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

CONTROL OF ASIAN CITRUS PSYLLID AND CITRUS LEAFMINER WITH FOLIAR APPLICATIONS OF INSECTICIDE IN ORANGES DURING SUMMER, 2008

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

Citrus leafminer (CLM), *Phyllocnistis citrella* Stainton

Asian citrus psyllid (ACP) vector's the bacterium *Candidatus* Liberibacter asiaticus causal organism of greening or "Huanglongbing" disease of citrus. Feeding damage from citrus leafminer larvae (CLM) facilitate the spread of citrus canker caused by *Xanthomonas axonopodis* pv. *citri*. Biological and chemical means of control and their compatibility is important in reducing the populations of both pests and for integrated pest management 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. Swale sides of the trees were pruned manually to induce new flush and encourage psyllid infestation. Seven 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 8 plots of 5 plants each distributed across 8 treated rows. Treatments were applied on 22 May 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 150 gpa at a tractor speed of 1.5 mph. However, treatments were washed out due to a sever thunderstorm immediately after applications and were applied again on 23 May. The low rate treatment of Micromite was planned for two applications and the second application was made on 12 June 2008. After second application only Micromite and Danitol treatments were evaluated. Post treatment evaluations were made on 28 May, 4, 11, 18, and 26 June, and 3 July. Three central trees in each plot were sampled. 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 white paper was used to estimate psyllid adults. One tap sample on the first sampling, two on the second and third, and four on the fourth, fifth and sixth sampling dates were conducted per tree adjusted due to the low numbers of adults observed particularly on the treated trees. Three flushes suitable for psyllid oviposition and nymphal development were tagged on each tree on 20 May. Eight of the nine tagged flushes were examined post treatment for presence or absence of psyllid eggs and to record the oldest nymphal instar on each flush. These flushes were also examined to count citrus leafminer larvae on five leaves per flush. Numbers of spiders, lacewings, and ladybeetles were also noted in tap samples.

All treated trees had significantly less adults compared to untreated trees on all observation dates except on 26 Jun when the high rate of Micromite 80 WGS + 435 Oil was not different from control (Table 1). The percentage of flush infested with psyllid eggs was significantly reduced by all treatments only on 28 May. However, the percentage of flush infested with psyllid nymphs was significantly reduced by all treatments on 28 May, 4 and 11 Jun (Table 2). The high rate of Micromite 80 WGS + 435 Oil was better than the low rate + 435 Oil on 28 May and was not effective after 18 Jun. The low rate of Micromite 80 WGS + 435 Oil applied again on 12 Jun was no better than the high rate applied once when evaluated on 18 Jun. At that time both rates resulted in significantly less infested flush compared to untreated control but were less effective compared to Danitol 2.4 EC which lasted through 3 Jul. The application of low rate of Micromite on 12 Jun was not as effective as application on 23 May. All treatments caused significant mortality of young nymphs; therefore significantly less mature nymphs were seen on the treated trees compared to untreated tress on 28 May, 4 and 11 Jun (Table 3). The Micromite treatments were less effective compared to all the other treatments on 11 Jun. Effects from both rates of Micomite were same on 18 Jun and the high rate was better than the low rate on later two dates. All treatments reduced adults for six weeks and flush infestation with their progeny for two weeks. It appears that the one time application of the high rate of Micomite 80 WGS with 435 Oil was better than the low rate with 435 Oil applied twice during the same period. No significant improvement in performance of Actara 25 WG was observed in combination with Induce.

Significant effects of all treatments except Actara 25 WG alone were observed on leafminer populations on 28 May and 4 Jun (Table 4). Agri-Mek 0.15 EC + 435 Oil and Danitol 2.4 EC were the most effective treatments on 4 and 11 Jun. Actara 25 WG applied alone was not effective after 28 May, however, Actara 25 WG + Induce resulted in less number of leafminer larvae compared to untreated control on 4 and 11 Jun.

Olla v-nigrum (Mulsant) was the only ladybeetle species seen with spiders and lacewings also appearing in low number.

Table 1.

Treatment/ formulation	Rate amt product/ acre or % v/v	Adults per tap sample					
		28-May	4-Jun	11-Jun	18-Jun	26-Jun	3-Jul
Untreated check	--	1.0 a	0.29 a	2.04 a	0.85 a	0.56 a	1.23 a
Danitol 2.4 EC	21.3 oz	0.00 b	0.00 b	0.04 c	0.25 bcd	0.10 c	0.10 b
Agri-Mek 0.15 EC + 435 Oil	20 oz + 2%	0.00 b	0.00 b	0.08 c	0.29 bcd	0.15 c	0.17 b
Warrior 1 SC	5.75 oz	0.00 b	0.00 b	0.04 c	0.27 bcd	0.08 c	0.17 b
Actara 25 WG	5.5 oz	0.17 b	0.00 b	0.04 c	0.13 cd	0.06 c	0.08 b
Actara 25 WG + Induce	5.5 oz + 0.1%	0.00 b	0.04 b	0.04 c	0.04 d	0.02 c	0.19 b
Micromite 80 WGS + 435 Oil	6.25 oz + 2%	0.00 b	0.08 b	0.54 bc	0.50 b	0.44 ab	0.31 b
Micromite 80 WGS + 435 Oil	3.125 oz + 2%	0.08 b	0.04 b	0.79 b	0.40 bc	0.21 bc	0.33 b

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	Infested flush (%)					
		28-May	4-Jun	11-Jun	18-Jun	26-Jun	3-Jul
Untreated check	--	91.67 a	82.29 a	64.59 a	55.20 a	71.88 a	72.92 a
Danitol 2.4 EC	21.3 oz	0.00 c	5.21 cd	0.00 c	7.29 c	40.63 b	46.88 b
Agri-Mek 0.15 EC + 435 Oil	20 oz + 2%	8.33 c	16.67 bc	11.46 c	--	--	--
Warrior 1 SC	5.75 oz	2.08 c	0.00 d	1.04 c	--	--	--
Actara 25 WG	5.5 oz	5.21 c	5.21 cd	4.17 c	--	--	--
Actara 25 WG + Induce	5.5 oz + 0.1%	1.04 c	9.38 cd	0.00 c	--	--	--
Micromite 80 WGS + 435 Oil	6.25 oz + 2%	8.33 c	12.5 bc	44.79 b	28.13 b	52.08 ab	54.17 ab
Micromite 80 WGS + 435 Oil	3.125 oz + 2%	29.17 b	22.92 b	48.96 b	23.96 b	68.75 a	68.75 a

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

Table 3.

Treatment/ formulation	Rate amt product/ acre or % v/v	Mean of oldest nymphal instars observed					
		28-May	4-Jun	11-Jun	18-Jun	26-Jun	3-Jul
Untreated check	--	2.86 a	3.90 a	3.17 a	1.80 a	2.26 ab	2.59 a
Danitol 2.4 EC	21.3 oz	0.00 c	0.10 d	0.00 d	0.11 c	1.25 c	1.34 b
Agri-Mek 0.15 EC + 435 Oil	20 oz + 2%	0.08 c	0.43 bc	0.46 c	--	--	--
Warrior 1 SC	5.75 oz	0.02 c	0.00 d	0.05 cd	--	--	--
Actara 25 WG	5.5 oz	0.05 c	0.18 cd	0.09 cd	--	--	--
Actara 25 WG + Induce	5.5 oz + 0.1%	0.01 c	0.24 cd	0.00 d	--	--	--
Micromite 80 WGS + 435 Oil	6.25 oz + 2%	0.14 c	0.48 bc	2.30 b	0.77 b	1.85 b	1.83 b
Micromite 80 WGS + 435 Oil	3.125 oz + 2%	0.38 b	0.74 b	2.24 b	0.59 b	2.38 a	2.61 a

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

Table 4

Treatment/ formulation	Rate amt product/ acre or % v/v	Leafminer larvae per 5 leaves per flush		
		28-May	4-Jun	11-Jun
Untreated check	--	6.23 a	3.35 a	1.26 a
Danitol 2.4 EC	21.3 oz	0.00 c	1.94 e	0.60 b
Agri-Mek 0.15 EC + 435 Oil	20 oz + 2%	0.00 c	0.96 f	0.14 c
Warrior 1 SC	5.75 oz	0.88 b	3.47 a	1.51 a
Actara 25 WG	5.5 oz	0.07 c	3.13 ab	1.53 a
Actara 25 WG + Induce	5.5 oz + 0.1%	0.00 c	2.73 bc	0.69 b
Micromite 80 WGS + 435 Oil	6.25 oz + 2%	0.03 c	2.24 de	1.39 a
Micromite 80 WGS + 435 Oil	3.125 oz + 2%	0.00 c	2.59 cd	1.39 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*

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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
thiamethoxam	Actara	WG	4H-1,3,5-Oxadiazin-4-imine,3-((2-	Syngenta Crop

			chloro-5-thiazolyl)methyl)tetrahydro- 5-methyl-N-nitro-	Protection P.O. Box 18300 Greensboro, NC 27419
diflubenzuron	Micromite	80WGS	N-[[(4-Chlorophenyl)amino]carbonyl]-2,6-difluorobenzamide	Uniroyal Chemical Company, Inc. A subsidiary of Crompton Corp. Middlebury, CT 06749
abamectin	Agri-Mek	0.15 EC	(Butyl)-7-((2,6-dideoxy-40-2,6-dideoxy3-0-methyl-x-L-arabinohexopyran osyl)-3-0-methyl-x-L-arabino-hexopyranosyl)oxy)-5’c6,6”,7,10,11,14,15,17a,20,20a,20b-dodecanydro-20b-dihydroxy-5’6,8,19-tetramethylsprio (11,16-methano-2H,13H,17H-furo (4,3,2-pg)(2,6) benzodioxacyclootadecin	Syngenta Crop Protection P.O. Box 18300 Greensboro, NC 27419
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
Lamda-	Warrior	1 SC	(*R*)-cyano(3-phenoxyphenyl)methyl	Syngenta Crop

cyhalothrin			(1*S*,3*S*)-*rel*-3-[(1*Z*)-2-chloro-3,3,3-trifluoro-1-propenyl]-2,2-dimethylcyclopropanecarboxylate	Protection P.O. Box 18300 Greensboro, NC 27419