

Management recommendations for citrus canker in 2009

When canker is already established, windbreaks, copper sprays and leafminer control are the primary means of control

**By Jim Graham
and Megan Dewdney**

The 1900-foot rule and eradication of citrus canker-affected trees were suspended in 2006 and the Citrus Health Response Plan (CHRP) does not require removal of affected trees. Therefore, growers are left to use their best judgment in canker management depending on their individual situations. Fortunately, the summers of 2006 and 2007 were relatively dry and canker losses were localized and mainly restricted to grapefruit, the most susceptible variety. In 2008, early rains in April and Tropical Storm Fay in August greatly increased disease incidence. The bacterium not only spread to new areas, but disease in infested groves increased rapidly in extent and severity.

Locations directly affected by both early- and late-season rain events had increased canker incidence that disqualified fruit sales from affected groves to the packinghouse, leading to severe losses. In addition, early season infection of Hamlin and other early orange varieties resulted in premature drop fruit. High canker incidence on these varieties was often associated with exposure to wind-blown rain due to the absence of natural or planted windbreaks.

The canker situation is a serious threat to the profitability of fresh fruit. Without windbreaks, production of canker-free grapefruit is proving difficult under the typically stormy Florida conditions. Unless the requirement for shipment of asymptomatic fruit is changed and some canker blemishes are accepted by domestic and foreign export markets, production of fresh grapefruit will be in jeopardy.

The necessity of windbreaks for fresh grapefruit was apparent in the aftermath of Tropical Storm Fay. Prior to Fay, disease incidence on fruit in our field trials of 6-year-old red grapefruit was less than 2 percent for copper sprays applied at 21-day intervals compared to 15 percent in the nonsprayed treatment. Post Fay,

disease incidence on fruit ballooned from 5 percent to 10 percent on copper-treated trees and to 27 percent in the non-treated trees. The protective film of copper, regardless of rate and formulation, was almost completely overcome by the windblown rain from Fay. When canker bacteria are driven by rain droplets at speeds greater than 18 mph, they impact fruit and leaf surfaces and move past the copper film into natural openings called stomates where they cause infection.

Canker infections mainly occur on leaves and stems within the first six weeks after initiation of growth. The most critical period is when stomates on the fruit surface are opening, making the fruit particularly vulnerable to bacterial penetration. After petal fall, fruit remain susceptible for the first 60 to 90 days for oranges or tangerines and 120 days for grapefruit. Infection after this time may result in the formation of small and inconspicuous pustules.

When canker lesions are wetted, millions of bacteria ooze onto the surface. Bacteria are spread by wind and rain mostly during thundershowers and distributed over short distances within the same block and to neighboring groves. Fruit infection by canker bacteria is most severe on the outside rows of trees that are most exposed to wind-driven rain. Canker spread may occur over longer distances, up to several miles, during tropical storms, hurricanes, and tornadoes. Workers can also carry the bacterium from one grove to another on hands, clothes, and equipment. Bacterium spread is most common within and among groves when trees are wet.

When canker is already established, the primary means of control are:

- 1) planting of windbreaks,
- 2) protection of fruit and leaves with copper sprays, and
- 3) leafminer control.

WINDBREAKS

Windbreaks are the single most

effective means for reducing infection. Windbreaks serve to reduce wind speed for a distance 5-10 times the height of the windbreak. That is, a 30-foot-tall windbreak can exert an effect for up to 300 feet. For effective canker control, windbreaks do not need to be dense, but able to reduce wind speed to less than 20 mph.

Research from Argentina and Brazil demonstrated that windbreaks greatly diminished canker incidence on fruit depending on the distance of trees from the wind-protected sides of the block. (See companion article from Argentina next page). For more information on selection of plant species and design of windbreak systems, see the CREC Web site (www.crec.ifas.ufl.edu/extension/windbreaks/index.htm).

COPPER SPRAYS

In the presence of windbreaks, copper sprays are quite effective in preventing fruit infection, but are much less effective for reducing leaf infection. Windbreaks reduce canker spread, but copper sprays do not. Protection of young leaves with copper lasts for only a few days due to rapid increase in the leaf surface area. Fruit grow more slowly and are protected for weeks depending on rainfall after spray application.

Our trials in Brazil demonstrated that the period of fruit protection averages about 21 days. Sprays applied at a 14-day interval improved disease control only slightly compared to a 21-day program. Orange fruit are susceptible to infection after the stomates open at about ¼ to ½ inch in diameter until they develop resistance in mid- to late-July. Grapefruit is susceptible from the ½ to ¾ inch diameter to full expansion in late September to mid-October. Infection through wounds can occur at any stage of fruit growth.

PROCESSING ORANGES

Programs for effective canker control on oranges in Florida were more fully evaluated in 2008. Before copper sprays were initiated, infection of Hamlins occurred during the early rains in April of 1 to 2 inches. The infection of very small fruit (<¾ inch, Fig. 1) resulted in a 40-70 percent increase of premature



Figure 1. Canker on 1/2- to 3/4-inch diameter Hamlin orange fruit that dropped in May because of early season infection by windblown rains April 1-6, 2008.

fruit drop in May. Disease control with copper applied after the early April rains was compromised for the remainder of the season.

For groves with endemic canker, the previous recommendation was four copper sprays for early oranges applied at 21-day intervals — one in mid-late April (fruit at 3/4 inch diameter), a second in mid to late-May, a third in early-mid June and a final one mid-July or when fruit reaches about 1 1/2 to 2 inches in diameter. In 2008, this spray application schedule was only partially effective for prevention of continued fruit drop after early season inoculum build-up. The number of fruit dropped due to canker was reduced from approximately one box per tree to 1/3 box per tree by various copper formulations (Fig. 2).

Therefore, prevention of early season fruit infection is crucial for subsequent control of fruit infection and risk of drop. For this reason, the recommendation for oranges has been shifted to begin the spray program in early April when fruit are 1/2 inch in diameter and proceed with additional sprays at 21-day intervals until July (five sprays). Similarly for Valencias and midseason varieties, the recommendation is likewise to apply sprays earlier from 1/2-inch fruit diameter at 21-day intervals until June.

In 2008, early orange varieties grown for higher color score (Early Gold, Westin, Ruby, Itaborai) were again found to be more susceptible than Hamlins. However, an aggressive program of copper sprays, starting with spring flush and ending in early August, was effective for canker control on Early Gold in a block with severe fruit losses (50 percent drop) and defoliation (nearly 100 percent) in the 2007 season. The 2007 defoliation removed the leaf inoculum and copper sprays started in February 2008 at first flush gave good control and little fruit drop occurred by the end of the season. This shows that a grove badly infected by canker can recover and early

season control is important. However, this spray schedule required nine applications in 2008, a regimen that will not be sustainable based on current processed fruit prices.

FRESH GRAPEFRUIT

Inoculum management on spring flush is critical for fruit protection throughout the season because of the greater susceptibility of grapefruit. Fungicide spray programs for fresh grapefruit are already intensive, with sprays for fungal diseases as well as canker. A low rate of copper could be used for the spray of spring flush for scab, unless scab pressure is high. When scab pressure is high, a stobilurin or Enable should be added to the spray. Subsequently, the copper sprays for melanose should also control canker from April to early July.

Copper can be substituted for fungicides such as stobilurins that do not control canker, but fungicides could also be used in the same sprays if additional fungal control is needed. Petroleum oil or other adjuvants can be combined with copper, but they will not improve the canker control. Surfactants that increase the wetting of the plant surface should be avoided as they risk increased bacterial infection of fruit.

SPECIALTY FRUIT

Most tangerines are fairly tolerant to canker. Programs used for control of Alternaria brown spot on Minneolas and Murcotts could also protect against canker, but copper will have to be used in each spray instead of or with other fungicides. Navel oranges are more susceptible to canker and will need to be sprayed every 21 days from early April



Figure 2. Hamlin fruit drop due to canker in September because of early season infection by windblown rains from April 1 to 6, 2008. The season-long drop was estimated to be about one box for the nonsprayed trees and 1/3 box per tree for the copper-sprayed trees in this location.

to mid-July. Fallglo is more tolerant and probably three sprays in April, May and June should suffice, but observations of canker on this variety are lacking.

YOUNG TREES

Young-fruited trees are more susceptible because they produce leaf flushes more often and flush tissue represents a high proportion of the canopy volume. The recommendation for susceptible varieties (grapefruit and early oranges) is that trees be sprayed every three weeks to coincide as much as possible with vegetative flush cycles from spring through the fall. Spray programs for young fruiting trees may have to be intensified as growers gain more experience.

Copper rates depend on the length of protection desired and the weather. As little as 0.5 lb of metallic copper per acre will protect spring flush or fruit during the dry spring season. However, in the rainy season, more than one pound of metallic copper may be required to protect fruit for three-week periods. To the extent possible,

copper usage should be minimized since it accumulates in soil, may cause burn of the fruit peel, or create environmental concerns.

LEAFMINER CONTROL

Leafminers do not spread canker, but extensive invasion of leafminer galleries by the bacterium greatly increases inoculum levels, making the disease explosive. Leafminers are not usually a problem on the spring flush and, except on grapefruit, no control may be needed at that time. Leafminer control on the first summer flush can reduce disease pressure considerably. If properly timed, applications of petroleum oil, Agri-mek, Micromite, Spintor or Assail will reduce damage by leafminer. Late summer flushes tend to be erratic and effective control will probably be difficult.

NON-BEARING TREES

Resets and young fruiting trees with canker are at the most susceptible

stage of tree development because they have the greatest number of leaf flushes per season. Leafminer control is essential on young trees of all varieties to control canker. Newly planted trees represent a small spray target, but reduction of canker-induced defoliation on newly planted trees can be achieved by two Admire drenches applied at the beginning and middle of the growing season.

In field trials, Admire control is not due to the effect on leafminer control, but principally to the neo-nicotinoid breakdown product in the tree that induces systemic acquired resistance (SAR). The additional benefit of Admire is long lasting and therefore effective for reducing disease on foliage all season. In an airblast sprayer trial with copper applied every 28 days, grapefruit trees receiving Admire soil drenches every 60 days had significantly less canker-induced defoliation than nontreated trees. In this trial, copper did not provide additional disease control compared to Admire alone be-

cause the airblast application did not adequately cover the foliage. In another trial, copper sprays applied with a hoop boom provided enough coverage to protect leaves and reduce canker.

The recommended application schedule for newly-planted orange trees is application of Admire soil drenches 14 days prior to spring flush for leafminer/psyllid control plus systemic activity for canker control with no additional copper sprays. Prior to mid-summer flushes, a second Admire application is needed to maintain leafminer/psyllid control plus systemic activity for canker control on foliage and fruit. Grapefruit and early oranges that are more susceptible will require copper to protect each flush (21-28 days, metallic copper rate from 0.5-1.0 lb/acre) in addition to the full season allowance of Admire.

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Observations on the effect of windbreaks on canker incidence in a grapefruit orchard in Northwest Argentina

(Summary of a presentation at the 11th International Citrus Congress in Wuhan, China in October 2008.)

By Hernan Salas, Jacqueline Ramallo and Beatriz Stein

In areas of Northwest Argentina where citrus canker is endemic, prevention and control of the disease is implemented through an integrated management program. These types of programs include the use of canker-free plants for new plantings and resets, multiple sprays of copper-based bactericides, citrus leafminer control, disinfection of tools, machinery, harvesting equipment, and most importantly a management system including windbreaks.

In the grapefruit areas of Salta and Jujuy provinces of Northwest Argentina, an irrigated area with 700 mm (~ 28 inches) average rainfall, hot and dry winds occur regularly and cause rind blemish that reduces fruit quality. Windbreaks, mostly *Casuarina cunninghamiana*, were used commonly even before canker outbreaks.

The purpose of this study was to evaluate the windbreak effect on canker fruit incidence in a grapefruit orchard without copper sprays. The orchard consisted of several blocks with different grapefruit varieties planted in 1996. Tree spacing was 25 x 16 feet (approximately 100 trees/acre). Prevailing wind in the area was from the southeast to the northwest.

Each block in the orchard was surrounded on all sides by a perimeter windbreak of *C. cunninghamiana*, approximately 36-foot tall that was planted at the same time as the orchard. Citrus canker incidence on fruit was evaluated in three tree rows in the north, middle, and south of each block. Canker incidence on fruit was assessed visually and the percentage of fruit with canker was calculated.

Canker incidence on fruit was reduced up to 60 percent

in blocks with windbreaks (Fig. 1). The area protected by windbreaks was up to 165 feet from the windbreak.

These results clearly document the primary role of windbreaks for control of canker on the most susceptible citrus variety, grapefruit, even under nonsprayed conditions. Copper sprays would be expected to augment but not substitute for this control effect. The distance from the windbreak providing effective control in grapefruit is about five times the height of the windbreak. This distance for a windbreak effect is shorter than predicted from other situations with more resistant varieties.

This study confirms the essential value of an intensive windbreak system for fresh market production of highly susceptible grapefruit.

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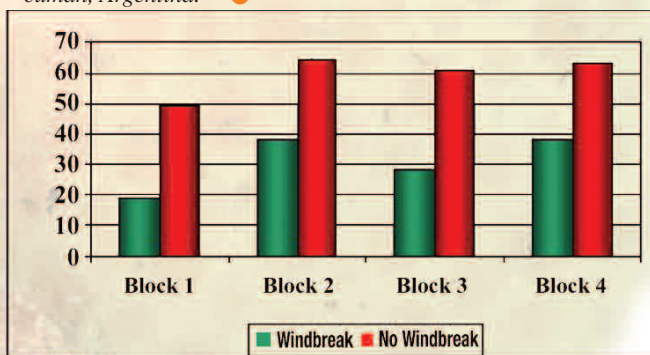


Figure 1. Incidence of fruit with canker (%) in grapefruit blocks with and without windbreaks.