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## **Brief Update to Laurel Wilt Recommendations – Ambrosia Beetles**

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The industry has implemented a detection and suppression program with the goal of preventing or limiting the incidence of laurel wilt (LW) in commercial groves and depressing the ambrosia beetle populations. Early detection, removal and destruction of LW affected trees is the most important practice for controlling LW. Detecting LW visually at the wilting stage and prompt removal and destruction of those trees provides the best chance of limiting the root-graft spread of the LW pathogen and eliminating ambrosia beetle breeding sites. Leaving LW affected trees and wood provides a protected site for ambrosia beetles to reproduce and potentially become contaminated with the LW pathogen. Several methods to reduce ambrosia beetle populations and the attractiveness of avocado trees to ambrosia beetle attack are discussed below.

### Ambrosia beetle suppression

A general trend has been the increase in ambrosia beetle activity during late winter/spring (late February – May) with an associated increase in LW affected trees. This is a critical time to remove and destroy LW affected trees and implement methods of suppressing ambrosia beetle activity.

### *Reducing avocado tree attractiveness*

Research has shown that ambrosia beetles are more attracted to trees with a dense, shaded canopy than trees with a less dense, open canopy. In addition, observation of many groves in the area suggests the height of avocado trees in many groves is currently quite tall and the hours of canopy sunlight exposure is so low as to result in loss of the lower canopy. Trees that are too tall also result in long hours of shade in the row middles of the grove. Of course, there is a need to balance removing canopy to increase sunlight penetration and the hours of sunlight inside the tree and the need for sufficient tree canopy to maintain fruit production. It has also been observed that top-worked groves appear to have less LW activity than old full-canopy groves - again sunlight penetration. It may be of benefit for producers to selectively prune out a center limb or two to increase light penetration, and reduce the intensity and hours of deep shade within and among trees. In addition, maximum tree canopy and production may be maintained by annual or biannual topping and hedging. In general, trees should be no taller than 2/3rds the distance among tree rows, e.g., 25 ft between tree rows, trees should be maintained at 16-17 ft in height. In groves where the lower canopy has been lost (due to excessive shading) more drastic rejuvenation pruning will be necessary to bring back a lower, productive canopy.

### *Ambrosia beetle control in the immediate vicinity of an active laurel wilt outbreak*

Ambrosia beetles are in three grove locations: (a) inside infested trees, (b) on tree wood surfaces, or (c) in the air. The largest portion of the ambrosia beetle population is inside infested trees. Contact insecticides do not prevent ambrosia beetle emergence from already infested trees or wood and only a few contact insecticides have been found to provide good control of ambrosia beetles on wood surfaces (Table 1).

Chipping and burning wood can eliminate ambrosia beetles inside tree stumps and wood and stop their reproduction. However, to kill ambrosia beetles on tree surfaces, applications of contact insecticides and/or biopesticides to about one acre of trees surrounding a LW affected tree is recommended to help control or prevent further beetle movement in the grove. After removing LW affected trees, make two applications of insecticide directed to the trunk, scaffold limbs and medium to large wood (not the foliage) at a 10-15-day interval. The spray should be bark directed spray to the lower part of the tree and not the leaves and upper canopy. Malathion, Danitol® and Epi-mek® are registered for bearing avocado trees. In order to reduce the chances of beetle resistance these products should be rotated (Table 1). Use an adjuvant such as NuFilm® to prolong the efficacy of the insecticide. Using Vapor Gard® and Pentrabark® adjuvants may cause phytotoxicity on leaves. For non-bearing avocado trees, Talstar®-S and Hero® may be applied (Table 1); use an adjuvant to prolong the efficacy.

The biopesticides BotaniGard® ES and Mycotrol® (the active ingredient is *Beauveria bassiana* or *Bb*) are registered for avocado and have been shown to control some ambrosia beetle species. The concept is to place live *Bb* spores on the main trunk and scaffold limbs where ambrosia beetles may contact the live *Bb* spores. Again this spray is to be directed to the bark of the lower part of the trees (<10 ft).

Research has shown trunk directed applications of *Bb* are capable of killing ambrosia beetles and the time-line for application of these materials is now (Feb.-May) when average temperatures are lower and beetle populations are increasing. However, proper trunk directed application is paramount for *Bb* to be effective.

- First, compatibility of *Bb* with other spray materials varies. A general recommendation is to clean spray tanks prior to tank mixing. *Bb* is not compatible with some fungicides (e.g., Abound and Switch) and insecticides (e.g., Danitol® and Malathion) (Table 2).
- Spraying *Bb* too close to an application of a non-compatible spray material application will reduce the effectiveness of ambrosia beetle control. Therefore, time *Bb* applications to have the most time before and after any potential non-compatible spray material is used.
- Only purchase what will be used immediately. Do not leave these bio-insecticides in the tank for prolonged periods since it will kill the active *Bb* spores. Also be sure to store BotaniGard® ES and Mycotrol® in a cool, dry place that stays between 40°F and 85°F – otherwise the *Bb* spores will be killed.
- Mix the BotaniGard® ES and Mycotrol® in sufficient water to just wet the trunk and major limbs. Do not spray to run-off as this causes the *Bb* spores to wash off the bark. A light but thorough wetting is ideal.

### Summary

Ambrosia beetle control is a part of the strategy to control the laurel wilt pathogen. However, it is imperative to implement early scouting for laurel wilt symptomatic trees and for tree destruction to occur quickly. Strategies to suppress the ambrosia beetle population: reducing the shading with and among avocado trees may reduce the attractiveness of trees to ambrosia beetles and actively controlling ambrosia beetles in the immediate vicinity of an active laurel wilt outbreak may reduce new laurel wilt outbreaks.

Table 1. Contact insecticides for ambrosia beetle control. Applications should be directed to the trunk and medium to large wood to about one acre of trees surrounding the LW affected tree. Rotate pesticides products reduce the potential for insect resistance. Mix the chemical insecticides (Danitol, Malathion and Hero) with an adjuvant (e.g., NuFilm) to prolong its efficacy. The biological control insecticides BotaniGard ES and Mycotrol do not need an adjuvant and should be stored in a cool (<85°F), dry place.

Product	Rate per acre	Spray interval	Potential # of applications allowed per year per acre	Comments – estimated days of efficacy <sup>z</sup>
Danitol® 2.4 EC (fenpropathrin)	21.3 oz	14	1	14-21
Malathion 5EC (malathion)	24 oz/100 gallons	7-10	Open	10-14
Hero® (liquid) <sup>y</sup> (zeta-cypermethrin+ bifenthrin)	10.3	14	6	14-21 ( <b>non-bearing trees only</b> <sup>xy</sup> )
Epi-mek 0.15EC (abamectin)	20 oz	30	2	Not known
Talstar® S (bifenthrin)	40 oz	NA	1	Not known; <b>non-bearing trees only</b> <sup>y</sup> ; may not need adjuvant
BotaniGard® ES ( <i>Beauvaria bassiana</i> )	32 oz	7-14	Open	Not known
Mycotrol-O® ( <i>Beauvaria bassiana</i> )	32 oz	7-14	Open	Not known; organic production

x, Special Local Need (SLN Section 24C); y, Only for non-bearing trees; do not apply within 1 year of harvest.

z, The estimated days of efficacy is influenced by numerous factors including weather conditions (e.g., rainfall, temperature, and UV light intensity).

Table 2. Compatibility of fungicides with BotaniGard®

Fungicide	BotaniGard	
	1 h	6 h
Pre-application		
Abound	NC	NC
Cuprofix-Ultra 40 Disperss	C	C
Flopan 80	NC	NC
Kocide 2000	C	C
Ridomil Gold Copper	C	C
Ridomil Gold SL	C	C
Switch 62.5WG	NC	NC
Tilt	C	C
ProPhyt Phosphonate	C	NC

C = compatible; NC = Not compatible

Table 2. Compatibility of insecticides with BotaniGard®

Insecticide	BotaniGard	
	1 hour	6 hours
Pre-application		
Danitol	NC	NC
Hero	C	C
Admire Pro	C	C
Malathion	NC	NC
Permethrin	C	NC
Agrimek, Vertimek or Epimek	C	C
Actara	C	C
Talstar	C	C
Mustang	C	C

C = compatible; NC = Not compatible

Table 2. Compatibility of adjuvants and a nutrient with BotaniGard®

Adjuvant	BotaniGard	
	1 hour	6 hours
Pre-application		
Banole	C	C
Citrus oil	C	C
Nuflim	C	C
L1700	C	C
Pentrabark	C	C

Nutrient

Pre-application	BotaniGard	
	1 hour	6 hours
Keyplex 350	C	C

C = compatible; NC = Not compatible

(c://AB-LW/2017/recommendations/brief update to laurel wilt recommendations 3-11-17.doc)