Bifenthrin trunk sprays as a strategy for Fuller rose beetle (FRB) field control in 2013

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Editor’s Note: Work on Fuller rose beetle is now a part of CRB’s core program of Integrated Pest Management research with Drs. Morse and Grafton-Cardwell as lead investigators.

Fuller rose beetle (FRB) (Figure 1) goes by many different names (synonyms) in the scientific literature including *Naupactus godmani* (Crotch) (most correct), *N. cervinus*, *Pantomorus cervinus*, *Asynonychus godmani*, and several others.

FRB is seldom considered a serious pest in California but has re-emerged as problematic because it is considered a quarantine pest in important citrus export markets such as Korea (see the sidebar on page 31).

The Fuller rose beetle has one generation a year. Eggs are laid in a mass of up to several dozen underneath the button of fruit, or in cracks and crevices in the tree (Figure 2). When eggs hatch, larvae drop to the ground and live in the soil where they feed on roots of citrus for 6 to 10 months (Figure 3).

They pupate in the soil, and adults emerge 1.5 to 2 months later. Peak emergence is July through September, but adults emerge from the soil year-round. For example, in the San Joaquin Valley, roughly 4.3% emerge in June, 14.5% in July, 53% in August, 17.3% in September, 3.7% in October, 2.6% in November, 2.8% in December, and 1.9% for the combined months of January through May.

Adults are all female and are flightless. They reach the canopy only by climbing up the trunk or branches that touch the ground or vegetation.

In past years, Korea has permitted blanket methyl bromide fumigation of citrus arriving in Korea as a means of ensuring that Fuller rose beetle is not introduced there.

The California citrus industry has been informed that Korea is not likely...
to allow the blanket fumigation starting with the 2013-14 shipping season. Instead, Korea will reject shipments with viable (unhatched) FRB egg masses if they are found on arrival.

To avoid severe impacts on the industry, it is suggested that growers with fruit likely to be shipped to this country reduce FRB levels in their groves to extremely low levels using a combination of skirt-pruning and trunk sprays as detailed below.

Meanwhile, research is continuing on FRB pre-harvest and postharvest management, and updates on control options can be found as they occur at the following two websites: http://ucanr.org/sites/KACCitrusEntomology/ and http://www.calcitrusquality.org/.

The ideal method of dealing with FRB would be an effective postharvest treatment that could be used only on loads of citrus destined for shipment to Korea. Postharvest research will continue, but at present we do not have an effective postharvest treatment that can be recommended for control.

FRB eggs are covered with a proteinaceous coating secreted by the female after eggs are laid. This coating protects the eggs from dessication, attack by many natural enemies, and also makes postharvest chemical control quite difficult.

A second strategy of control that has been evaluated is various treatments that might reduce the survival of larvae found feeding on the roots of citrus in the soil. Soil application of parasitic nematodes has been shown to be only somewhat effective in controlling FRB larvae. Based on discussions with PCAs, it also appears that post-petal fall soil applications of imidacloprid applied over a period of 4-5 years gradually lead to reduced FRB levels. Unfortunately, the level of control that is needed for the Korean export market is much higher than what can be obtained via these soil treatments.

Substantial research has been done using foliar sprays to control adult FRB. The bottom line is that these insects are very difficult to kill. Even the most effective materials are not extremely persistent, making re-application necessary if sustained control is expected of adult beetles which continue to emerge out of the soil over many months (June-November).

Check UC Pest Management Guidelines for updates (http://www.ipm.ucdavis.edu), but the most effective materials identified to date are cryolite, thiamethoxam, and carbaryl. Unfortunately, MRLs are not established for cryolite in Japan or Korea suggesting that this material should not be used on export fruit (the PHI of 15 days is based on a U.S. tolerance of 7 ppm – see Table 1).

Carbaryl might be used on export fruit only well in advance of harvest (contact the manufacturer for advice). The PHI of 5 days is based on a U.S. tolerance of 10 ppm which is 20-fold higher than the Korean MRL of 0.5 ppm.

Only with thiamethoxam is the MRL in export markets equal or higher than the U.S. tolerance, indicating that the label PHI should result in fruit residues below the MRL (PHI is 0 days but REI is 12 hours). The downside of thiamethoxam is the number of repeated foliar sprays needed for effective FRB control; likely 4-5 sprays applied at monthly intervals from June through harvest. If the 5.5 fl oz/acre rate is used, only 2 applications of thiamethoxam are allowed per year. Therefore, we suggest that skirt-pruning and bifenthrin trunk sprays are more effective strategies to manage FRB during 2013.

**Suggested strategy for 2013: skirt-pruning + bifenthrin trunk sprays**

Research done to date suggests that an effective method of controlling FRB is skirt-pruning coupled with repeated trunk sprays of bifenthrin; Brigade WSB is the formulation shown to be effective in trials.

Fig. 4. Skirt prune the trees at least 24” from the ground and check the trees regularly to eliminate suckers and fruit touching the ground in order to prevent access to the fruit and foliage other than via the trunk.
should start in early June, just before adult beetles start to emerge in significant numbers out of the soil. Skirt-pruning alone will reduce FRB levels only to a limited degree.

It is critical that the skirt be pruned high enough initially so that when suckers grow or the weight of fruit bends branches downward, they do not contact the soil or weeds that have been allowed to grow in the grove (Figure 4). FRB adults have a habit of climbing upward and will rapidly find any “bridge” into the tree that allows them to bypass the repellent trunk sprays of bifenthrin. We suggest that initial skirt-pruning be done at a minimum height of 24” (higher is better and might save labor later in the season).

It is critical that the grove is walked every 4-6 weeks to touch up skirt-pruning and maintain weed control. If adult beetles bypass the trunk spray, then one has wasted time and the cost of the skirt-pruning and trunk spray.

The strategy of using pyrethroid trunk sprays originates from work done in California with carbaryl and azinphos-methyl trunk sprays when FRB was a problem for California citrus exported to Japan back in the late 1980s. This is no longer an issue because FRB has been found in commercial citrus groves in Japan.

Later research by R.D. Magarey (Sunraysia Horticultural Centre, Mildura) and co-workers in Australia showed that several pyrethroids were effective. Trunk sprays of lamda-cyhalothrin are now being used there for FRB control based on work by Greg Baker and Peter Crisp of the South Australian Research & Development Institute. Lamda-cyhalothrin is not labeled for use on citrus in the U.S. Our research comparing trunk sprays of lamda-cyhalothrin versus bifenthrin indicated that bifenthrin is a more effective FRB trunk spray.

The Brigade WSB 2ee label allows trunk application of up to 0.5 lbs AI (active ingredient) per acre. Unfortunately, bifenthrin applied in 1 application of 0.5 lbs or 2 applications of 0.25 lbs is not persistent enough to provide season-long control due to the prolonged period of time over which adults emerge out of the soil. The highest levels of soil emergence occur from July to September. Furthermore, adult
FRB kept in the laboratory lived an average of 110 days; even under field conditions, adult FRB will be quite long-lived.

If skirt-pruning and trunk sprays are applied too late in the season, adults that emerged earlier will already be in the canopy of citrus trees producing eggs that remain unhatched and could be detected on fruit at harvest.

Based on our FRB efficacy data and in cooperation with FMC Corporation and CCQC, we are working to obtain a 24c label allowing trunk application of a total of 1.0 lbs AI per acre (allowing an additional 0.5 lb AI per acre amount needed to make this strategy effective).

We are currently evaluating two strategies for Brigade trunk sprays, and results will be available prior to the first June treatment. These strategies include: (1) 4 applications of 0.25 lb AI/acre applied every 6 weeks (e.g., June 3, July 15, Aug. 26, and Oct. 7) versus (2) 2 applications of 0.5 lb AI/acre applied at an interval of 12 weeks (June 3 and Aug. 26).

Obviously, growers would prefer to put on two sprays at a higher rate rather than 4 sprays at the lower rate to save on application costs; however, our recommendation will depend on Korea’s Quarantine Inspection Agency has advised the California citrus industry that they plan to eliminate methyl bromide fumigation of oranges on arrival in Korea beginning next season.

The California Citrus Quality Council (CCQC) is recommending that growers skirt prune their groves and use trunk applications to control Fuller rose beetle (FRB) so the industry can maintain access to the Korean market.

According to the CCQC’s Jim Cranney, “Growers risk lower returns next season if they do not skirt prune and treat their groves for FRB.” He said the California citrus industry ships approximately 10 million cartons of oranges to Korea each year, but the removal of blanket fumigation and poor FRB control could reduce that volume by a third or even by half.

Cranney said he is sympathetic to growers who will incur greater costs to skirt prune and make trunk applications, but he said growers also need to consider the impact that significant reductions in exports to Korea would have on prices. He said some fruit that is not sent to Korea can be diverted to other markets, but not large numbers.

Using the 10 million carton figure and assuming a one-third reduction in exports to Korea means the industry would have to divert approximately 3 million cartons to other markets that are already pretty well satisfied.

He said, “It’s not likely that kind of volume could be moved on short notice without price reductions, and that includes the domestic market.”

Cranney reports that CCQC is working with its University of California and USDA partners to provide as many FRB control options as possible.

UC Riverside’s Joe Morse is leading the effort on FRB control using pesticide applications to the trunk, Lindcove Director Beth Grafton-Cardwell is screening foliar treatments, the Agricultural Research Service’s Spencer Walse is evaluating phosphine fumigation, and UC Davis’ Beth Mitcham and Veronique Bikoba are testing ethyl formate as an additional fumigation option.

However, Cranney added, “It’s unlikely that any single option can fully control FRB. Unfortunately, this will be a multyear process of defining the best control practices and then learning how to use them in the most efficient and cost-effective combinations.

“There are no easy answers” he said.

Maintaining access to Korean market
bifenthrin efficacy data we will have quite soon.

The first two applications of 0.25 lb AI/acre or the first application of 0.5 lb AI/acre are legal under the 2ee label. If a 24c Special Local Needs label is granted, an application of the second 0.5 lb AI/acre would be allowed (a total of 1.0 lb AI/acre, which is the amount shown by research to be effective).

It is critical that bifenthrin trunk sprays do not contact foliage and fruit because the current tolerance, which was originally established for a soil application, is quite low.

Concurrently, we are working with the IR-4 program to register a more practical method of bifenthrin application that we hope would allow contact with fruit and foliage; if successful, this will take 3 or more years.

At present, applications must be applied using a homemade “wand” similar to that depicted in Figures 5-7. This will be required on the 24c label, if it is approved. Each grower or PCA may have ideas on how to build their own wand applicator and/or to power the spray.

The key features of this strategy are: (1) the spray must contact only the trunk (soil runoff is ok but application to the trunk provides the best control); (2) the spray cannot contact the foliage or fruit; (3) to be effective and persistent, a high spray concentration is needed (5-10 gpa or less is ideal) applied to 12”–18” of trunk height all the way around the trunk; (4) it may be necessary to move irrigation emitters away from the trunk so they do not wash bifenthrin off the trunk (should know by the time of the April 22 FRB meeting at Lindcove); (5) at this con-

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**Summary of the Bifenthrin Trunk Spray Strategy:**

1. Build a model wand sprayer by early May so you can test it and consider modifications.
2. Skirt-prune to a minimum height of 24” by early June.
3. Treat with either 4 applications of 0.25 lb AI/acre bifenthrin spaced out every 6 weeks or 2 applications of 0.5 lb AI/acre applied 12 weeks apart. (Stay tuned for a California Citrus Quality Council [CCQC] advisory by early May advising which strategy is most effective).
4. 0.5 lb AI/acre is allowed under the Brigade WSB 2ee label. Legal use of the second 0.5 lb AI/acre (total of 1.0 lb AI/acre) depends on approval of CCQC’s 24c application (CCQC advisory expected early August).
5. The trunk spray must be hand-applied using a home-built u-shaped wand. Trunk sprays cannot be applied with a weed sprayer or other device that would allow the spray to contact foliage and/or fruit.
6. It is critical the first bifenthrin trunk spray be applied BEFORE significant emergence of adult beetles out of the soil occurs – get the spray on by early June.
7. The grove must be patrolled every 4-6 weeks to make sure that weeds growing under trees or suckers/branches do not allow FRB adults to bypass the trunk.
centration, the bifenthrin will be a thick slurry – agitation of the spray solution is important; and (6) we suggest growers and/or PCAs build their own wand applicator well in advance (by early May) and test it out so as to consider possible changes or improvements.

Stay tuned for future developments which will be posted on the following two web sites: http://ucanr.org/sites/KACCitrusEntomology/ and http://www.calcitrusquality.org/.

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