss and Impact Assessment Working Group, which maintains databases on insect losses, including to whiteflies, for cotton, head lettuce and melons.

Outputs: A new insecticide, spiromesifin (Oberon, a lipid biosynthesis inhibitor), is due to be registered this year and has been shown in laboratory and limited field trials to be effective in controlling both B and Q biotypes of *B. tabaci*. We propose to conduct a replicated, commercial-scale trial (15 Acres total) at the Maricopa Agricultural Center this summer to compare and contrast the efficacy and selectivity of Oberon in the management of *B. tabaci*. The management of *B. tabaci* with Oberon will be contrasted with our current three-stage management strategy founded on the initial use of pyriproxyfen (Knack) and buprofezin (Courier). The trial will also involve a contrast of ground and aerial application systems so that results will be widely applicable to commercial production practices. Data will be collected on whitefly population dynamics and on resulting yield and quality. We will also examine the dynamics of about two dozen species of natural enemies in order to evaluate and contrast the selectivity of Oberon to the current known selective strategy founded upon the IGRs. Small plot investigations will also be conducted in cotton (MAC) and vegetables (YAC).

The large-scale research and demonstration will be conducted at the Maricopa Agricultural Center's Demonstration Farm. Unique in our system, this farm facilitates the commercial-scale testing and demonstration of commercial or near-commercial technologies. This site will serve as a convenient focal point for a field day and other workshops dedicated to improving grower understanding of whitefly management options and preparation for any introductions of Q-biotype to field-scale agriculture in Arizona. New whitefly management guidelines (for B and Q-biotype whiteflies) based on the results of this project may be generated and disseminated to clients through Extension fact sheets, other bulletins, CALS commodity reports, ACIS, and county extension offices. If detection or worse establishment of Q-biotype be confirmed in field-scale agriculture this year, we will rapidly communicate our results via email, internet / ACIS, and other electronic means.

Inputs: The overall project proposed is a coordinated and collaborative effort among university and federal researchers and extension specialists, and industry. The overall cost of the trial and extension related activities is approximately \$45,000 including land rental, seed, insecticide and application (air and ground) costs and labor. Research of this nature is highly labor intensive and some aspects involve specialized training and experience (e.g. accurate sampling of whitefly populations and identifying natural enemy species). The budget requested here would defray some labor costs and contribute to education and outreach efforts to make the findings available to end-users.

- Project Team's time
- Research Specialists and other technical staff time
- Grant from Bayer (ca. \$15,500)
- Grant from Valent (ca. \$4,000)
- USDA-ARS in-kind personnel support
- Custom Farm Service (donation of aerial application time and costs)
- UA-MAC, discounted facilities use costs (ca. \$6,000)

Budget request: \$7,000