



By Jim Graham, Barrett Gruber and Clive Bock

Fruit losses due to citrus canker, caused by *Xanthomonas citri* subsp. *citri* (Xcc), vary each crop season depending on citrus variety, tree age, flushing condition, leafminer control, and coincidence of weather events with occurrence of susceptible fruit and foliage. In 2012, crop losses in Hamlin from premature fruit drop, and in grapefruit from unacceptable levels of fruit lesions, were far lower compared to the 2011 season. This difference between 2011 and 2012 was due to the prevalence of April and May rains in 2011 that occurred when fruit were at the most susceptible stage of expansion. In 2012, Huanglongbing (HLB) caused unprecedented premature fruit drop in Hamlins and grapefruit, which overshadowed the crop loss from canker. Nevertheless, canker remains an obstacle to optimal yields and packouts, particularly for fresh grapefruit growers.

EFFICACY OF WINDBREAKS FOR CANKER IN YOUNG GRAPEFRUIT

In grapefruit groves, where the goal is to minimize canker incidence and severity to ensure an economi-

cally viable packout, windbreaks reduced wind speed and fruit infection experienced during typical Florida rain storms in 2011. In 2012, 5-year-old red grapefruit trees in an 11-acre trial block surrounded by a 20-foot- to 30-foot-tall *Corymbia torelliana* windbreak averaged 50 percent less canker-infected fruit in copper-sprayed trees than in the non-sprayed trees.

In an adjacent block with the same windbreak system, weather stations were deployed in east-west and north-south directions to measure the effect of proximity to the windbreak on wind speed expressed as the number of wind gusts ≥ 11 miles per hour (mph) and the relationship with incidence of fruit lesions. As predicted from previous simulations of the effect of wind on bacterial infection,

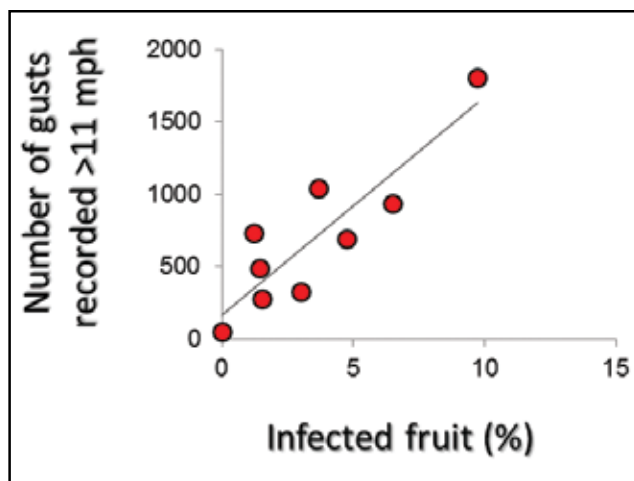


Fig. 1. Relationship between canker incidence (percent infected fruit) and wind speed (number of gusts recorded ≥ 11 miles per hour) in an 11-acre, 5-year-old Ray Ruby grapefruit block surrounded by a windbreak of 20- to 25-foot-tall *Corymbia torelliana*

the greater the exposure to wind, the higher the canker fruit incidence (Fig. 1). The number of wind gusts ≥ 11 mph increased with distance from the windbreak whether measured within the north-to-south rows or across the rows from east to west. Therefore, the highest fruit disease (~10 percent) was in the center of the 11-acre block and the lowest incidence (~2 percent) was in the east-west row location nearest the windbreak (Fig. 2, page 14).

IMPROVING THE PERFORMANCE OF COPPER FORMULATIONS

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 standard copper formulations applied at 2 to 4 pounds/acre of product (0.75 to 1.4 pounds/acre of metallic copper). Nordox™ (copper oxide, 75 percent metallic) at 0.44 pound/acre, 30 percent of the

FOUR GENERATIONS of FLORIDA CITRUS NURSERIES



Now accepting orders for 2014-2015 delivery

EXCLUSIVE LIFETIME REPLACEMENT POLICY.
Every tree is hand nurtured and inspected. Swingle, Kuharske, Carrizo, Cleo and Sour rootstocks available. Other varieties are also available.

Call Chris at (407) 404-0355 or Paul at (407) 832-1010

Visit our exciting new website TODAY!
www.blue-heron-nurseries.com

BLUE HERON NURSERIES

WINTER GARDEN, FLORIDA www.blue-heron-nurseries.com


Reg. # 48006420

1.33 pounds/acre (1.0 pound metallic) rate, combined with Magna-Bon™ at 100 parts per million/acre was as effective as 1.33 pounds of Nordox™. Alternatively, application of Nordox at 1.33 pounds/acre for the first five sprays followed by five sprays of Magna-Bon™ at 100 ppm/acre was also as effective as the full rate of

Nordox™ season-long.

These mixtures or alternations of copper formulations amount to 50 percent less metallic copper per season, which represents a substantial reduction in copper loading of the grove soil, considering that 10 to 11 sprays are recommended to protect grapefruit until full expansion.

standard rate (0.44 pound/acre) was as effective as the full rate with only 50 percent of the metallic copper per application. Likewise, protecting fruit with Nordox™ early in the season in the first three sprays followed by two sprays of Magna-Bon™ was as effective as five sprays of the full rate of Nordox™.

In 2013, our recommendation for young early oranges will continue to be four to five copper sprays applied at 21-day intervals beginning when fruit diameter is 0.25 to 0.5-inch with follow-up sprays until fruit diameter reaches 1.5 to 2 inches in July.

The good news from an earlier Hamlin trial is that as the trees develop into hedgerows, the grove becomes its own internal windbreak that reduces early-season *Xcc* infection and minimizes fruit drop due to the disease. Hence, in older Hamlin blocks, applications of copper beyond the early season may not be necessary or economically sustainable when the cost of additional sprays is compared with the value of the crop lost to fruit drop.

COPPER SPRAYS PROTECT FRUIT

Because fruit grow more slowly than leaves, the copper film can protect for 14 to 21 days, after which time fruit expansion exposes unprotected fruit surfaces. The Citrus Copper Application Scheduler helps determine if the copper residue on the fruit from conventional copper formulations is adequate for disease control (see "Optimization of Copper Application Timing" on page 26). The output graphically demonstrates reduction in copper residue based on time after application, cultivar and local rainfall. The model, as part of AgroClimate (<http://www.agroclimate.org/tools/cudecay/>), is currently most appropriate for the period from bloom to mid-summer but can be used for the entire growing season.

Copper formulations are equivalent because the reduction of copper residue from the fruit surface differs little for the various products tested except for the residue from Magna-Bon™, a soluble product with low metallic copper (5 percent). Magna-Bon™ has performed well in our grapefruit trials under dry spring conditions, but not as well in Hamlin trials experiencing early spring rains. The lower performance of Magna-Bon™ in Hamlins may be due to insufficient metallic copper on the fruit surface early in the season compared to the standard copper formulations at three times as much metallic copper.

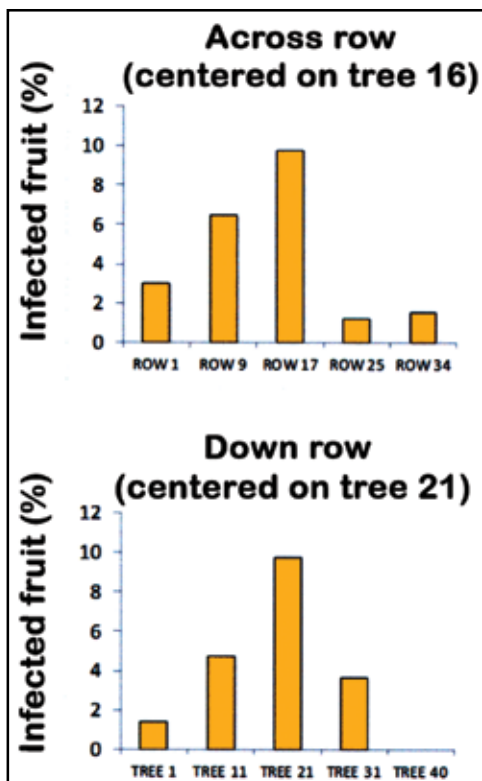


Fig. 2. Effect of a *Corymbia torelliana* windbreak on wind speed and fruit canker incidence in an 11-acre block of 5-year-old Ray Ruby grapefruit. Row 17 and Tree 21 represent the center of the block and center of the row, respectively. (Note: across rows, distance is ~150 feet.)

A TALE OF TWO CANKER EPIDEMIC SEASONS IN HAMLINS

In young groves where trees have not yet grown together to form hedgerows, copper sprays are targeted to prevent early-season fruit infection as the stomates open at 0.25- to 0.5-inch fruit diameter. In 2011, our trial of 4-year-old Hamlins suffered 70 percent fruit drop in the non-sprayed trees due to intense rains in April and May. Even with copper sprays, the losses were reduced to ~40 percent fruit drop, which is an unacceptable level of control. This outcome emphasizes the importance of early-season spray timing in relation to fruit size and the application of a formulation or mixture of formulations with sufficient metallic copper to protect the fruit.

In 2012, April and May were relatively dry, and sprays were stopped early in July as recommended (after four to five sprays). Although the incidence of new canker lesions exceeded 30 percent to 40 percent in copper treatments by the end of season, these late-season lesions caused only minor fruit drop. Similar to the results with grapefruit, a mixture of Magna-Bon at 100 ppm/acre with a rate of Nordox™ reduced to 30 percent of the

Keep your investments growing with

SPROUT GUARDS

Sprout Guards may also be custom ordered to any size needed, regarding mechanical harvesting.

★ 30 YEARS EXPERIENCE ★



Black Sprout Guards, 8" x 20"



Green Sprout Guards, 8" x 14" standard size tree

★ FREE ESTIMATES ★

★ BEST WRAP, BEST PRICE AND BEST SERVICE ★

Mike Hurst Citrus Services, Inc.

(863) 452-6469 • Cell (863) 443-0531; Nextel 161★20414★1

ALTERNATIVES TO COPPER

Recently completed studies identified the potential for development of copper resistance in *Xcc* after long-term use in citrus groves. Use of FireWall™ (AgroSource, Inc.) is effective for canker control on grapefruit and reduces the risk of copper phytotoxicity to fruit, and possibly for development of copper resistance in *Xcc*. In September 2012, FireWall™ received a Section 18 Emergency Use Exemption from the Environmental Protection Agency (EPA) for use against canker on fresh grapefruit. Use is limited to two applications per season at 2 pounds/acre per application. FireWall may be used based upon advice from experts, particularly at the critical time for fruit infection during tropical weather conditions.

INTEGRATION OF LEAFMINER CONTROL IS ESSENTIAL

Leafminer galleries are very susceptible to invasion by the canker bacterium. Extensive infection of leafminer galleries by *Xcc* greatly increases inoculum, making the disease explosive, particularly on flush from July to the end of the season. Leafminer control on the first summer flush is difficult because the duration of flush susceptibility exceeds the

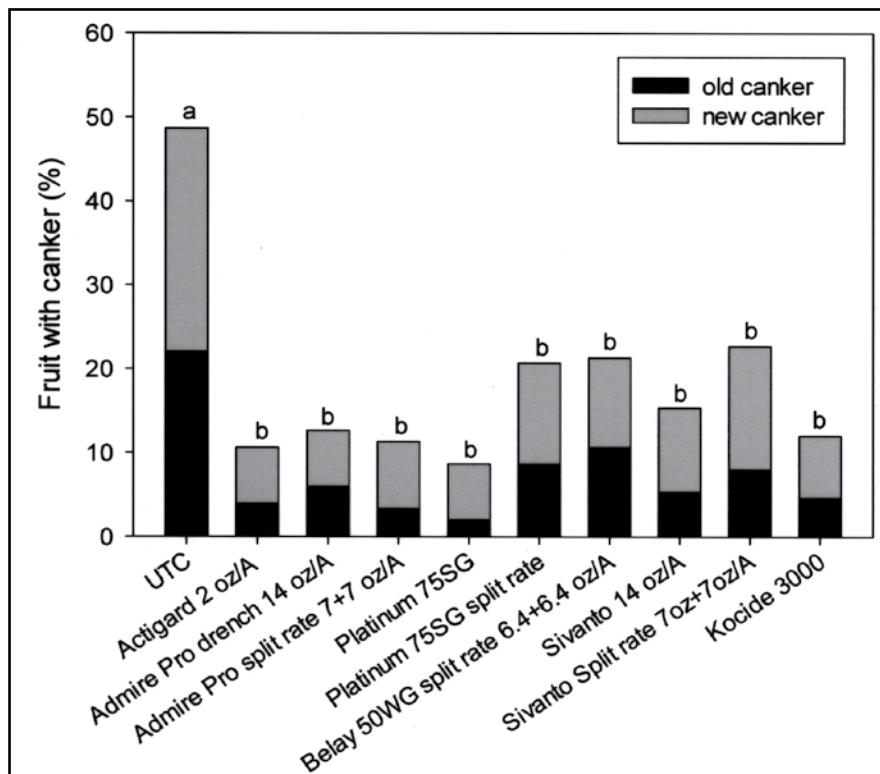


Fig. 3. Single and split soil applications of SAR inducers Actigard™, Admire Pro™, Platinum™, Belay™ and Sivanto™ compared with 21-day interval sprays of Kocide 3000™ on 3-year-old Vernia oranges. Lesions were classified as “old” if they were larger than 0.25 inch in diameter, coalescing with surrounding lesions, black in color, exuding gum or had a prominent yellow halo; and “young” if lesions were smaller than 0.25 inch in diameter, brown in color and were not coalescing with surrounding lesions.

The Spreader-Sticker for Serious Fungicide Applications



Cohere is a film-free spreader-sticker that is an excellent choice with fungicide applications on citrus crops.

Cohere leaves no sticky residue on spray equipment and has good spray mix compatibility. It also has a much lower risk of contaminating spray mixes with residue from previous mixes. And after application, there's less risk of wash-off with Cohere.

Helena Chemical Company • 2405 N. 71st Street • Tampa, FL 33619 • 813-626-5121 • www.helenachemical.com

Always read and follow label directions. Cohere & People...Products...Knowledge... are registered trademarks of Helena Holding Company. © 2013 Helena Holding Company.



Film-Free Spreader-Sticker

- Excellent sticking & wetting
- No sticky residue on equipment
- Does not need sunlight to “set” the solution
- Resists UV degradation
- Better deposition with low-volume applications
- Active with contact & systemic pesticides & nutritionals



People...
Products...
Knowledge...

residual activity of most insecticides. On younger trees, loss of leafminer control on late-summer flushes occurs when the control effect of systemic neonicotinoids has run out. Furthermore, it is accentuated by erratic flushing activity, making the timing of foliar insecticide sprays problematic.

Effective leafminer control is even more difficult since the intensive sprays required for Asian citrus psyllid control have reduced biological control agents in the grove. Nevertheless, stringent leafminer control is essential to reduce canker severity on leaves and to minimize fruit infection.

SYSTEMIC ACQUIRED RESISTANCE (SAR) FOR CANKER CONTROL ON YOUNG FRUITING TREES

Repeated vigorous flushes of young trees render them extremely prone to leafminer damage with the potential for explosive increase in *Xcc* inoculum, resulting in defoliation and fruit infection. We have documented consistent reductions in foliar infection and canker-induced defoliation on young non-bearing trees after soil applications with the neonicotinoids, Admire Pro™ (imidacloprid) and Platinum™ (thiamethoxam). Soil drenches of the commercial SAR elicitor, Actigard™

(acibenzolar-S-methyl), and season-long rotations with Admire Pro™ and Platinum™ are highly effective for suppressing foliar canker epidemic development on young, bearing grapefruit and orange trees. These findings are consistent with the current or pending approval of comprehensive seasonal application of neonicotinoid insecticides for psyllid control on trees of larger volume.

For best management, the timing for the application of neonicotinoids should be determined by the potential for movement in the soil. Thus far, canker control on leaves and fruit for soil-applied SAR inducers — including Admire Pro™, Platinum™, Belay™, Actigard™ and a new insecticide for aphids, psyllids and whiteflies called Sivanto™ (nAChR Agonist / Butenolide; Bayer Crop Science) — is equivalent to season-long 21-day interval sprays of Kocide™ 3000 (Fig. 3, page 16). Actigard™ is not yet registered for use on citrus, but we are currently working with Syngenta under an EPA experimental use permit to develop efficacy data to support registration for young bearing grapefruit trees in an integrated canker management program with copper sprays.

For additional information regarding insect and disease management

recommendations, consult the Florida Citrus Pest Management Guide (<http://www.crec.ifas.ufl.edu/extension/pest/>).

Jim Graham is professor of soil microbiology at the University of Florida's (UF) Citrus Research and Education Center at Lake Alfred; Barrett Gruber is assistant professor of horticulture at UF's Indian River Research and Education Center at Fort Pierce; Clive Bock is research plant pathologist with the U.S. Department of Agriculture at Byron, Ga.

WHAT'S SHAKIN'

Katrina Moseley, who received her master's degree from the University of Florida in 2010, conducted a study to determine if mechanical harvesting has an adverse effect on short-term crop yield and tree health. She and her advisers — Fritz Roka and Lisa House — co-authored a paper for the *International Food and Agribusiness Management Review*, 2012. The results indicated that mechanical harvesting did not create an adverse near-term nor long-term effect on yields.

The paper is available on the website: <http://citrusmh.ifas.ufl.edu>. The author's introductory video is on YouTube: <http://www.youtube.com/watch?v=NyI6-jKIfo0>

Mention Promotion Code:
GZ Citrus 13 and
Receive 5%

Additional free product on
orders filled 4-1-2013 thru
4-30-2013.

Invoices of product purchases
need to be submitted for free
product.

TIMAC AGRO'S CITRUS GREENING BIOSTIMULANT PROGRAM



Timac Agro's Citrus Greening Biostimulant Program gives growers a viable and proven option to combat HLB. Over two years of grower trials have proven the program gives you:

- ✓ Higher Lbs Solids Per Box vs. Untreated
- ✓ Higher Lbs of Juice Per Box vs. Untreated
- ✓ Less Fruit Drop vs. Untreated

The two prong approach starts with FERTIACTYL® GZ stimulating root development, followed by FERTILEADER® AXIS and ELITE being applied foliar enhancing the uptake and circulation of nutrients found in the soil and leaf. The synergistic benefits provided by the products allow constant stimulation of the tree from the roots to the fruit.

Application Times:

- January – March
- Late May – June
- September – Early October
- November – December

For a List of Distributors, a Copy of the Greening Trial Study, and Program Rates Please Contact:
Kevin Murphy - 863-443-1852 or Eric Hammons - 813-422-8133

