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ORANGE: *Citrus sinensis* (L.) Osbeck, 'Valencia'

FOLIAR APPLICATIONS OF DELEGATE AND SOME COMMONLY USED INSECTICIDES AGAINST ASIAN CITRUS PSYLLID AND CITRUS LEAFMINER IN ORANGES: 2008

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Asian citrus psyllid (ACP): *Diaphorina citri* Kuwayama

Citrus leafminer (CLM), *Phyllocnistis citrella* Stainton

Asian citrus psyllid (ACP) vectors the bacterium *Candidatus* Liberibacter asiaticus causal organism of greening or "Huanglongbing" disease of citrus and feeding damage from citrus leafminer larvae (CLM) facilitates the spread of citrus canker caused by *Xanthomonas* *axonopodis* pv. *citri*. Effective control measures are needed upon which to develop integrated management strategies against this pest and the disease it vectors in Florida citrus. The experimental block at the Southwest Florida Research and Education Center (SWFREC), Immokalee, Florida consisted of 13-yr-old sweet orange *Citrus sinensis* (L) Osbeck 'Valencia' trees planted on double-row raised beds at a density of 132 trees/acre. Trees were irrigated by micro-sprinklers and subjected to conventional cultural practices. Bed sides of the trees were pruned with a hand-held hedger to induce new flush and encourage psyllid infestation. Eight treatments and an untreated check were randomly distributed across 4 replicates in 17 rows that included a buffer row after every treated row. Each replicate contained 9 plots of 5 plants distributed across 9 treated rows. Treatments were applied to both bed and swale sides of the trees on 10 October 2008 using a Durand Wayland 3P-10C-32 air blast speed sprayer with an array of six # 5 T-Jet stainless steel cone nozzles per side operating at a pressure of 200 psi delivering 130 gpa at a tractor speed of 1.5 mph. Three central trees per plot were included in post treatment evaluations made on 13, 20, and 27 October and 3 November. A "tap" sample made by striking with the hand a randomly chosen branch 3 times and counting adult psyllids falling on a clipboard covered with an 8 ½ × 11 inch laminated white sheet was used to assess density of psyllid adults. Two tap samples, one each on the bed and swale sides were conducted on each sampling. Branches with flushes suitable for psyllid oviposition and nymphal development were tagged on each tree prior to treatment application. Three young shoots were examined per tree and presence or absence of eggs and nymphs recorded. One randomly selected shoot from each tree was brought to the lab and examined under the microscope to count psyllid nymphs. The same shoot was examined to count CLM larvae on five fully expanded leaves. Ladybeetles, lacewings, and spiders were recorded if observed in the tap samples or flushes examined for psyllid immatures. Data were subjected to ANOVA to evaluate treatment effects on ACP and CLM and treatment means separated using LSD contingent on a significant treatment effect (P = 0.05). Numbers of ladybeetles, lacewings, and spiders were too low throughout the trial to observe treatment effects (data not shown).

At 3 and 10 days after treatment (DAT) numbers of adults, nymphs and percent infested shoots were all significantly less than the check with no differences between sprayed treatments (Tables 1,2). The situation in regard to adults had changed little at 17 DAT but at 24 DAT numbers observed on trees sprayed with Delegate alone were significantly greater than other treatments and not different from the check. No differences compared to the check in percentage shoots infested at 17 DAT were seen with any treatments of Delegate except the one including oil alone. At 24 days this distinction fell to the Delegate + Induce treatment. The number of nymphs per shoot at 17 DAT was not different from the untreated check with any Delegate treatment. Most nymphs were seen in response to Delegate + Induce + Copper hydroxide although not significantly more than the check. . All treatments but Delegate + Induce reduced CLM numbers significantly at 17 DAT, but at 24 DAT, significant reduction was seen only with Danitol, Mustang and the two treatments of Delegate that included oil (Table 2).

Table 1

Treatment/ Formulation	Rate amt product/ acre or % v/v	Adults per tap (No.)				Shoots infested with eggs and nymphs (%)			
		13-Oct	20-Oct	27-Oct	3-Nov	13-Oct	20-Oct	27-Oct	3-Nov
		3 DAT	10 DAT	17 DAT	24 DAT	3 DAT	10 DAT	17 DAT	24 DAT
Control	--	0.75 a	0.71 a	0.86 a	0.58 a	47.2 a	44.4 a	61.1 a	38.9 ab
Danitol 2.4 EC	16 oz	0.04 b	0.00 b	0.42 b	0.00 d	2.8 b	8.3 b	16.7 bc	16.7 bcd
Chlorpyrifos EW	5 pts	0.00 b	0.00 b	0.04 bc	0.00 d	13.9 b	2.8 b	19.4 bc	27.8 abc
Mustang 1.5 EC	4.3 oz	0.00 b	0.04 b	0.04 bc	0.00 d	16.7 b	0.0 b	0.0 c	0.0 d
Delegate WG	4 oz	0.00 b	0.04 b	0.00 c	0.42 ab	2.8 b	2.8 b	55.6 a	38.9 ab
Delegate WG + 435 Oil	4 oz + 2%	0.00 b	0.00 b	0.08 bc	0.04 dc	8.3 b	2.8 b	27.8 b	44.4 a
Delegate WG + 435 Oil + Copper Hydroxide	4 oz + 2% + 3 lbs	0.00 b	0.04 b	0.13 bc	0.00 d	2.8 b	0.0 b	41.7 ab	22.2 abcd
Delegate WG + Induce	4 oz + 0.2%	0.00 b	0.00 b	0.04 bc	0.17 dc	0.0 b	2.8 b	38.9 ab	11.1 cd
Delegate WG + Induce + Copper Hydroxide	4 oz + 0.2% + 3 lbs	0.25 b	0.13 b	0.08 bc	0.21 bc	8.3 b	5.6 b	58.3 a	44.4 a

Means in a column followed by the same letter are not significantly different ($p < 0.05$, LSD).

Table 2

Treatment/ Formulation	Rate amt product/ acre or % v/v	Nymphs / infested shoot (No.)				CLM larvae / 5 leaves / shoot (No.)		
		13-Oct	20-Oct	27-Oct	3-Nov	20-Oct	27-Oct	3-Nov
		3 DAT	10 DAT	17 DAT	24 Dat	10 DAT	17 DAT	24 DAT
Control	--	12.5 a	4.8 a	8.1 ab	5.7 a	0.00 a	2.00 a	0.92 a
Danitol 2.4 EC	16 oz	0.0 b	0.2 b	1.8 c	0.9 a	0.08 a	0.33 c	0.17 b
Chlorpyrifos EW	5 pts	0.0 b	0.1 b	0.4 c	1.3 a	0.08 a	0.25 c	0.33 ab
Mustang 1.5 EC	4.3 oz	0.1 b	0.0 b	0.2 c	0.3 a	0.00 a	0.58 bc	0.00 b
Delegate WG	4 oz	0.4 b	0.3 b	4.2 bc	9.8 a	0.00 a	0.33 c	0.50 ab
Delegate WG + 435 Oil	4 oz + 2%	0.0 b	0.0 b	5.3 bc	4.3 a	0.00 a	0.42 c	0.00 b
Delegate WG + 435 Oil + Copper Hydroxide	4 oz + 2% + 3 lbs	0.0 b	0.0 b	3.4 bc	6.4 a	0.00 a	0.17 c	0.25 b
Delegate WG + Induce	4 oz + 0.2%	0.0 b	0.1 b	1.4 c	0.1 a	0.83 a	1.58 ab	0.83 ab
Delegate WG + Induce + Copper Hydroxide	4 oz + 0.2% + 3 lbs	0.1 b	0.9 b	12.5 a	4.4 a	0.00 a	0.67 bc	0.83 a

Means in a column followed by the same letter are not significantly different ($p < 0.05$, LSD).

Part II: Materials Tested for Arthropod Management

ORANGE: *Citrus sinensis* (L.) Osbeck, 'Valencia'

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Common name	Trade name/ Cultivar	Concentration/ Formulation	Chemical name/resistance	Manufacture/source
horticultural spray oil	435 oil	98.8%L	Refined petroleum distillate	Drexel Chemical Company P.O. Box 13327 Memphis, TN 38113-0327
Spinetoram	Delegate	1 WG	1-H-as-Indaceno[3,2-d]o oxacyclododecin-7,15-dione, 2-[(6-deoxy-3-O-ethyl-2,4-di-O-methyl-a-Lmannopyranosyl)oxy]-13-[[(2R,5S,6R)-5-(dimethylamino) tetrahydro-6-methyl-2H-pyran-2-yl]oxy]-9-ethyl-2,3,3a,4,5,5a,5b,6,9,	Dow Agrosciences LLC

			10,11,12,13,14,16a,16b-hexadecahydro1 14-methyl-, (2R,3aR,5aR,5bS,9S,13S,14R,16aS,16bR) and 1H-as-Indaceno[3,2-d]oxacyclododecin-7,15-dione, 2-[(6-deoxy-3-O-ethyl-2,4-di-O-methyl-a-Lmannopyranosyl)oxy]-13-[[(2R,5S,6R)-5-(dimethylamino)tetrahydro-6-methyl-2H-pyran-2-yl]oxy]-9-ethyl-2,3,3a,5a,5b,6,9,10,11,12,13,14,16a,16btetradecahydro-4,14-dimethyl-, (2S,3aR,5aS,5bS,9S,13S,14R,16aS,16b	Indianapolis IN 46288
Chlopyrifos	Experimental formulation Chlorpyifos	EW	*O*,*O*-diethyl *O*-(3,5,6-trichloro-2-pyridinyl) phosphorothioate	Dow Agrosciences LLC Indianapolis IN 46288
Zeta-cypermethrin	Mustang	1.5 EC	S-Cyano (3-phenoxyphenyl)methyl (+) cis/trans 3-(2,2-dichloroethenyl)- 2,2 dimethylcyclopropane carboxylate	FMC Corporation Agriculture Products Group 1735 Market Street Philadelphia, PA 19103
fenpropathrin	Danitol	2.4 EC	(alpha-Cyano-3-phenoxybenzyl-2,2,3,3-tetramethyl cyclopropanecarboxylate)	Valent USA Corporation P.O. Box 8025 Walnut Creek, CA 94596-8025