

CITRUS GREENING

By Bob Rouse

The 16th annual Citrus Expo set new records for grower and industry attendance. The two-day seminar program focused on the most important problem in the industry: citrus greening disease (HLB, *huanglong-bing*). All speakers had excellent PowerPoint slides that can be viewed on the SWFREC Web site at www.imok.ufl.edu. The pictures in the PowerPoints are worth viewing for greening symptoms and written information about the disease and control strategies.

The morning of day one began with moderator Mike Irey's comments on HLB as a bacteria and description of symptoms. Symptoms resemble nutritional deficiencies of zinc and iron, yellowing and mottling of leaves, yellow and corky veins, along with small, lopsided fruit. There are no resistant commercial varieties. The disease is generally insect transmitted by the Asian citrus psyllid (*Diaphorina citri*) and can be graft transmitted. There is no evidence of seed transmission.

Distribution of greening in Florida began August 2005 with the first find in residential Dade County. The disease has spread to 25 counties with a definite gradient of infection from south to north in the state.

INFRARED IMAGERY

Elizabeth Steger presented information on how infrared imagery could be used for disease detection and how to differentiate mineral deficiencies from greening. She explained how infrared detects dead from sick trees. Infrared shows the yellow dragon on HLB trees since yellow shows white on infrared imagery. Use of the technology gives growers maps of their groves with good tree inventory that shows tree density, acres, GPS reference, and tree counts without going to the grove. A good inventory of the grove shows how many resets are needed and where. The technology can be used to locate areas where scouting for HLB should be focused first.

SCOUTING

Tim Gast gave an excellent presentation on how to organize and manage the scouting effort for HLB. He described the scouting system at Southern Gardens groves, where scouts work in pairs, walking both sides of a tree row.

Scouts are beginning to inspect on platforms to increase efficiency and accuracy, allowing them to see symptoms high in the tree.

HLB suspect trees are flagged, including a small flag on symptomatic branches. Symptoms used for a visual diagnosis are blotchy mottle, chlorotic leaves with 'green island' zinc deficiency, and fruit symptoms including lopsided fruit and aborted seed.

After the flagging, a second look for confirmation is given by a well-trained senior scout. Confirmation by the senior scout includes visual diagnosis, recording GPS locations, painting the trunk for tree removal, collecting a leaf sample for PCR from symptomatic tissue, and removal of flagging tape for trees diagnosed negative.

Gast gave these recommendations to growers beginning a scouting program:

- 1) Start with a delimiting survey to determine if you have HLB.
- 2) Start with grove boundaries along edges of blocks.
- 3) Scout young trees first.
- 4) Look at trees in poor soil areas or affected by stress because they tend to show symptoms earlier.
- 5) Be on the lookout for yellow trees or trees in decline.

The cost for scouting four times per year can be nearly \$110/acre.

GREENING IN SAO PAULO

Scientific manager of Fundecitrus in Brazil, Juliano Ayres, gave an update on HLB in San Paulo State. He stated that they discovered greening three years ago, but believe they have had it for 10 years. He gave statistics that show Brazil has 659,000 hectares (1.62 million acres) of citrus, 348 million boxes — 93 percent oranges, 69 percent on Rangpur with others on Swingle, Sunki, and Cleopatra rootstocks. Their main problems are diseases which include citrus sudden death, CVC (Citrus Variegated Chlorosis), canker, leprosis, citrus black spot and HLB, which is the worst problem in the world.

They are fighting the disease with tree removal of infected trees and clean nursery stock propagated in screen-protected structures. One of the biggest problems growers are facing is neighboring groves not practicing tree removal of infected trees.

Growers are doing inspections and

psyllid control. Inspections are by people walking and on platforms. Psyllid management is done by chemical control — eight to 12 sprays/year and two systemic applications on resets.

Depending on intensity of surveys and sprays, costs can be from \$124 to \$279 (U.S. dollars). They have changed laws to force growers to do inspections, force growers to eliminate citrus and *Murraya paniculata* (orange jasmine) trees showing HLB symptoms, and force nurseries to produce plants in screenhouses.

RESEARCH AND FUNDING

Peter McClure, chairperson of the FCPRAC (Florida Citrus Production Research Advisory Council) gave an update on HLB research and funding. The Florida Legislature appropriated \$3.75 million of state funds if matched, the FCPRAC has \$1.629 million from growers, and the DOC (Department of Citrus) put up \$2 million for a total of \$7.379 million.

Who's paying? You are, whether from growers box tax or state tax dollars. The FCPRAC has funded 83 projects with \$5.2 million and there are 100 projects under review worth \$8 million, but only about \$2 million in funds available.

Compared to \$7 million this year, greening research was funded with only \$1.5 million last year. The increased money has resulted in attracting good talent and good projects. McClure said the amount of money needed to solve HLB is unknown, but if nothing is spent, the growers will be out of business.

FRESH FRUIT REGS

Mark Ritenour gave a simple and complete explanation of citrus canker regulations and practices for fresh fruit. There are a lot of new and changed rules from last year. The industry is still under last year's rule until the new proposed rule of June 21, 2007, becomes approved by the USDA.

As we start this season under last year's rule, all Florida packing facilities must sign a compliance agreement, all Florida citrus is prohibited from being shipped to citrus producing states and territories, and fruit shipped to non-citrus producing states and some export markets must satisfy numerous pre- and postharvest requirements.

Fruit must come from groves inspected within 30 days of harvest, carry a fruit harvesting permit, be treated to kill canker bacteria on fruit surface, be accompanied by a "Limited Permit," and traceable back to the block harvested. All boxes packed must be marked with the "Limited Permit" that identifies the states where the fruit cannot be distributed.

No fruit can be shipped interstate from a block with canker. If canker is found in a box, it must be re-inspected and shipped only where canker is not a concern (Japan and Canada). European markets have their own set of requirements. There are no limitations on shipments within Florida.

The new proposed rule is based on a pest risk analysis. Risk management analysis will be based on how the fruit is handled in the packinghouse. The proposed rule would amend the canker regulations in that field inspections would no longer be required. All the control would be at the packinghouse. Asymptomatic fruit could be shipped to other states regardless of canker in the grove.

PSYLLID CONTROL

The afternoon session was moderated by Tim Spann, who introduced the first speaker, Michael Rogers, describing what we know about psyllid feeding and transmission of HLB. As little as 15 minutes to 24 hours of feeding is needed for the psyllid to pick up the bacteria and be able to infect a plant.

After the psyllid acquires the bacteria, it may take five hours to 25 days until it can transmit the pathogen. Less than one hour to seven hours of feeding is necessary to infect a healthy plant. One study has shown that the female African psyllid can produce young that will be HLB positive. There is no evidence of this with the Asian citrus psyllid. The longer psyllids are allowed to feed on infected tissue, the greater percentage of psyllids that become infected, and some psyllids will not become infected. In one cage study, psyllids picked up the bacteria from non-symptomatic leaves. On field trees, the psyllid could only acquire the bacteria from tissue that tested positive with PCR.

Rogers also discussed managing psyllids with chemicals. The start of a psyllid management program should be to eliminate overwintering populations. The longer the psyllids remain in the grove over the winter, the greater they will be infected and ready to move the disease to the new flush in the spring. Reducing the overwintering population lessens the potential for egg laying in the flush, where nymphs are difficult to control.

Avoid spraying during bloom because it is toxic to bees and other insects that may be beneficial. The strategy should be to reduce adult psyllid populations prior to major flushes, since controlling populations is easier when they are low.

When developing a psyllid control program, after hedging and topping, the grower should consider spraying the resulting new flush. Know the chemical products used as to whether they are broad spectrum or targeted for nymphs.

In conclusion, everyone should develop their psyllid control program as if they had HLB in their grove, Rogers noted.

Andrew Beattie from the University of Western Sydney, New South Wales, Australia, gave an excellent discussion on managing psyllids with oils. Beattie has been the leader of the HLB project in southeast Asia for the past several years. He presented a very interesting history of how citrus moved around the world and said HLB may have originated in Africa and is not believed to have been in China before the 1920s.

The use of Imidacloprid did not prevent the HLB disease from establishing within two years in 4-year-old trees. Use of oils were effective by altering psyllid behavior in preventing

egg laying of the adult female; they don't like to lay eggs on oil. Oil applied at seven- to 10-day intervals was as effective as any synthetic chemical pesticide. The advantage of oil is that it not only controlled the psyllid, but also many other pests and diseases, and the trees treated with oil were always clean. Beattie's recommendation was to apply the first two oil sprays with thorough coverage at 0.4 to 0.5% v/v, and apply the third and subsequent sprays at 0.25%. Spray coverage is critical, so increasing spray volume is better than increasing oil concentration.

The story that guava interplanted with citrus reduces the HLB disease is very hard to believe, but true, and the scientists who went to Vietnam and saw it don't know why. It is believed the growers in Vietnam planted guava because they wanted an additional source of income. For some reason, the psyllid is repelled from the guava. The only insecticide used was oil at eight to 10 applications per year.

Andrew reported several instances where they visited plantings and saw guava being grown with citrus. The psyllid and HLB were amazingly not present, yet a neighbor planting without guava was highly infested with psyllids and HLB. Andrew doesn't believe biological control of psyllids is possible in the presence of HLB, because there will always be a small population present that can spread the disease.

Phil Stansly discussed a strategy for managing psyllid without unleashing pest havoc by upsetting the benefits of the bio-control we have enjoyed over the past decades. Growers find themselves presently in a mode of avoiding greening. They know they have greening and hope that possibly by controlling the psyllid and reducing inoculum, they can get back to a world without greening. Stansly hopes that comes to pass, but knows growers need to consider that they may find themselves in a world that includes greening, and they will have to live with it.

Regardless of which world they live in, growers will be trying to control psyllids to prevent continual reinoculation of trees. In their control strategies, growers need to manage a whole complex of pests, not just psyllids, and don't want to upset the biological control of pests that they haven't had to deal with in many years. Where harsh chemicals have been used this year, there has already been observed a resurgence of leafminer, chaff scale, cottony cushion, mealy bugs, and armored scale.

Growers can target insecticides to control pests and spare beneficial insects. This can be done, as Rogers said, by choosing the type of material as either selective or broad spectrum, and application type as either foliar or soil-applied systemic.

Applications can be timed to either dormant or growing season, and to growth flush or no-flush periods. The spring flush is the springboard for the whole season.

A strategy for mature trees might be to use broad spectrum products during the dormant period (January-February) before flush to target the adult psyllid and at a time when the beneficials (lady beetles) are not present. This strategy combined with a Temik application in January gave six months control of psyllids and didn't disrupt the biological control. Focus on young trees with systemic materials like Imidacloprid.

In summary, to control psyllids and conserve beneficials, Rogers suggests focusing control on young trees and overwintering adults, spraying just before the spring flush, using soil-applied systemics, and organizing scouting efforts to optimize resources.

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