

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 TRANSMISSION AND SPREAD

Effects of Systemic Insecticides on Pathogen Transmission by HLB Infected Psyllids

Work continues to determine whether psyllids feeding on an insecticide treated plant will die before successfully transmitting the greening pathogen. To date, more than 200 plants, half treated with soil applied imidacloprid and half untreated, have been challenged with HLB infected psyllids in transmission trials. In these experiments, approximately 10 HLB infected psyllids are placed onto each plant and left to feed until death (on imidacloprid treated plants) or for 72 hours on untreated plants. Once the psyllids are removed from the plants, psyllids are analyzed individually using PCR to determine how many psyllids were HLB positive. Plants are then held in a secure quarantine greenhouse facility for periodic testing using PCR to determine if imidacloprid was able to prevent transmission (or at least reduce infection rates) compared to the untreated plants. So far, we have observed suspicious symptoms on some of the plants, but all PCR run thus far have given negative results. Based on our transmission studies conducted to date, it takes about eight months from the time that an infected psyllid feeds on a plant before that plant tests PCR positive for HLB. Thus, not enough time has yet passed since these experiments were initiated for us to be successful in identifying HLB positive plants. We expect to be able to detect positive plants within the next couple of months. (Michael Rogers, mrgers@ufl.edu; Ron Brlansky, rhby@ufl.edu)

Movement of Asian Citrus Psyllid Within and Between Groves

Studies continue on psyllid movement following the development of an effective protein marker, psyllids are now being marked in the field and their movement is being tracked by recapturing marked psyllids with sticky traps and analyzing them with an ELISA method. The initial results suggest that

psyllid movement between adjacent groves occurs frequently.

We have found that psyllids can move back and forth between abandoned and managed groves separated by 50-100 yards within two days. Although the underlying reasons for this dispersal are not yet understood, the data provide direct proof that psyllid-infested groves (managed or abandoned) likely serve as a source of infestation for nearby uninfested groves. (Lukasz Stelinski, stelinski@ufl.edu)

Seasonality of Psyllid Transmission of the Citrus Greening Pathogen

Work by post-doctoral associate Dr. Tim Ebert (CREC) continues to assess the seasonal variation in Asian Citrus Psyllid acquisition rates of HLB (Greening disease). Ebert is currently working in five groves in Polk, two groves in Highlands, and one in Desoto counties. Collections of wild psyllids are being made to estimate the HLB infection rates in the psyllid populations at each location. Healthy (not infected with HLB) psyllids are also being caged on healthy and HLB positive citrus shoots and later tested to determine if those psyllids were able to acquire the greening pathogen and if the rate of acquisition changes throughout the year. Since the beginning of this year, more than 7,900 psyllids have been collected from these grove sites. An additional 6,384 psyllids have also been caged on trees. From the results obtained thus far, we estimate that the infection rate in the wild psyllid population has never exceeded 1 percent at these locations. Acquisition of HLB by psyllids caged on HLB infected trees has also been lower than the average 30 percent rate we see under laboratory conditions. (Michael Rogers, mrgers@ufl.edu; Ron Brlansky, rhby@ufl.edu)

HORTICULTURAL PRACTICES FOR DEALING WITH GREENING

The primary horticultural objective to deal with greening is to shorten the time required to bring trees into production and to control summer flush growth to limit psyllid feeding opportunities. A number of projects being developed by IFAS faculty will investigate intensive management/fertigation practices (open hydroponics, OHS) as well as plant growth regulators, novel methods to impose drought stress and modifying hedging practices to control shoot growth. Specific projects being developed are: 1. An OHS planting at CREC is being used to test the response of mature Hamlins to the introduction of pulse drip irrigation and intensive hydroponics nutrition (13 nutrient elements). 2. A block with an established perennial peanut cover crop at CREC is being converted to drip irrigation to study the effects of a limited wetted zone combined with the consumptive water use of the peanut to reduce vegetative growth on both existing and newly planted trees. 3. A 15 acre citrus block with Gapway Groves is being developed for an open hydroponics trial using two rootstocks, three trees spacings, and various fertigation comparisons. 3. A \$500,000 proposal has been submitted to the USDA-CSREES National Integrated Water Quality Program entitled, "Water Conservation Using Intensively Managed Citrus Fertigation to Maximize Water Use Efficiency" to study the complete open hydroponics system under Florida conditions. 4. Greenhouse trials are underway to assess the response of trees to different timings of pulsed irrigation to develop preliminary data for use in setting up field trials. 5. Greenhouse and field studies are being started to determine the interactions between drought stress and plant growth regulators in controlling shoot growth. 6. A heading trial began in September in cooperation with Gapway Groves to assess the timing of hedging on tree growth responses. Plans call for plant growth regulators to be incorporated into that trial this season to further evaluate mechanisms for controlling tree growth. (Arnold Schumann, schumaw@ufl.edu)

GREENING DIAGNOSTICS

A GLIMPSE OF CHINA HUANGLONGBING IN SOUTHERN CHINA

(Photos referred to in this article appear on page 4.)

Citrus Huanglongbing (HLB) is widely spread and extremely devastating in several southern provinces of China, including Guangdong, Guangxi, Fujian, and Jiangxi. However, as Todd Holtsberry said in at the Greening Summit in Avon Park, "It's (greening) been in China a thousand years, and they're still producing citrus." Although that is true, citrus fruit production in the southern regions still accounts for a substantial proportion of the total in China.

Last month, collaborating with Dr. Ganjun Yi, the Director of Guangdong Fruit Research Institute (GFRI), Guangdong Provincial Academy of Agricultural Sciences, we visited citrus groves in the HLB regions in Guangdong and Guangxi Provinces, and gathered first-hand information on the seriousness of the problem and practical management. Additionally, we defined ways to continue the collaboration in research areas of our mutual interest.

In Guangdong Province, infected and dead trees were found in almost every grove, and many small farms were abandoned. Season-long high temperature and humidity make it impossible to prevent HLB spread and infection through killing the transmission vectors alone. However, controlling psyllids can greatly reduce the transmission incidence and help maintain profitable production. Other practices for survival that are widely adopted include: 1) Use of localized citrus varieties; they may have better adaptability and longer production life. Two local varieties, called Nianju and Shatangju, now account for about 90 percent of the total citrus production in Guangdong Province. High financial returns for these varieties in the market allow production to continue, even in the face of significant tree losses. 2) Use of all cultural methods to promote early production; for example, girdling is widely and intensively used in many groves (Photo 1). Cheaper labor in the countryside also provides an economic advantage, though labor is becoming more difficult to find. 3) Use of dwarfing and high-

density plantation; almost all groves are very dense, with small tree size, particularly in those small farms where no mechanical equipment is used. 4) Use of covers to extend the harvest season (Photo 2); this practice is starting in some groves, to maintain fruits on trees until next March-April when the price will be 5-10 times higher than the normal harvest season. The cover may also reduce the likelihood of HLB transmission.

Compared to most groves in Guangdong, Guangxi Province groves showed something different. Some poorly managed groves with highly susceptible sweet orange varieties looked much worse. Other well-managed groves looked perfectly healthy (Photo 3); it was hard to believe that many groves, just 30 miles away, were completely wiped out by the disease (Photo 4). These groves were in Fuchuan County, Hezhou (City) District. The difference in these groves was strict management from the very beginning! They have their own pathogen-free foundation and increase trees in locked greenhouses. All nursery trees are propagated and maintained in screen houses (Photo 5). Vector control spray is constant and coordinated. In the meantime, the vector is monitored to provide feedback on the effectiveness of control measures.

Another purpose of the field survey was to find citrus survivors or escapes in severely infected or abandoned groves. Some trees were identified in abandoned groves in Guangdong and Guangxi, including one in Photo 6. They are now under investigation in their facility, as a component of our collaborative agreement with GFRI. (Chunxian Chen, cxchen@ufl.edu; Fred Gmitter, fgmitter@ufl.edu)

PSYLLID MANAGEMENT

The Influence of Post-treatment Temperature on the Toxicity of Insecticides against the Asian Citrus Psyllid

Effective psyllid and disease management in Florida requires insecticide applications throughout the entire season over a range of temperature and environmental conditions. Temperature is known to affect the toxicity of insecticides and thus their efficacy. Quantifying the

effect of temperature on the toxicity of recommended and new insecticides against the psyllid should allow for informed selection of an insecticide based on prevailing seasonal conditions. Dr. Dhana Raj Boina, a trained insect toxicologist, working with Dr. Salyani and Dr. Stelinski at CREC, has been investigating the influence of post-treatment temperature on toxicity of several insecticides used for psyllid control. Dr. Boina's investigations show that the toxicities of organophosphate, carbamate, and avermectin insecticides against the psyllid increase with increasing temperature while the toxicity of synthetic pyrethroids decreases with increasing temperature. In contrast, neonicotinoids show a mixed temperature-dependent response with an initial decrease in toxicity between 62 to 80°F followed by a subsequent increase in toxicity between 80 and 98°F. This data suggests that synthetic pyrethroids may be more effective during the cooler winter months in Florida, while organophosphate, carbamate, and avermectin insecticides may be more effective during the warmer spring and summer months. Since the neonicotinoid imidacloprid was found to be more toxic at both of the extreme temperatures, it can be rotated with pyrethroids at low field temperatures and with organophosphate, carbamate, or avermectin insecticides at high field temperatures while still maintaining optimal temperature-dependent toxicity. (Lukasz Stelinski, stelinski@ufl.edu)

EVENT UPDATE

GREENING SUMMIT PRESENTATIONS

The Greening Summit, held in Avon Park at the South Florida Community College on April 8, was one of the largest citrus programs in years with more than 350 growers, managers and allied industry representatives attending the day-long program. In an effort to allow individuals to view or review the presentations, all PowerPoint presentations the speakers provided are now available on the web at [http:// citrusagents.ifas.ufl.edu](http://citrusagents.ifas.ufl.edu) The recorded video presentations are also posted to the same web site. (Steve Futch, shf@crec.ifas.ufl.edu)



photo 1



photo 2



photo 3



photo 4



photo 5



photo 6

1. Girdling many times to enhance early and heavy fruiting; 2. Covering the grove to extend the harvest season three to five months; 3. Aggressive management to maintain the tree health and production in a severe HLB region; 4. A grove, about 30 miles away from the one in Photo 3, devastated by HLB; 5. Pathogen-free nursery trees propagated inside screen houses with good irrigation and fertilization system; 6. A healthy-looking survivor standing alone in an abandoned ten-year-old grove where most of the trees were already dead, and all remaining trees were showing obvious HLB symptoms.