

Citrus canker management update

By Jim Graham
and Megan Dewdney

High citrus canker incidence, caused by *Xanthomonas citri* subsp. *citri* (Xcc), can occur on any citrus species depending on tree age, flush condition, pest control and weather conditions during the season. However, in seasons since canker eradication was discontinued, crop losses due to premature fruit drop of early oranges and an unacceptably

high incidence of fruit blemishes on grapefruit cultivars have occurred mostly on young fruiting trees. Fresh fruit losses have eased somewhat since a new rule was published in October 2009 that discontinued APHIS inspections for canker on fresh fruit and opened up shipments to all states in the United States, even if canker symptoms are present. Even so, in 2008-09, about 25 percent of Florida's grapefruit shipments were sent to the European Union, which still requires

preharvest grove inspections as well as postharvest inspection for canker before fruit qualifies for shipment.

Despite being allowed to pack canker-blemished fruit for U.S. shipments, the goal is still to reduce inoculum potential in fresh grapefruit groves as much as possible to ensure an economically viable pack-out with few or no lesions. In young grapefruit groves, this goal is especially difficult to achieve without windbreaks to reduce wind speed and inoculum spread in typical Florida storms.

In all situations, the recommendation for fresh grapefruit is to begin a canker management program before or at the time of the spring flush, and to protect fruit greater than half-an-inch diameter with copper sprays applied at 21-day intervals until full expansion of fruit in mid-October. This interval between sprays is based on copper trials in Brazil with mid- and late-season oranges, and evaluation of coverage of grapefruit with copper films under Florida conditions.

Although the 2010 season was marked by the absence of severe weather, disease incidence on young grapefruit trees was kept to only about 15 percent to 20 percent with 21-day interval sprays with copper formulations, compared to more than 45 percent on non-treated fruit. As in past seasons, the majority of fruit infections occurred after July as determined by the greater numbers of lesions less than a quarter-inch in diameter.

Consistent with previous trials in Florida as well as in Brazil and Argentina, the effectiveness of the protective film of copper on fruit did not vary greatly among copper formulations at 1.5 to 3 lbs. of product or 0.6 to 1.1 lbs. of metallic copper per acre per application. As in the past three seasons, applications in July and August of Firewall, a formulation of the antibiotic streptomycin, were effective for canker control on grapefruit either in combination with a reduced rate of copper or when substituted for copper in the spray program. Based on Firewall's efficacy and ability to lower the risk of copper phytotoxicity, an application has been submitted by Florida Fruit and Vegetable Association and the Florida Department of Agriculture and Consumer Services to gain EPA Section 18 emergency registration for use of Firewall against canker on fresh grapefruit.

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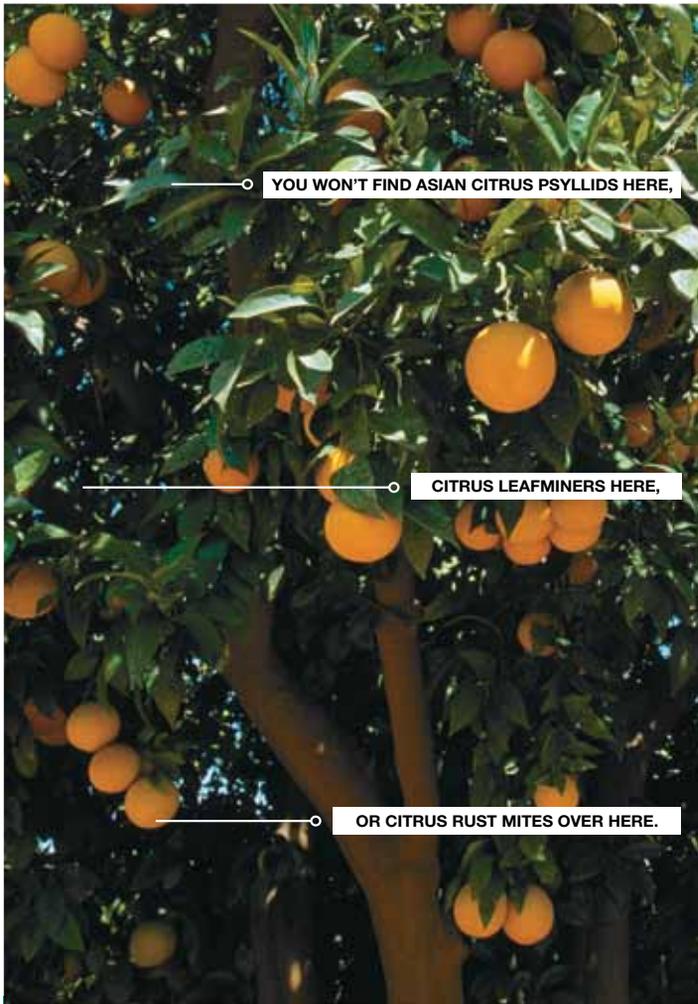
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ADOPTION OF WINDBREAKS

Where canker is well established in South America, the primary means of disease management are: 1) windbreaks, 2) protection of fruit and leaves with copper sprays, and 3) leafminer control.

Windbreaks are by far the single most effective means for reducing canker infection. Windbreaks can reduce wind speed to below 20 mph for a distance of 5 to 10 times the height of the windbreak. Reduced wind speed protects fruit because the peel and surface film of copper can be penetrated at higher wind speeds. Several fresh grapefruit growers who have suffered canker losses in young grapefruit groves have established windbreaks and are beginning to improve canker control during periods of stormy weather in spring and fall. Updates for the selection and availability of plant species, grove designs and establishment requirements for windbreaks in Florida can be found at www.crec.ifas.ufl.edu/extension/windbreaks/index/shtml.

LEAFMINER CONTROL IS ESSENTIAL

Leafminer galleries are very susceptible to invasion by the canker bacterium. Extensive invasion of leafminer galleries by Xcc greatly increases inoculum levels, making the disease explosive, particularly on flush from July to the end of the season. Leafminer control on the first summer flush is problematic since the duration of flush susceptibility exceeds the residual activity of most insecticide sprays. On younger trees, loss of leafminer control on late summer flushes is accentuated by erratic flushing activity, making the timing of sprays difficult for effective control. Leafminer control has become even more difficult since the beginning of intensive Asian citrus psyllid control, which reduced the number of biological control agents in the grove. Nevertheless, controlling leafminer damage is essential to lowering canker severity on leaves and reducing the risk of fruit infection.

COPPER SPRAYS PROTECT FRUIT

Young leaves are protected by a copper film for only a few days because their surface area increases rapidly as leaves expand. Because fruit grow more slowly, the copper film can protect for weeks after a spray application. In 2010, we compared the copper fruit residues from different copper-

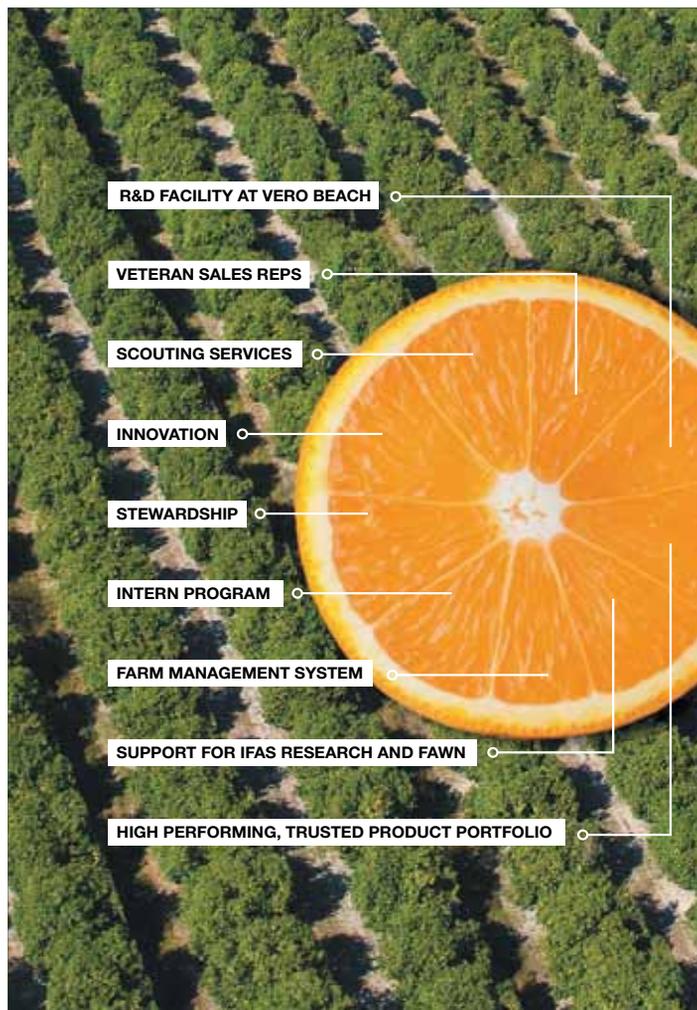
containing products up to 28 days after application to grapefruit. The copper product used and the number of days after application significantly affected the amount of copper residue. These effects were consistent whether the data were analyzed as copper/fruit or copper/surface area.

The rate of copper residue decrease was different for the various products tested. Copper products forming films — Kocide 3000 (copper hydroxide), Cuprofix Ultra 40 Disperss (copper sulfate) and Badge X2 (copper hydroxide and oxyclozide) — decreased at a similar rate, whereas the non-film forming Magna-Bon CS2005 (copper sulfate pentahydrate) decreased at a higher rate and left about 75 percent less fruit residue. This was expected as Magna-Bon is applied at approximately 15 percent of the metallic contained in film-forming coppers. Since Magna-Bon performed as well as film-forming copper products for control of canker on grapefruit the last two seasons, we have hypothesized that the Magna-Bon copper may be locally systemic in fruit rind tissues. This coming season, we will attempt to assay the activity of copper in the rind against Xcc to determine whether the copper is located internally as well as externally.

PROGRAM FOR EARLY ORANGES

Hamlin and early orange cultivars grown for higher color score (Early Gold, Westin, Ruby, Itaborai) are much more susceptible than mid-season and Valencia oranges. Copper sprays should be targeted to prevent early-season fruit infection and premature fruit drop on these cultivars. Orange fruit become susceptible to Xcc after the stomates open at about one-quarter-inch to one-half-inch in diameter, but by mid- to late-July, fruit are sufficiently resistant to prevent full development of lesions. Larger, early season lesions are responsible for an ethylene response in maturing fruit and subsequent premature fruit abscission.

In 2010, growers who adopted our recommendation of four to five copper sprays applied at 21-day intervals had satisfactory control if they began when fruit reached one-quarter-inch to one-half-inch diameter in late April, and sprayed until fruit reached about 1½ inches to 2 inches in diameter. Growers who started copper applications to Hamlins during or after the May rains had insufficient early-season disease control on fruit and experienced fruit drop before harvest



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Figure 1. Fruit drop on a young Hamlin tree due to early-season canker infection promoted by rain events in May 2010, Hardee County. (Photo taken January 2011.)

(Figure 1). Canker on more susceptible early orange cultivars (Early Gold, Westin, Ruby, Itaborai) was controlled with an aggressive program of copper sprays, starting with spring flush and ending in early August. However, the additional applications of copper for these cultivars may not be sustainable based on the processed pounds solid price differential with Hamlin.

INOCULUM MANAGEMENT FOR FRESH GRAPEFRUIT

Inoculum reduction on spring flush is critical for fruit protection throughout the season because of the greater grapefruit susceptibility. We have been following the results of Cooperative Producers, Inc., Felda, protocol for reducing inoculum in grapefruit trees with endemic canker infection. The strategy depends on inoculum reduction during the coolest, driest time of the year when environmental conditions are least conducive for Xcc infection.

Inoculum reduction is initially accomplished by hedging off the canker-infected summer and fall growth. Additional infected foliage is identified by a follow-up survey, and trees with excessive infection are spot-treated with a defoliant. Performing operations during the cooler, drier season minimizes the infection

risk of susceptible new flush stimulated by inoculum removal. After re-inspection, the trees are sprayed with copper when the spring flush reaches one-half to three-quarter leaf expansion stage. Applying this protocol every season since 2008 in a Ruby red grapefruit block has substantially reduced the incidence of canker-blemished fruit in the grove, such that there is now little impact of canker blemishes on pack-out for domestic shipment (Figure 2).

CANKER CONTROL ON NON-BEARING AND YOUNG FRUITING TREES

More susceptible flush per canopy volume occurs on younger trees. Repeated vigorous flushes are also extremely prone to leafminer damage. Infection of this susceptible, wounded tissue promotes an explosive increase in leaf inoculum and subsequent canker-induced defoliation. The rapid buildup of canker on leaves puts developing fruit at high risk for infec-

tion. Copper is somewhat effective if applied at 21-day intervals for canker control on foliage, but newly planted trees represent a small target for copper application so sprays should be applied with a hand gun or hoop-boom sprayer for thorough coverage.

Copper spray intervals longer than 21 days compromise control of canker-induced defoliation. More consistent reductions of foliar symptoms and canker-induced defoliation on young trees have been achieved with Admire and Platinum root drenches applied at the beginning and middle of the growing season. Control is due not only to more effective leafminer management, but also to the neonicotinoid induction of systemic acquired resistance (SAR). The SAR produced by one or two soil applications of these insecticides effectively reduces canker on foliage all season. For canker management on more susceptible non-bearing grapefruit trees, copper should be timed to protect each flush (21 days, metallic copper rate from 0.5-1.0 lb./acre) in addition to the full-season allowance of soil-applied Admire or Platinum.

For additional information regarding insect and disease management recommendations consult the Florida Citrus Pest Management Guide (<http://www.crec.ifas.ufl.edu/extension/pest/>).

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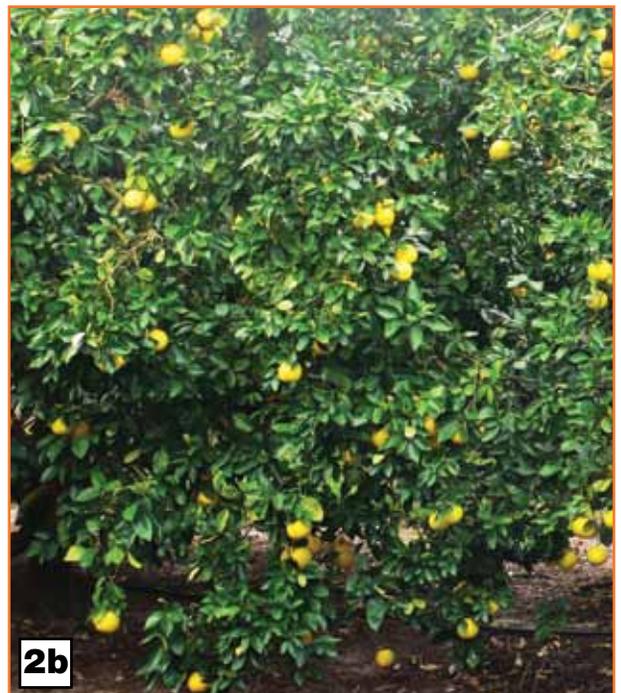


Figure 2. Hedging followed by spot defoliation of trees with residual foliar canker (2A) performed each dormant season since 2008 has substantially reduced incidence of canker-blemished fruit in Ruby red grapefruit blocks, Collier County, November 2010 (2B).