# How will Irma affect citrus canker management?

By Evan G. Johnson

he citrus canker season is quickly approaching again, so it is time to start planning your canker management program to avoid fruit drop and freshmarket quality loss. It is easy to forget the importance of controlling citrus canker with the current state of HLB



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in Florida. However, citrus canker can cause almost complete crop loss if environmental conditions are favorable for disease early in the season.

This crop loss is not just a freshfruit problem. If fruit are infected in the early stages of expansion, the large lesions produced can induce midsummer fruit drop. With properly timed and applied management, this midsummer canker fruit drop can be greatly reduced to protect yields and fresh-fruit quality.

The effects of Hurricane Irma will complicate canker management for the coming years, especially in young groves. In this article, the effects of Irma on citrus canker management in the coming season will be discussed.

Hurricane Irma caused a lot of direct damage to groves throughout the state. However, its effects on multiple diseases, such as canker and Phytophthora, will continue to be seen over the coming years. The direct effects of Irma were to produce management-breaking environmental conditions. Windblown rain is the main driver of canker infection through groves by spreading bacteria from existing lesions to young susceptible leaves and fruit, and providing the moisture for stomatal or wound entry.

Copper sprays act as a barrier to prevent splash-dispersed bacteria from surviving as they travel from the leaf surface into the leaf. When winds reach higher speeds, such as tropical storm or The effects of Hurricane Irma will complicate canker management for the coming years, especially in young groves.

hurricane force winds, the rain splash can be forced through the stomata or wounds into the leaf. Immediately after high-speed, wind-driven rain, leaves will look water-soaked. In these instances, the bacterium is forced right past the protective barrier of copper and directly into the leaf, where it begins causing disease.

Irma's winds were high enough to push bacteria into mature leaves and cause lesions on leaves that are normally considered resistant because of their age (Figure 1, page 24). Depending on the prevalence of canker in or adjacent to young blocks, the



Figure 1. Hurricane Irma caused canker lesions on mature leaves of new plantings in Lake Placid and Lake Alfred.

severity of leaf infection caused significant leaf drop weeks after Irma passed. Little could have been done right before Irma's arrival to prevent this damage.

#### **WINDBREAKS**

Established windbreaks reduced the spread of canker where they took the

brunt of the damage from the storm. In cases where gaps in windbreaks existed or where holes were created by downed trees, a local area of increased canker is likely because winds were funneled through the hole. However, other parts of the block would still be protected.

Many windbreaks suffered severe

leaf and branch loss in their lower portions, which were level with citrus trees. To maintain efficacy of the windbreaks, these areas will need to be monitored as they fill back in. New windbreak trees should be planted where holes have formed to prevent future funneling of wind.



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#### **STEM LESIONS**

The greatest long-term damage caused by Irma will result from stem lesions. The high winds and wounding caused by the storm greatly increased the incidence of stem lesions in shoots that still had green bark (Figure 2, page 26). These stem lesions were readily apparent in new plantings, but may have developed in older blocks as well. While leaf lesions only remain a source of inoculum for a few months, stem lesions can continue to produce bacterial inoculum for many years. This will be particularly damaging in young Hamlin and grapefruit plantings as the fruit production increases.

Normally, the previous year's canker severity does not affect the next year because most of the infections were leaf lesions. In these cases, it is frequent early-season rains that build up a new active inoculum source in leaves that drive the canker season. This year, a large active inoculum source is likely to be present in the stem lesions, so the first few rainfalls could cause severe fruit infection.

#### MANAGEMENT

The first step should be to scout young blocks for stem lesions. The most attention should be paid to highly susceptible varieties and fresh-fruit varieties. Post-Irma canker management decisions in these young groves should be based on the number and severity of stem lesions throughout the grove. Depending on location and incidence of canker in neighboring blocks, some young plantings may have escaped the Irma-induced canker epidemic.

Removal of Irma-induced stem lesions should effectively reduce inoculum in blocks with young trees (1 to 2 years old) when you can easily spot and remove all shoots with stem lesions. However, if most green shoots have stem lesions, this may do too much damage to the young trees. Removal of these shoots from young trees will induce a large new flush. The timing of pruning needs to be considered as this new flush will be highly susceptible to new canker infections if a rain event occurs. Also, it is unlikely that all inoculum (leaf and stem lesions) will be

## Update on Thermotherapy Research

s early as 1965, high-temperature treatments were shown to reduce HLB bacterial infection without killing the tree. Trials [Ehsani, University of Florida/Institute of Food and Agricultural Sciences (UF/IFAS)] using portable, semi-transparent, plastic houses were placed over trees, achieved temperatures of above 120 F for several hours over several days, and reduced *Candidatus* Liberibacter asiaticus (*C*Las) bacteria. Some leaves were killed, but after tree recovery from the heat stress, HLB symptoms improved and tree growth recovered.

Heating entire potted seedlings in growth rooms to a constant 10 F for two days completely eliminated CLas bacteria from HLB-affected citrus seedlings for 24 months [Hoffman, U.S. Department of Agriculture/Agricultural Research Service (USDA/ARS), 2013]. By 2014, there was optimism about the usefulness of canopy heat treatments for improving growth and yield of HLB trees. Efforts to optimize heat treatments incorporated steam generators and portable tents that could achieve even better results in as little as 30 seconds to two minutes at 132 F, depending on tree size and age. Polymerase chain reaction analysis showed a decrease in CLas in leaves after treatment, but there was no reliable technique for detecting live vs. dead bacteria in the tree. Roots and shoots of heat-treated trees were never completely free of HLB. Subsequent psyllid and leafminer infestations were a problem, which impacted regrowth leaves.

There was no psyllid acquisition of Clas from thermal-treated potted citrus trees compared with 75 percent of psyllids acquiring CLas from untreated HLB trees (Pelz-Stelinski, UF/IFAS). Practical methods are yet to be developed for whole-tree thermal therapy on both psyllid acquisition and long-term HLB status.

Although fruit yields are lower in HLB trees, juice quality taste panels (Baldwin, USDA/ARS) said that juice from heat-treated HLB fruit was sweeter, less acidic, less bitter and had more flavor and body than the juice produced from unheated trees.

A large, multi-year Citrus Research and Development Foundation project evaluated impacts of thermotherapy treatments at 14 Florida sites on various tree ages, rootstocks and scions. Thermotherapy trials used a variety of steam heat treatments from different portable machinery delivering a range of temperature/duration combinations in support of potential scale-up to commercial thermal therapy treatments. Tree health, foliar nutrition, disease rating, HLB status, fruit drop, yield and fruit quality were evaluated before and after thermotherapy heat treatments of 127 F to 132 F for 30 seconds to one minute.

Thermotherapy treatments only achieved short-term improvements in tree appearance and *C*Las reductions, which lasted from two to several months. Reductions in fruit drop or increases in yield generally did not occur after treatment. Some heat treatments reduced tree size and yield. Based on these results, several commercial participants revised designs and deployed next-generation steam machines. Overall participation slowed, however, as most potential solvers did not participate. All of the treated trees that displayed previous short-term responses to thermotherapy are now similar to non-treated control trees. CRDF has thus discontinued monitoring tree status as there was no evidence of any lasting positive effects of thermotherapy alone on HLB. Studies are continuing, however, on potential synergistic effects of thermotherapy plus bactericide treatments on the health of HLB-infected trees.

#### Prepared by the CRDF project management team



Column sponsored by the Citrus Research and Development Foundation





Figure 2: Stem lesions two months after Hurricane Irma came through a 6-month-old Hamlin block at the Citrus Research and Education Center.

pruned from the tree or block. Labor costs may still be prohibitive even for plantings less than 1 year old.

In non-bearing and young bearing trees, use of systemic acquired resistance inducers (e.g., Actigard) should be considered to reduce continued production and spread of lesions in the grove. Copper does not effectively manage leaf and stem inoculum because of the rapid growth of these tissues.

In bearing blocks with significant stem lesions, closely monitor the weather and have copper out before early-season rain events to protect susceptible fruit. In susceptible varieties, such as Hamlin and grapefruit, early-season canker infections lead to fruit drop. Protecting fruit with copper sprays every 21 days is essential to maintain a protective barrier as fruit expand through June. After June, the decision to spray copper depends on whether the fruit is for processing or the fresh market. Maintaining a copper barrier through October rains is essential for fresh-market grapefruit if canker is present in the block or neighboring blocks.

Although highly susceptible varieties will need to be aggressively managed for citrus canker in the next few years because of Irma, less susceptible varieties, such as Valencia, also saw high canker incidence after Irma. The effects of this large, stem-lesion Protecting fruit with copper sprays every 21 days is essential to maintain a protective barrier as fruit expand through June.

inoculum source on these varieties over the next few years remains uncertain. In Brazil's Parana state, young Valencia blocks can suffer from serious canker outbreaks. We will have to keep a close eye on all blocks that suffered a canker outbreak after Irma for the next few years to know the long-term impact and adjust canker management accordingly.

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