

(D11)

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

CONTROL OF ASIAN CITRUS PSYLLID AND CITRUS LEAFMINER ON ORANGE WITH SPRAY APPLICATIONS OF INSECTICIDE, 2007

Philip A. Stansly

University of Florida/ IFAS
Southwest Florida Res. and Ed. Center
2686 State Road 29 North
Immokalee, FL 34142-9515
Phone: (239) 658-3427
Fax: (239) 658-3469
E-mail: pstansly@ufl.edu

Jawwad A. Qureshi and Barry C. Kostyk

Asian citrus psyllid (ACP): *Diaphorina citri* Kuwayama
Citrus leafminer (CLM), *Phyllocnistis citrella* Stainton
Lady beetles: *Curinus coeruleus* (Mulsant), *Olla v-nigrum* (Mulsant), *Harmonia axyridis* (Pallas) and *Cycloneda sanguinea* (L.)

ACP and CLM have recently become two key pests of citrus in Florida, due primarily to their interactions with plant disease. ACP is an efficient vector of the bacterium, *Candidatus Liberibacter asiaticus* responsible for greening or "Huanglongbing" disease of citrus while feeding by CLM larvae exposes tender leaf tissue to infection by the bacterium *Xanthomonas citri* responsible for the citrus canker disease. The experimental block at the Southwest Florida Research and Education Center (SWFREC), Immokalee, Florida consisted of 12-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 tractor-mounted box blade mower to induce new flush and encourage psyllid infestation. Eleven treatments and an untreated check were randomly distributed across 4 replicates in 23 rows that included a buffer row after every treated row. Each replicate contained 3 treated rows of 20 trees divided into four 5-tree plots. Treatments were applied on 4 Jun 2007 to the bed side of the trees using a tractor mounted hydraulic sprayer operating at a pressure of 150 psi with an array of twelve ATR-80 ceramic hollow cone nozzles directed at the tree on 3, 5 foot booms to deliver 54 gpa at a tractor speed of 1.5 mph. A pre-treatment sampling was conducted on 31 May and post-treatment evaluations were made 3, 7, 14, 24, and 49 DAT. One and three trees were observed per plot for pre and post-treatment samplings, respectively. Adult psyllid density was estimated on each of 3 trees per treatment by counting the insects falling on a clipboard covered with an 8 ½ × 11 inch white paper sheet placed under randomly chosen branches which were then tapped 3 times with the hand. Ten randomly selected shoots were observed and the number infested with psyllid eggs or nymphs recorded. Infestation on each shoot was rated for psyllid stages on a 0 to 3 scale: 0 = none, 1 = eggs and first instars, 2 = second and third instars, 3 = fourth and fifth instars. One infested flush of these ten was examined in the laboratory under a microscope to count eggs and different instars of ACP. A well developed shoot with tender leaves was randomly selected and all live CLM larvae were counted on five expanded leaves. Additionally, leaves with and without fresh CLM mines were counted per shoot to assess the level of protection afforded by the treatments. The number of larvae and adults of four predatory lady beetles were recorded during one min observations of each tree. All data were subjected to ANOVA to evaluate treatment effects on ACP, CLM, and lady beetle abundance and means were separated using LSD contingent on a significant treatment effect ($P = 0.05$). Numbers of lady beetle species were combined and means were transformed by $\log(x + 1)$ prior to analysis.

For CLM, significantly more % undamaged leaves per shoot compared to the untreated check were seen at 24 DAT for all treatments except Sevin (Table 1). The highest % undamaged leaves were seen with Provado alone at 10 oz or at 5 oz + Induce. Significantly fewer CLM larvae/5 leaf flush compared to the untreated check were seen at 24 DAT for the high rate of Movento + MSO oil, the low rate Movento + Induce, and the low rate of Movento + Provado + and Induce. No significant effects on CLM were seen at 49 DAT.

A mean of 17% psyllid-infested shoots and 0.65 adult ACP per tap were seen at 3 DAT with no significant treatment effects (Table 2). At 7 DAT, lowest % shoot infestation was seen with Provado alone or in combination with Induce, followed by Movento in combination with Provado and Induce or in combination with oil. No treatment effect on % ACP shoot

infestation was seen at 14, 24 and 49 DAT. Fewer ACP nymphs were seen on infested flush from treated trees at 3 DAT compared to the untreated check except for the high rate of Provado alone. Provado alone or in combination with Induce and the high rate of Movento with 435 oil or Induce reduced most nymphs compared to the untreated check at 14 DAT. There was no treatment effect on nymphal density at 7, 24, and 49 DAT. Infestation rating was significantly reduced only in the Movento with 435 Oil treatment compared to the untreated check at 24 DAT. At 7 DAT, adult numbers were significantly reduced compared to the untreated check by all treatments except Movento with Kinetic. The high rate of Provado alone or with Induce, Movento with Provado and Induce, and Sevin were also effective in reducing adults at 14 DAT. Induce and 435 Oil were more effective adjuvants for Movento than MSO or Kinetic.

It is unlikely that predation from lady beetles affected any of the ACP or CLM results as no treatment effects on these predators were noted before 49 DAT when significantly more ladybeetles were seen on untreated trees than all other treatments except Movento + MSO oil (Table 1). No lady beetles were seen in treatments with the high rate of Provado + Induce and the high rate of Movento + Kinetic.

Table 1.

Treatment/formulation	Rate amt product/acre or % v/v	% undamaged leaves 24 DAT	CLM larvae/5 leaves/flush		Lady beetles/ 1 min observation/tree 49 DAT
			24 DAT	49 DAT	
Untreated check	---	3.0e	1.8ab	3.0a	0.6a
Provado 1.6 F	10 fl oz	61.1a	0.9bc	2.2a	0.1bc
Provado 1.6 F + Induce	5 fl oz + 0.25%	61.5a	1.0bc	2.7a	0.1bc
Provado 1.6 F + Induce	10 fl oz + 0.25%	54.6ab	1.2abc	2.1a	0.0c
Movento 240SC + 435 Oil	10 fl oz + 2.5%	47.1abc	1.0bc	2.7a	0.2bc
Movento 240SC + MSO Seed Oil	10 fl oz + 0.25%	39.6bcd	0.3c	2.7a	0.3ab
Movento 240SC + Induce	5 fl oz + 0.25%	37.5bcd	0.3c	2.4a	0.1bc
Movento 240SC + Induce	10 fl oz + 0.25%	35.5cd	0.8bc	2.8a	0.1bc
Movento 240SC + Kinetic	10 fl oz + 0.10%	21.8d	1.1abc	2.7a	0.0c
Movento 240SC + Provado 1.6 F + Induce	5 fl oz + 5 fl oz + 0.25%	54.1abc	0.3c	2.8a	0.2bc
Movento 240SC + Provado 1.6 F + Induce	10 fl oz + 5 fl oz + 0.25%	55.3ab	2.1a	3.5a	0.1bc
Sevin XLR	48 fl oz	21.6de	1.2abc	3.6a	0.2bc

Means within columns followed by the same letter are not significantly different (LSD, $P = 0.05$). For ladybeetles, untransformed means are listed.

Table 2.

Treatment/formulation	Rate-amt product/ acre or % v/v	% Shoots infested with ACP eggs and nymphs					ACP nymphs/infested shoot					Infestation rating*/shoot		ACP Adults/tap sample				
		3 DAT	7 DAT	14 DAT	24 DAT	49 DAT	3 DAT	7 DAT	14 DAT	24 DAT	49 DAT	24 DAT	49 DAT	3 DAT	7 DAT	14 DAT	24 DAT	49 DAT
Untreated check	---	23.2a	92.5a	99.2a	95.5a	81.7bc	16.9a	12.5a	28.5a	31.3a	16.3a	2.3bcd	1.4a	0.8a	3.9a	1.4a	4.8a	1.8a
Provado 1.6 F	10 fl oz	28.9a	33.3de	87.5a	92.5a	80.8c	8.0a	1.9a	7.6d	48.6a	11.5a	2.4abcd	1.7a	0.7a	0.9cd	0.5bc	3.5a	2.2a
Provado 1.6 F + Induce	5 fl oz + 0.25%	17.8a	29.2de	95.0a	90.0a	97.3a	6.6b	3.3a	11.9cd	51.5a	13.8a	2.6abc	2.0a	0.5a	0.5d	0.9abc	2.6a	2.4abc
Provado 1.6 F + Induce	10 fl oz + 0.25%	11.2a	21.7e	83.3a	100.0a	91.7abc	2.9b	2.3a	12.1cd	42.7a	11.1a	2.7ab	1.9a	1.0a	0.3d	0.2c	2.2a	0.8a
Movento + 435 Oil	10 fl oz + 2.5%	6.7a	44.2cd	96.7a	82.7a	79.8c	2.5b	1.2a	10.2cd	31.0a	17.5a	1.8e	1.6a	0.5a	0.9cd	0.9abc	2.1a	0.8a
Movento + MSO Seed Oil	10 fl oz + 0.25%	25.8a	95.8a	99.2a	94.2a	87.8abc	5.3b	5.9a	25.9ab	43.3a	13.8a	2.2cd	1.6a	0.7a	1.9bc	0.8abc	2.2a	2.0a
Movento + Induce	5 fl oz + 0.25%	20.0a	87.0a	94.2a	94.2a	89.8abc	1.6b	8.5a	22.8abc	39.8a	16.3a	2.1de	1.8a	0.7a	1.4cd	0.9abc	3.5ab	2.1a
Movento + Induce	10 fl oz + 0.25%	9.5a	76.2ab	91.7a	89.3a	82.9bc	6.8b	4.1a	12.5cd	28.0a	9.4a	2.1de	1.6a	0.7a	1.3cd	1.1ab	2.7a	2.1a
Movento + Kinetic	10 fl oz + 0.10%	17.8a	87.5a	98.3a	92.8a	99.2a	1.6b	13.3a	19.0abcd	32.6a	13.0a	2.3cd	1.9a	0.7a	2.8ab	0.8abc	4.3a	2.1abc
Movento + Provado 1.6 F + Induce	5 fl oz + 5 fl oz + 0.25%	19.3a	44.3cd	96.7a	99.2a	90.8abc	7.9b	2.7a	14.5bcd	61.4a	6.9a	2.8a	1.8a	0.4a	1.5bcd	0.4bc	3.0a	1.1a
Movento + Provado 1.6 F + Induce	10 fl oz + 5 fl oz + 0.25%	11.4a	47.3cd	88.0a	99.1a	82.8bc	5.8b	5.5a	14.3bcd	42.9a	14.6a	2.7ab	1.6a	0.8a	0.8cd	0.2c	4.8a	2.8a
Sevin XLR	48 fl oz	12.8a	64.6bc	83.3a	91.9a	94.8ab	1.3b	3.1a	29.1a	39.8a	28.0a	2.4abcd	1.7a	0.3a	0.8cd	0.3c	4.3a	2.9a

*ACP per shoot: 0 = none, 1 = eggs and first instars, 2 = second and third instars, 3 = fourth and fifth instars
Means within columns followed by the same letter are not significantly different (LSD, $P = 0.05$).