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

FOLIAR APPLICATIONS OF IMIDAN, AZA-DIRECT AND SOME EXPERIMENTAL INSECTICIDES AGAINST ASIAN CITRUS PSYLLID IN ORANGES: SUMMER, 2008

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

Asian citrus psyllid (ACP) vector's the bacterium *Candidatus* Liberibacter asiaticus causal organism of greening or "Huanglongbing" disease of citrus. 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. Swale sides of the trees were pruned with hand held hedger to induce new flush and encourage psyllid infestation. Ten treatments and an untreated check were randomly distributed across 4 replicates in 21 rows that included a buffer row after every treated row. Each replicate contained 11 plots of 5 plants distributed across 11 treated rows. Treatments were applied to both bed and swale sides of the trees on 9 July 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. Three central trees per plot were included in post treatment evaluations made on 14, 21, and 28 July and 4 and 11 August. Evaluations against immatures and adults were made through 28 July and 11 August, respectively. 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 assess density of psyllid adults. Two tap samples, one each on the bed and swale sides were conducted on 14, 21, and 28 July and increased to four tap samples per tree including the other two sides within rows on 4 and 11 August due to low populations of psyllids. Branches with flushes suitable for psyllid oviposition and nymphal development were tagged on each tree prior to treatment application. Eight flushes were examined per tree and presence or absence of eggs and nymphs recorded. Nymphal density on each flush was rated on scale of 0 to 4: 0 = none, 1 = less than 5, 2 = 6-15, 3 = 16-25, and 4 = more than 25. The oldest nymphal instar observed on each flush was rated on a scale of 1 to 3: 1 = eggs and first instars, 2 = second and third instars, and 3 = fourth and fifth instars. 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 treatment means separated using LSD contingent on a significant treatment effect (P = 0.05).

Significantly fewer adults compared to untreated trees were observed on all dates except for AZA-Direct alone on the first four dates, the low rate of Imidan 70 W + AZA-Direct on 28-Jul and the low rate of GWN 1708 + 435 Oil on 11-Aug (Table 1). On the last observation date more than a month after application, no adults were sampled from trees treated with 16 oz/ac Danitol, although this was not significantly less than seen with the high rate of Imidan 70W alone, either rate with Aza-Direct, the two highest rates of GWN 1708 + 435 Oil or Supracide 2E. The percentage of flush infested with psyllid eggs on 14-Jul was significantly lower than the untreated check in all treatments except Imidan 70 W alone at either rate, and on 21-Jul with the low rate of Imidan 70 W alone, the high rate of Imidan 70 W + AZA-Direct, and the low and medium rates of GWN 1708 + 435 Oil (Table 2). In contrast, all treatments were effective in reducing flush infestation with nymphs on both dates except AZA-Direct alone on 14-Jul (Table 2). Similar results were observed on nymphal density rating but no differences with the untreated check were seen on 21-Jul in mature instar presence with the high rate of Imidan 70 W alone or in combination with AZA-Direct and with Supracide 2 E (Table 3). Treatment effects on immatures were short-lived and none were observed on 28-Jul. Numbers of ladybeetles, lacewings, and spiders were too low throughout the trial to observe treatment effects (data not shown). However effects on adult psyllids were more long lasting than those seen on immature stages and showed significant rate responses.

Table 1

Treatment/ Formulation	Rate amt product/ acre or % v/v	Adults per tap sample *				
		14-Jul	21-Jul	28-Jul	4-Aug	11-Aug
Control	--	0.96 a	1.50 a	0.50 a	0.63 a	0.58 a
Danitol 2.4 EC	16 oz	0.00 e	0.04 b	0.00 d	0.08 b	0.00 e
Imidan 70 W	1.0 lbs	0.13 de	0.21 b	0.08 bcd	0.15 b	0.21 cd
Imidan 70 W	1.5 lbs	0.13 de	0.08 b	0.04 cd	0.00 b	0.04 de
Imidan 70 W + AZA-Direct 1.2%	1.0 lbs + 8 oz	0.00 e	0.42 b	0.29 abc	0.15 b	0.17 de
Imidan 70 W + AZA-Direct 1.2%	1.5 lbs + 8 oz	0.00 e	0.21 b	0.00 d	0.06 b	0.06 de
AZA-direct 1.2%	8oz	0.79 ab	1.25 a	0.33 ab	0.65 a	0.38 bc
GWN 1708 + 435 Oil	16 oz + 2%	0.42 cd	0.38 b	0.17 bcd	0.10 b	0.46 ab
GWN 1708 + 435 Oil	24 oz + 2%	0.08 de	0.17 b	0.00 d	0.17 b	0.19 cde
GWN 1708 + 435 Oil	30 oz + 2%	0.50 bc	0.25 b	0.13 bcd	0.15 b	0.17 de
Supracide 2 E	1 qt	0.13 de	0.00 b	0.04 cd	0.08 b	0.06 de

* 2 tap samples per tree July 14 -21-28; 4 tap samples Aug 4 and 11

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	Percent of flushes with eggs			Percent of flushes with nymphs		
		14-Jul	21-Jul	28-Jul	14-Jul	21-Jul	28-Jul
Control	--	50.0 a	26.0 a	16.7 a	65.6 a	82.3 a	5.2 a
Danitol 2.4 EC	16 oz	12.5 d	5.2 c	7.3 a	8.3 d	9.4 e	1.0 a
Imidan 70 W	1.0 lbs	43.8 ab	13.5 abc	32.3 a	36.5 b	16.7 cde	11.5 a
Imidan 70 W	1.5 lbs	34.4 abc	5.2 c	15.6 a	18.6 bcd	7.3 e	0.0 a
Imidan 70 W + AZA-Direct 1.2%	1.0 lbs + 8 oz	28.1 bcd	7.3 c	10.4 a	18.6 bcd	9.4 e	1.0 a
Imidan 70 W + AZA-Direct 1.2%	1.5 lbs + 8 oz	16.7 cd	14.6 abc	20.8 a	12.5 cd	12.5 de	2.1 a
AZA-direct 1.2%	8oz	19.8 cd	6.3 c	25.0 a	60.4 a	46.9 b	5.2 a
GWN 1708 + 435 Oil	16 oz + 2%	28.1 bcd	22.9 ab	10.4 a	29.1 bc	30.2 c	1.0 a
GWN 1708 + 435 Oil	24 oz + 2%	14.6 d	21.9 ab	26.0 a	17.7 bcd	20.8 cde	9.4 a
GWN 1708 + 435 Oil	30 oz + 2%	17.7 cd	9.4 bc	20.8 a	19.8 bcd	16.7 cde	1.0 a
Supracide 2 E	1 qt	24.0 cd	7.3 c	17.7 a	19.8 bcd	25.0 cd	2.1 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 nymphal density rating per flush		Mean oldest nymphal instar rating per flush	
		14-Jul	21-Jul	14-Jul	21-Jul
Control	--	1.35 a	1.57 a	2.03 ab	2.71 ab
Danitol 2.4 EC	16 oz	0.06 d	0.14 ef	1.0 e	2.11 bcd
Imidan 70 W	1.0 lbs	0.30 bc	0.21 def	1.31 cde	1.88 cd
Imidan 70 W	1.5 lbs	0.18 bcd	0.08 f	1.0 e	2.71 ab
Imidan 70 W + AZA-Direct 1.2%	1.0 lbs + 8 oz	0.20 bcd	0.17 def	1.06 de	1.89 cd
Imidan 70 W + AZA-Direct 1.2%	1.5 lbs + 8 oz	0.13 cd	0.13 ef	1.33 cde	2.33 abcd
AZA-direct 1.2%	8oz	1.44 a	0.75 b	2.34 a	2.78 a
GWN 1708 + 435 Oil	16 oz + 2%	0.33 bc	0.53 c	1.46 cd	1.93 cd
GWN 1708 + 435 Oil	24 oz + 2%	0.19 bcd	0.33 de	1.71 bc	1.75 d
GWN 1708 + 435 Oil	30 oz + 2%	0.40 b	0.34 cd	1.37 cde	2.00 cd
Supracide 2 E	1 qt	0.29 bc	0.37 cd	1.52 de	2.42 abc

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
Phosmet	Imidan	70 W	*S*-[(1,3-dihydro-1,3-dioxo-2*H*-isoindol-2-yl)methyl] *O,O*-dimethyl phosphorodithioate	Gowan Company P.O.Box: 5569 Yuma, AZ 85366-5569
azadirachtin	Aza-Direct	1.2	dimethyl (2a*R*,3*S*,4*S*,4a*R*,5*S*,7a*S*,8*S*,10*R*,10a*S*,10b*R*)-10-(acetyloxy)octahydro-3,5-dihydroxy-4-methyl-8-[[(2*E*)-2-methyl-1-oxo-2-butenyl]oxy]-4-[(1a*R*,2*S*,3a*S*,6a*S*,7*S*,7a*S*)-3a,6a,7,7a-tetrahydro-6a-hydroxy-7a-methyl-2,7-methanofuro[2,3-*b*]oxireno[*e*]oxepin-1a(2*H*)-yl]-1*H*,7*H*-naphtho[1,8-*bc*:4,4a-*c′*]difuran-5,10a(8*H*)-dicarboxylate	Gowan Company P.O.Box: 5569 Yuma, AZ 85366-5569
methidathion	Supracide	2E	*S*-[(5-methoxy-2-oxo-1,3,4-thiadiazol-3(2*H*)-yl)methyl] *O,O*-dimethyl	Gowan Company P.O.Box: 5569

			phosphorodithioate	Yuma, AZ 85366-5569
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
Experimental	GWN-1708		Experimental	Gowan Company P.O.Box: 5569 Yuma, AZ 85366-5569