Insecticides vs. frequent oil: cost and efficacy comparisons for psyllid control

By James Tansey and Phil Stansly

Before HLB, synthetic insecticides were generally not considered necessary for pest control in mature Florida citrus destined for processing. Invasion by the Asian citrus psyllid (ACP) and detection of HLB in Florida changed all that, and monthly applications of broad-spectrum insecticides are now more often the norm. While ACP suppression is needed to live with HLB, frequent use of synthetic insecticides comes at considerable cost and carries the risk of secondary pest outbreaks and insecticide resistance.

OIL PROS AND CONS

Petroleum-based horticultural mineral oils (HMOs) have long been used to control pests such as mites, scales and aphids as well as diseases like greasy spot. They are also known to suppress ACP. HMOs are relatively inexpensive, less damaging to beneficial insect communities than most conventional insecticides, and no resistance to them has been reported. Most HMOs are approved by the Organic Materials Review Institute for organic citrus production.

Part of the difficulty with HMOs is associated with limited residual activity. How does one take advantage of the positive qualities of HMOs and overcome this shortcoming? Increase the frequency of application. There's one obvious problem with this strategy: Applications cost money. Low-volume sprays of other insect-control products can reduce costs and application time and are effective for ACP control. We thought this approach might be effective, but found that low-volume HMO applications hadn't been tested for ACP.

PUTTING OIL TO THE TEST

We set out, with the support of the Citrus Research and Development Foundation, to determine if a low-volume, high-frequency approach to HMO applications would be effective for ACP control, reduce HLB incidence and be economically feasible. A replicated trial was set up in 2011 in a commercial block of Valencia orange on Swingle citromelo rootstock in Lee County. Approximately 5 percent of trees sampled in 2011 were HLB-positive.

We tested the effects of bi-weekly HMO applications on: (1) ACP counts, (2) HLB titer, (3) fruit yield and (4) fruit quality. These applications were compared to an untreated check and to insecticide applications made when a threshold of 0.2 per tap sample was reached. The trial was run through harvest in April 2014.

HMO was applied at 2 gallons per acre, either neat or with 2 gallons of water using a Proptec rotary atomizer P400D sprayer. An air-blast sprayer (100 gallons per acre) was used to apply insecticides (Table 1). All plots,

Table 1. Comparison of costs of insecticide products applied on specific dates.
†Dormant sprays were applied to all treatments.

Date	End-Use Product	Active Ingredient	Manufacturer	Retail Cost	Rate per Acre	Cost per Acre
23-Mar-11	Sevin XLR	Carbaryl	Bayer CropScience	$51.60/1 gal	0.75 gal	$38.70
8-Apr-11	Azatin XL	Azadirachtin	OHP Inc.	$201.67/32 oz	6 oz	$37.81
21-Apr-11	Actara WG	Thiamethoxam	Syngenta Crop Protection	$92.70/30 oz	5.5 oz	$17.00
14-Jun-11	Agri-mek	Abamectin	Syngenta Crop Protection	$91.00/32 oz	10 oz	$28.44
30-Jun-11	Dimethoate	Dimethoate	Helena Chemical	$51.37/1 gal	20 oz	$8.03
29-Jul-11	Delegate WG	Spinetoram	Dow AgroSciences	$229.32/26 oz	4 oz	$35.28
10-Jan-12	Danitol†	Fenpropathrin	Valent USA	$160.21/1 gal	16 oz	$20.03
12-Mar-12	Micromite 80 WGS	Diflubenzuron	Chemtura Corporation	$100.00/1.95 lb	6.25 oz	$20.03
17-May-12	Agri-mek	Abamectin	Syngenta Crop Protection	$92.70/30 oz	16 oz	$49.44
11-Jul-12	Delegate WG	Spinetoram	Dow AgroSciences	$229.32/26 oz	3 oz	$26.46
10-Aug-12	Dimethoate	Dimethoate	Helena Chemical	$51.37/1 gal	16 oz	$6.42
7-Nov-12	Imidan 70 W	Phosmet	Gowan	$11.00/1 lb	1 lb	$11.00
10-Jan-13	Danitol†	Fenpropathrin	Valent USA	$160.21/1 gal	16 oz	$20.03
9-Apr-13	Delegate WG	Spinetoram	Dow AgroSciences	$229.32/26 oz	4 oz	$35.28
1-Jul-13	Agri-mek	Abamectin	Syngenta Crop Protection	$91.00/32 oz	15 oz	$42.66
7-Oct-13	Gladiator	Zeta-cypermethrin + Abamectin	FMC	$93.16/1 gal	19 oz	$13.83
5-Dec-13	Danitol†	Fenpropathrin	Valent USA	$160.21/1 gal	19 oz	$23.78

Table 2. Costs of materials and applications associated with horticultural mineral oil (HMO), insecticide treatments and the untreated check.

	Treatment	2011–2012	2012–2013	2013–2014	Sum
Material costs ($/acre)	HMO	218	241	218	678
	Insecticides	255	192	151	597
	Check	20	20	20	60
Application costs ($/acre)	HMO	155	170	155	481
	Insecticides	195	167	112	474
	Check	28	28	28	84
Total costs ($/acre)	HMO	374	412	374	1159
	Insecticides	450	359	262	1072
	Check	48	48	48	144

including the check, received foliar nutrition and a dormant spray of insecticide in winter.

Economic analyses were conducted to see which program was more profitable. The costs of each treatment for economic analysis were based on material prices quoted from retailers (Table 1, page 27) and application costs (Table 2) based on state averages of $7.50 per acre for low-volume HMO applications and $27.89 per acre for 100 gallon per acre air-blast insecticide applications. Calculated delivered-in prices that assumed harvesting and transport costs of $2.82 per 90-pound box of harvested oranges and 6.2 pounds solids were also incorporated into the analyses.

RESEARCH RESULTS

Although both HMO and insecticide treatments significantly reduced ACP populations, insecticides were more effective overall (Table 2).

Table 3. Comparison of treatment effects on ACP nymph densities (nymphs/ft^3 canopy) and adults per stem tap sample on Valencia orange trees over three years treated with: (1) horticultural mineral oil (HMO), (2) insecticides or (3) an untreated check. Like-lettered groups are not significantly different.

Variable	Treatment	Mean	
ACP Nymphs	Check	0.376	a
	HMO	0.268	b
	Insecticides	0.118	b
ACP Adults	Check	0.184	a
	HMO	0.128	b
	Insecticides	0.082	c

HLB titer did not differ significantly among treatments, and HLB incidence increased to 81 percent by 2014. However, yields were greatest for trees treated with HMO in 2012. Yields improved from 2012 to 2013 in all treatments, although no differences were seen among treatments in 2013. Although yields fell in all treatments in 2014, they were greatest again in HMO-treated trees (Figure 1). Fruit drop also differed by treatment and was greater for untreated trees than either HMO or insecticide-treated trees, particularly in 2013 (Figure 2). Juice quality did not differ among treatments.

So what did all of this cost and was it justified? Although individual air-blast sprays are more expensive than low-volume applications, more frequent applications (53 for HMO vs. 14 for insecticides from 2011 to 2014) and sum material costs meant moderately higher costs for HMO. However, when the benefits of greater yields are considered, the returns were slightly better for HMO than insecticides (Table 3).

At the 2014 production differential, delivered-in price of just over $1.13 per pound solids for HMO and nearly $1.36 per pound solids for insecticides were needed to cover input costs. Importantly, it took three years for the economic benefits of either insecticide or HMO applications to materialize. This means that profits took a hit until benefits were realized.

These results are related to a specific site, variety/rootstock combination and time. More trials

Table 4. Horticultural mineral oil (HMO) and insecticide treatment-associated production gains from Valencia orange trees in 2014. At the 2014 production differential, delivered-in price of just over $1.13 per pound solids for HMO and nearly $1.36 per pound solids for insecticides are needed to justify input costs. Calculated delivered-in prices assumed harvesting and transport costs of $2.82 per 90-pound box of harvested oranges and 6.2 pounds solids per box.

With transport/picking costs ($2.82/box)							
$ per lb solids	2.27	2.04	1.81	1.59	1.36	1.13	
Marginal income per acre ($)							
Check	0	0	0	0	0	0	
HMO	1077	926	775	624	473	322	
Insecticides	592	510	429	348	266	185	
Marginal profit per acre ($)							**Marginal control cost per acre ($)**
Check	0	0	0	0	0	0	0
HMO	752	601	450	299	147	-4	326
Insecticides	378	296	215	133	52	-29	214

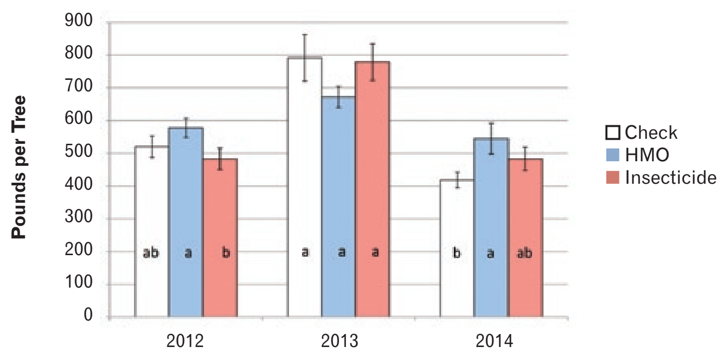

Figure 1. Comparisons of yield per tree (pounds) from Valencia on Swingle orange trees treated with horticultural mineral oil (HMO), insecticide and an untreated check.

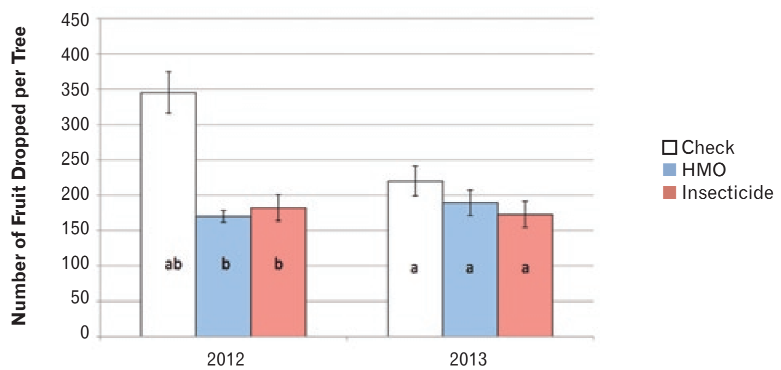

Figure 2. Comparisons of fruit drop per tree from Valencia on Swingle orange trees treated with horticultural mineral oil (HMO), insecticide or an untreated check.

on trees of different ages and in several locations are required to flesh out the general applicability of frequent low-volume HMO sprays for ACP in citrus. Nevertheless, the positive outcome indicates that frequent low-volume applications of horticultural spray oil holds promise for management of ACP and thus warrants further testing.

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