

Citrus Industry Update

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Published by the University of Florida, Institute of Food and Agricultural Sciences, with the mission of keeping the Florida Citrus Industry informed of current research concerning canker and greening.

Greening

Psyllid Management

Effectiveness of aerial applications for controlling psyllids

We have recently concluded our second of two psyllid control trials using aerial applications of insecticides. The first trial was conducted in Hardee county Florida in July 2007. In this trial, Dimethoate 4E was applied at a rate of 2 pints per acre. Spray volumes of 5 gallons and 10 gallons per acre were compared to determine if increasing spray volume resulted in better psyllid control by increasing penetration of the spray inside the tree canopy. In this trial we saw an immediate reduction in psyllid numbers in blocks treated aerially, but there was no difference in psyllid control between the two spray volumes used. After aerial applications were made, adult psyllid numbers remained low the entire 25 days in which the trial was evaluated.

Twenty days after application, we began to see some increase in the number of psyllid eggs and nymphs on new flush that was produced after applications were made (and thus not protected). This increase in the immature stages of the psyllid was likely due to adult psyllids migrating into the grove from the surrounding untreated areas and reproducing on the new flush. Such an increase in immature psyllid populations may not have occurred as quickly if a larger area had been concurrently treated.

A second aerial trial to determine the effectiveness of aerial sprays for controlling psyllid populations was begun in late October 2007. In this trial, a group of citrus growers in DeSoto county, collaborated to treat 20,000+ acres of contiguous citrus acreage using aerial applications. Applications were made during the start of the winter dormant period (when trees are producing little or no new flush). Within this treated citrus acreage we set up a trial to determine the effectiveness of Dimethoate and Sevin XLR treatments applied

aerially compared to Dimethoate applied by airblast sprayer on the ground. Blocks of citrus were also left untreated for comparison.

Immediately following application, psyllid populations were reduced to undetectable levels in all insecticide treated areas, regardless of whether treatments were made using ground sprays or aerial applications. Adult psyllids have remained undetectable in the treated areas under our evaluation through the beginning of this month while psyllids were continuously found in the untreated control plots throughout the duration (Oct. 25 – Feb. 5) of the trial. (Michael E. Rogers, mrgrs@ufl.edu)

Timing of Aldicarb Applications

Reductions of 86 percent psyllid adults and 77 percent in shoot infestation were seen in spring following application in January 2007 of 33 lb/ac Temik® to the bed side of mature 'Valencia' trees in a 35-acre block near Immokalee. These results were generally better than the November and especially February applications. Adults caged on branches during spring flush in Mar and Apr. also showed greater mortality on trees treated in Nov or Jan indicating that the toxicant did not have sufficient time to reach emerging foliage when applied in mid-February. Spiders and ladybeetles were equally abundant in treated and untreated trees, indicating Temik compatibility with these predators. These findings indicate that application of Temik 2-3 months before spring shoot initiation can significantly suppress ACP populations during the critical spring growth period and afterward with minimal impact to generalist predators. A trial was initiated this year to look at rates of Temik required to treat young trees of

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different sizes (small, medium, large). Temik was applied in January and psyllid populations will be monitored on the treated and untreated trees during the season. (Phil Stansly and Jawwad Qureshi; pstansly@ufl.edu).

Insecticide Trials for Psyllid Control

Mature 'Valencia' trees at SWFREC in Immokalee were hedged to induce flush. Insecticides were applied for the first two trials with a tractor mounted hydraulic sprayer operating at a pressure of 150 psi with an array of 12 or 15 ATR-80 ceramic hollow cone nozzles directed at the tree on 3, 5 foot booms to deliver 54-66 gpa. One result from the first trial was that a non-ionic surfactant (Induce®) or 435 Oil were more effective adjuvants for Movento® (spirotetramat) than MSO or Kinetic. In the second trial, percentage infested shoots at 24 days after treatment (DAT) was lower on trees treated with the high rate (5.5 oz) of Actara 25 WG (thiamethoxam) and MANA AG 8412-094B (imidacloprid), though not significantly less than Provado 1.6F (imidacloprid) @ 12 oz, either rate (10 or 20 oz) of Agri-Mek 0.15EC, the low rate of MSR 2E or two experimentals, GF-1640, or QRD 400. An air-assisted speed sprayer delivering 200 gpa was used for the 3rd trial which showed no effect from a guava leaf extract estimated at 2 percent and only Danitol and oil showing significant suppression at 14 DAT. In another trial, two formulations of imidacloprid, Admire Pro at 14 oz, Mana AG 8412-094b (4F) at 16 oz and one of thiamethoxam (Platinum 2F at 13.7 oz) applied as a drench to 6 ft 'Valencia' trees on June 13, 2007 were still providing active psyllid suppression 99 days later on Sept. 20, 2007. Full reports of these studies can be found at http://swfrec.ifas.ufl.edu/entlab/pubs/sta_rpts/index.htm (Phil Stansly, Jawwad Qureshi and Barry Kostyk; pstansly@ufl.edu).

New Post-Doctoral Extension and Research Entomologist On Board

In January, Alejandro Arevalo joined the citrus entomology team at SWFREC Immokalee. Dr. Arevalo is originally from Colombia and received his M.Sc. and Ph.D. in entomology at UF Gainesville. His charge is to work with growers to design and test their psyllid control programs. (Phil Stansly, pstansly@ufl.edu).

Greening Diagnostics

Evaluation of Field Techniques to Aid in the Rapid Detection of Citrus Greening

The objectives are to establish the proper protocol in terms of sampling technique, iodine solution, and parameters to be used for visual detection; Analyze starch accumulation patterns in symptomatic and asymptomatic leaves from trees infected with Citrus greening; Determine any limitations based on varietal differences; Distinguish between greening and other biological diseases and horticultural deficiencies in terms of starch staining. The progress on this project through December 2007:

Results from our experiments have by now completed objectives 1 and 2, with objective 4 nearly fulfilled. Based on our initial observations that starch accumulation in HLB infected trees far exceeds normal levels, we devised an effective and rapid protocol for its detection. The protocol was devised with emphasis on ease of sampling, availability of ingredients and versatility in terms of number of samples and portability. The technique is now in use by greening scouts and growers in general.

A survey of tissue samples from trees with a variety of conditions revealed that abnormal starch accumulation can be the result of few other circumstances such as root-rot and in leaves from severed branches. However, when leaves of all ages were thoroughly tested, we found that starch accumulation is also evident in young and immature leaves from HLB trees, making this a potential tool to differentiate the few other conditions that lead to starch accumulation (such as Phytophthora and broken branches). This will be tested in Spring, 2008.

Samples from leaves, petioles, branches and roots show that in HLB trees, starch accumulates in high amounts in the aerial parts whereas roots seem to be devoid. A totally opposite distribution is observed in healthy trees. (Ed Etxeberria, eje@ufl.edu)

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Citrus Production Systems

Methods to quick kill Huanglongbing affected citrus trees allowing delay in removal

The objectives of this project are to determine what combinations of citrus grove legal herbicides, known phytotoxic chemicals, spreader stickers and other uptake enhancement chemicals will quickly kill citrus trees; Determine if adverse effects occur to adjacent, apparently healthy trees either through transfer through natural root grafts or from spray drift and evaluate spray drift guards if needed; and determine if trunk or foliar spray applications work best.

Test trees were secured from a grower between Lake Alfred and Haines City. Four tests were run during the Summer-Fall that included various phytotoxic chemical mixtures and two spray techniques. Mixtures that included Remedy were more effective than those with Glyphosate. Trees generally did not die rapidly; however, the better mixtures stopped new growth from forming, thus stopping psyllid feeding and disease spread, and the trees died over a two month period. Over canopy sprays were difficult to confine to the target tree. Inside canopy sprays appeared to work well without cross-tree contamination.

Currently, tests are being run on HLB affected trees on two properties in the Lake Placid area. Chemical mixes and varying concentrations are being tested and application methods are being investigated. A U-shaped spray boom will be tested that will slide under the tree and around the trunk with spray nozzles pointed upward and slightly outward in order to get thorough inside scaffolding/canopy coverage. (L. Gene

New HLB Testing Lab Open

The new HLB Lab at the University of Florida/IFAS Southwest Research and Education Center is now open and accepting samples.

UF/IFAS SWREC

2686 SR 29 North,

Immokalee, Florida

Telephone: 239-658-3400

Monday through Friday from 8 a.m. to 5 p.m.

For more information, growers may visit the website, <http://swfrec.ifas.ufl.edu/hlb/> for sampling information and forms.

Citrus Canker

Exploiting moth communication as a new tool for citrus leafminer management.

Citrus leafminer moth mating is dependent on chemical communication between males and females. In order for a female to mate, she must attract her mate with a trail of chemical called a pheromone. Male leafminers follow these trails in the evening using their antennae as sensors (insect noses). By smelling their way up these chemical trails males are able to locate females in citrus groves and mate with them, which results in fertilized eggs and subsequent damaging larvae. Recently, the specific chemical females use to attract males was identified by chemists and entomologist at the University of California in Riverside and Davis. Since this identification took place, entomologists Lukasz Stelinski and Michael Rogers at the University of Florida CREC have been working on practical implementation of this new discovery for control of the citrus leafminer. Given that pheromones mediate long-range mate finding for numerous insect pests and that this communication takes place at minute amounts of chemical, pheromones can be powerful tools for insect control. Furthermore, pheromones are highly species specific. The pheromone of citrus leafminer is produced only by females of this species and only citrus leafminer males use it as a signal to find their mates, so deploying it in groves does not affect non-target beneficial predators or parasitoids.

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Recent findings:

Use of pheromones for monitoring:
Do you want to know if you have a major leafminer infestation before you see flush infestation? Monitoring with pheromones can provide you with this information before the flush is damaged. A commercial pheromone lure has recently become available for monitoring the occurrence of adult citrus leafminers (Citalure, ISCA Technologies, Riverside, California). Recent research by CREC entomologists has proven that this lure is highly effective in attracting male leafminers to monitoring traps. Pherocon VI Delta (Trécé Inc., Adair, Oklahoma) traps are highly effective when baited with this lure. Within canopies of citrus trees 12-15 ft high, traps at mid-canopy height (6-8 ft) are at optimal height for monitoring this pest. On the canopy perimeter and in between canopies, traps near ground level (2 ft height) capture the most moths. Traps deployed in trees on the edge of groves capture more males than traps within the grove interior. Males fly at night on calm evenings, so several nights of monitoring under calm weather conditions is needed in order to get a good reading of moth presence. It is possible that pheromone-monitoring of leafminer may become a tool for timing pesticide applications. Preliminary data suggests that peak male moth catch in traps precedes peak larval infestation of new leaf flush by one month. So, if sprays are targeted against this peak adult moth flight as measured by pheromone traps, perhaps adults could be effectively eliminated before larval damage appears. This will be verified by IFAS researchers shortly.

Use of pheromones for direct control:

Given that female citrus leafminers use minute amounts of pheromone to attract their mates, this chemical communication system can be disrupted by deploying synthetic pheromone into groves. This control tactic is commonly known as mating disruption. Recent studies on mating disruption conducted in mature citrus groves in Florida demonstrated that very small doses of the pheromone per acre of crop (0.3-1.5 g / acre) could reduce citrus leafminer larval infestation by 69-98 percent. Although very little pheromone is required to

achieve this effective control, current use of this technology remains cost prohibitive for use in mature citrus because of the current complicated and expensive synthesis protocol for the pheromone. However, research is underway to develop a cheaper synthesis of the pheromone and an efficient mechanized delivery system for the pheromone to make it economically feasible in the near future. (Lukasz Stelinski, Stelinski@ufl.edu).

Genetics

“Cybridization” to develop potential canker resistance without transformation

A few years ago, Jude Grosser, a CREC plant improvement program student and canker pathologists in Jim Graham’s lab collaborated to evaluate transfer of citrus canker resistance derived from kumquat into improved seedless triploid acid lemon and lime hybrids. The hybrids evaluated in this project came from crosses of ‘Lakeland Limequat’ with allotetraploid acid-fruit somatic hybrids created by protoplast fusion. The results indicated that the limequat as a maternal parent could provide a high level of canker resistance in hybrids with very susceptible ‘Key’ lime (a host even more susceptible than grapefruit). Another approach that utilizes protoplast fusion, somatic cybridization, combined cell culture protoplasts (naked cells) of the maternal ‘Meiwa’ kumquat with leaf protoplasts of rough lemon 8166 (also highly susceptible to canker). The diploid rough lemon “cybrid” shows inheritance of a resistance response we identify as “hyposensitivity”. Movement of the resistance from the maternal kumquat to the susceptible parent (recipient) appears to occur via mitochondrial transfer in the “cybridization” process. Although other research indicates that there are some nuclear kumquat genes involved in canker resistance, transfer of mitochondrial kumquat genes for resistance to canker alone to this rough lemon “cybrid” was adequate to impart resistance. To prove the transfer of the resistance, we will follow the expression of known mitochondrial genes that we have identified in Jackie Burns’ lab by microarray analysis of kumquat as important in the resistance response. Based on the

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concept that resistance can be transferred from 'Meiwa' kumquat via mitochondria, a dedicated effort is underway in the plant improvement program to develop "cybrids" of highly susceptible grapefruit and early season oranges to transfer canker resistance into these important cultivars. Since "cybrids" acquire resistance by cell hybridization, this process doesn't require transformation of citrus with foreign genes that create regulatory and public perception concerns.

(Jim Graham, Jude Grosser, Marta Francis, Igor Kostenyuk, and Jackie Burns, jhg@ufl.edu)

Management of Citrus Canker

The objective is to screen copper products and leading chemical prospects in Florida groves to gain efficacy data required for a Section 18 registration on Florida grapefruit and to determine the period of fruit susceptibility of grapefruit to canker.

Trials are conducted in commercial groves of companies that have allowed epidemics of canker in grapefruit. The programs are applications of foliar sprays at 21 day intervals with formulations of copper and rotations of Firewall (streptomycin,) on grapefruit. Also, to determine the duration of fruit susceptibility, copper sprays are terminated at different times during the fruit growth period. Disease progress is evaluated on foliage and fruits to determine the incidence of infected fruit and copper toxicity. (Dr. Jim Graham and Monty Myers, jhg@ufl.edu)

Upcoming Events

April 8

2008 Greening Summit
South Florida Community College
University Center Auditorium
For more information, call Jane Wilson at
863-956-1151.

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