Proposed industry strategy

LW and RAB suppression

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Background (reasoning behind the recommendations)

Research has shown:

RAB

1. The generation time of RAB inside avocado trees takes about 40-50 days depending upon temperatures (JE Peña, unpublished data).
2. Chipping dramatically decreases RAB survival and emergence but not completely (JA Smith, unpublished data).
3. RAB flight activity is highest in the late afternoon and early evening and trapping has shown most RAB flight is mostly from the ground to about 15 ft (G. Brar, unpublished data).
4. The number of RAB emerging from avocado wood has been proportionally minute compared to other ambrosia beetle species (JE Peña et al., 2010). Whether this is due to competition among beetles or avocado is a less efficient brood rearing host is not known at this time.
5. Damaged or recently pruned avocado wood is more attractive to RAB than non-damaged/pruned wood for about a 3 week period (LK Stelinski, unpublished data).
6. RAB is more attracted to redbay and swampbay trees than avocado trees.
7. Larger trees are attacked first. When most of the large trees are eliminated the RAB population declines rapidly.

LW

1. The molecular identification method to identify LW has been improved and is being perfected (JA Smith, unpublished data).
2. The LW pathogen does not survive in the mulched wood chips (JA Smith, unpublished data). The LW pathogen does not appear to be transmitted by high-speed mechanical pruning equipment. The LW pathogen can be transmitted with hand saws (hand-powered) pruning saws.
3. The visual external plant symptoms e.g., leaf wilting and stem dieback, of laurel wilt lag behind the degree of internal infestation and damage to the tree (RC Ploetz, unpublished data).
4. Preliminary data utilizing small avocado trees strongly suggests the reaction to (i.e., tolerance) LW varies by genetic background (i.e., West Indian, Guatemalan, Mexican, and hybrids among these) and cultivar (RC Ploetz et al., 2010). In general West Indian and West Indian-Guatemalan hybrids are less tolerant of LW than Guatemalan and Guatemalan-Mexican hybrids.

5. Data suggests larger avocado trees are more affected by LW than smaller avocado trees (RC Ploetz et al., 2010).
6. The laurel wilt pathogen has not been demonstrated to move by root grafting from an infested avocado tree to adjacent avocado trees; although it is suspected this may occur.

Economics

1. A comparison of the use of Alamo® and Tilt® formulations of propiconazole using current information on the macro-infusion technique for mature trees and avocado production cost data suggest only macro-infusion of Tilt® with a 3 year efficacy would be economically feasible (Ploetz, et al., 2011). However, the optimum rates and efficacy of Tilt® for use on mature trees is unknown at this time. This work is on-going.
2. A preliminary analysis of the effect of avocado tree removal on grove profitability suggests a maximum of 15-20 trees in a 100 tree/acre and 8-11 trees in a 88 tree/acre grove could be removed and the grove remain economically profitable (EA Evans, unpublished data). Of course the result of the analysis depends upon avocado prices, cost of tree removal/destruction, and any other treatment costs. Thus removing the 2 to 8 non-symptomatic trees adjacent to LW positive trees may not be economically sustainable.

Observations

1. The avocado trees in small avocado groves on Merritt Island surrounded by dead and declining redbay trees have not been decimated over a 3-4 year period by LW (JE Peña, JC Ploetz, and JH Crane). Over a 2-3 year period while the redbay trees are being attacked there appears to be only random, limited attack of the adjacent avocado trees. There is a potential for this to change once the redbay population is devastated.
2. Large mature trees have usually not died quickly but in sections over time (months to years) (JE Peña, JC Ploetz, and JH Crane). For example, one or two major limbs would show external symptoms and others would not. However, one large avocado tree in Gainesville died in approximately 6 weeks following initial symptom development in one main branch.

These research findings and observations suggest that RAB and LW has not quickly overwhelmed avocado groves in Merritt Island, that chipping wood and tarping or burning infested wood suppresses RAB, LW does not survive in chipped wood, RAB flight activity is highest during the late afternoon/early evening, most flight is within 15 ft of the ground and avocado may not be a "good" host for RAB reproduction all suggest RAB suppression may slow the spread of LW.

The proposed industry strategy

Continually and consistently depress the RAB population in the avocado production area through industry-wide scouting, elimination of infested limbs and/or trees, and limited area insecticidal applications.

Reasoning

As the RAB spreads and eliminates the large native swampbay in the natural areas and the large dooryard avocado and neighborhood swampbay trees these trees will no longer act as a host for RAB. Since the RAB introduction was just to the north of the avocado production area, the RAB-LW spread to the west and north may eventually create a zone of ever expanding non-host trees away from the agricultural area. To the north and east the loss of dooryard avocado and neighborhood native trees again may create a zone of non-host trees. If the industry can act in concert to continually and consistently depress any RAB population build up within the avocado production area, over time the RAB outbreak may be manageable.

This strategy would be part of the RAB-LW control solution but also provide time for additional short-term chemical control tactics for RAB and LW, trap and kill systems, and repellent work to come on-line. Furthermore, it may provide time for natural predators and parasites of RAB to be evaluated and eventually released.

Resources

1. Weekly aerial survey that identifies potential LW-RAB with identification of potential "finds" located and then ground-truthed.
2. Quick lab identification for LW.
3. Willingness on the part of the growers to quickly sample trees, wait for identification, and then if necessary take appropriate action.

Control

<u>Severely declining trees</u>

1. Cut, chip, and tarp LW positive trees.
2. Cut, chip, and burn LW positive trees.

<u>Trees either just wilting and/or just one section of canopy affected</u>

1. Cut, chip, and tarp the wood from section of tree affected.
2. Paint with pruning tar the cut limb(s) to reduce RAB attractiveness.

<u>Adjacent avocado trees and groves</u>

1. Adjacent avocado trees not showing symptoms should be treated with a soil drench of imidacloprid (Admire Pro®) to kill any potential RAB inside the trees.

<u>The immediate area of the grove</u>

1. Make a late afternoon foliar application of contact insecticide (Danitol®, Permethrin® or Malathion®) to kill flying RAB and to cover bark surfaces within the grove or 1-2 acre area.
2. Continue to monitor the grove for LW and apply additional insecticide on an as needed basis.
3. Suggested insecticide spray application rotation.

4.

Product rotation	Spray interval	Potential number of applications allowed per year per acre	Comments – estimated days of efficacy
Danitol 2.4 EC	14	2	14-21
Malathion 5EC	0	Open	7-10
Permethrin 3.2AG	7-10	6	10-14
Admire Pro	NA, soil drench	1	3-6 mos.

Redbay ambrosia beetle activity may be depressed due to temperatures during Dec. through March.

Estimated cost of insecticides per gallon.

Name	Cost ($/gallon)
DANITOL 2.4 EC (Fenpropathrin)	130
MALATHION 5EC((Malathion)	28.5
PERMETHRIN 3.2AG(Permethrin)	50
ENDIGO ZC (Lambda-cyhalothrin +Thiamethoxam)[z]	190
HERO (zeta-cypermethrin+bifenthrin)[z]	120
BRIGADE 2EC(Bifenthrin)[z]	100
ADMIRE PRO (Imidacloprid)	235* ($215/gallon)

*, 140 oz; z, to be registered for use

Comment. Since we do not know if there is any specific pattern to the location of RAB infestation there will most likely be scattered isolated attacks creating hot spots of RAB infestation. Consequently, I'd suggest that only the immediate area (~1 acre) be treated with insecticide once and that monitoring continue to determine if additional applications are warranted.

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Redbay ambrosia beetle insecticide cost estimate on yearly basis.

Table: Estimated cost of treatments [Cost ($) per acre **per year**] if spraying throughout/all the year.

Treatment	Unit	Units per Acre	Material Cost	Machinery Costs	Cost per Appl	Max No. of Appl per yr	Total Cost/yr
Registered insecticides							
DANITOL 2.4 Ec[x,z] (Fenpropathrin)	oz	21.3	21.63	20	41.63	2	83
MALATHION[x,z] 5EC((Malathion)	oz	24	5.34	20	25.34	12	304
PERMETHRIN[x,z] 3.2AG(Permethrin)	oz	8	3.13	20	23.13	6	139
DANITOL 2.4 Ec[x,z] (Fenpropathrin)	oz	21.3	21.63	20	41.63	2	83
ADMIRE PRO[x] (Imidacloprid)	oz	14	23.52	20	43.52	1	44
ADMIRE PRO[y] (Imidacloprid)	oz	14	23.52	10	33.52	1	34
Insecticides showing efficacy to be registered							
ENDIGO ZC [x] (Lambda-cyhalothrin +Thiamethoxam)	oz	5.5	8.16	20	28.16	2	56
HERO[x] (zeta-cypermethrin+bifenthrin)	oz	11.2	10.50	20	30.50	4	122
BRIGADE 2EC[x] (Bifenthrin)	oz	12.8	10.00	20	30.00	2	60
BRIGADE2EC[y] (Bifenthrin)	oz	24	18.75	10	28.75	1	29

*, actually no limit is cited on label: x/ spray; y/ soil drench; z/ Registered for avocados

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