D9

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

**FOLIAR APPLICATIONS OF INSECTICIDES AGAINST ASIAN CITRUS PSYLLID IN ORANGES: SUMMER, 2008**

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

ACP vectors the bacterium *Candidatus Liberibacter asiaticus*, the causal organism of greening or “Huanglongbing” disease of citrus. Effective control measures are needed to develop integrated management strategies against this pest in Florida citrus. The experimental block at the Southwest Florida Research and Education Center, Immokalee, Florida consisted of 13-yr-old sweet orange ‘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 ACP 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 trees distributed across 11 treated rows. Treatments were applied to both bed and swale sides of the trees on 9 Jul 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, 28 Jul and 4, 11 Aug. The density of adult ACP was evaluated using a “tap” sample made by striking with the hand a randomly chosen branch 3 times and counting adult ACP falling on a clipboard covered with an 8 ½ x 11 inch white paper. Two tap samples, one each on the bed and swale sides were conducted on 14, 21, and 28 Jul and increased to four tap samples per tree including the other two sides within rows on 4 and 11 Aug due to low populations of ACP. Branches with flushes suitable for ACP oviposition and nymphal development were tagged on each tree prior to treatment application. Eight of these flushes were examined per tree and presence or absence of eggs and nymphs recorded. Additionally, 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. 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 in all treatments 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 detected in trees treated with 16 oz/acre Danitol. The percentage of flush infested with ACP 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 percentage of flush infested with nymphs on both dates except AZA-Direct alone on 14 Jul (Table 2). Similar results were observed for the nymphal density rating and the mean oldest nymphal instar rating per flush on 14 Jul (Table 3). On 21 Jul, no differences in mature instar presence with the high rate of Imidan 70 W alone or in combination with AZA-Direct and with Supracide 2 E compared to the untreated check were seen (Table 3). Treatment effects on immatures were short-lived and none were observed on 28 Jul. Effects on adult ACP were more long lasting than those seen on immature stages and showed significant rate responses.
Table 1  
Adult ACP per tap sample *

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

*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 (\(P = 0.05, \text{LSD}\)).

Table 2  
Percentage of flushes with eggs  
Percentage of flushes with nymphs

<table>
<thead>
<tr>
<th>Treatment/ Formulation</th>
<th>Rate amt product/ acre or % v/v</th>
<th>14-Jul</th>
<th>21-Jul</th>
<th>28-Jul</th>
<th>14-Jul</th>
<th>21-Jul</th>
<th>28-Jul</th>
</tr>
</thead>
<tbody>
<tr>
<td>Untreated check</td>
<td>---</td>
<td>50.0a</td>
<td>26.0a</td>
<td>16.7a</td>
<td>65.6a</td>
<td>82.3a</td>
<td>5.2a</td>
</tr>
<tr>
<td>Danitol 2.4 EC</td>
<td>16 oz</td>
<td>12.5d</td>
<td>5.2c</td>
<td>7.3a</td>
<td>8.3d</td>
<td>9.4e</td>
<td>1.0a</td>
</tr>
<tr>
<td>Imidan 70 W</td>
<td>1.0 lbs</td>
<td>43.8ab</td>
<td>13.5abc</td>
<td>32.3a</td>
<td>36.5b</td>
<td>16.7cd</td>
<td>11.5a</td>
</tr>
<tr>
<td>Imidan 70 W + AZA-Direct 1.2%</td>
<td>8 oz</td>
<td>28.1bcd</td>
<td>7.3c</td>
<td>10.4a</td>
<td>18.6bcd</td>
<td>7.3e</td>
<td>0.0a</td>
</tr>
<tr>
<td>Imidan 70 W + AZA-Direct 1.2%</td>
<td>1.5 lbs</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>AZA-direct 1.2%</td>
<td>8 oz</td>
<td>19.8cd</td>
<td>6.3c</td>
<td>25.0a</td>
<td>60.4a</td>
<td>46.9b</td>
<td>5.2a</td>
</tr>
<tr>
<td>GWN 1708 + 435 Oil</td>
<td>16 oz + 2%</td>
<td>28.1bcd</td>
<td>22.9ab</td>
<td>10.4a</td>
<td>29.1bc</td>
<td>30.2c</td>
<td>1.0a</td>
</tr>
<tr>
<td>GWN 1708 + 435 Oil</td>
<td>24 oz + 2%</td>
<td>14.6d</td>
<td>21.9ab</td>
<td>26.0a</td>
<td>17.7bc</td>
<td>20.8cde</td>
<td>9.4a</td>
</tr>
<tr>
<td>GWN 1708 + 435 Oil</td>
<td>30 oz + 2%</td>
<td>17.7cd</td>
<td>9.4bc</td>
<td>20.8a</td>
<td>19.8bcd</td>
<td>16.7cde</td>
<td>1.0a</td>
</tr>
<tr>
<td>Supracide 2E</td>
<td>1 qt</td>
<td>24.0cd</td>
<td>7.3c</td>
<td>17.7a</td>
<td>19.8bcd</td>
<td>25.0cd</td>
<td>2.1a</td>
</tr>
</tbody>
</table>

Means in a column followed by the same letter are not significantly different (\(P = 0.05, \text{LSD}\)).

Table 3  
Mean nymphal density rating per flush  
Mean oldest nymphal instar rating per flush

<table>
<thead>
<tr>
<th>Treatment/ Formulation</th>
<th>Rate amt product/ acre or % v/v</th>
<th>14-Jul</th>
<th>21-Jul</th>
<th>14-Jul</th>
<th>21-Jul</th>
</tr>
</thead>
<tbody>
<tr>
<td>Untreated check</td>
<td>---</td>
<td>1.35a</td>
<td>1.57a</td>
<td>2.03ab</td>
<td>2.71ab</td>
</tr>
<tr>
<td>Danitol 2.4 EC</td>
<td>16 oz</td>
<td>0.08d</td>
<td>0.14ef</td>
<td>1.0e</td>
<td>2.11bcd</td>
</tr>
<tr>
<td>Imidan 70 W</td>
<td>1.0 lbs</td>
<td>0.30bc</td>
<td>0.21def</td>
<td>1.31cde</td>
<td>1.88cd</td>
</tr>
<tr>
<td>Imidan 70 W + AZA-Direct 1.2%</td>
<td>8 oz</td>
<td>0.18bcd</td>
<td>0.08f</td>
<td>1.0e</td>
<td>2.71ab</td>
</tr>
<tr>
<td>Imidan 70 W + AZA-Direct 1.2%</td>
<td>1.5 lbs</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>AZA-direct 1.2%</td>
<td>8 oz</td>
<td>0.20bcd</td>
<td>0.17def</td>
<td>1.06de</td>
<td>1.89cd</td>
</tr>
<tr>
<td>GWN 1708 + 435 Oil</td>
<td>16 oz + 2%</td>
<td>0.33bc</td>
<td>0.53c</td>
<td>1.46cd</td>
<td>1.93cd</td>
</tr>
<tr>
<td>GWN 1708 + 435 Oil</td>
<td>24 oz + 2%</td>
<td>0.19bcd</td>
<td>0.33de</td>
<td>1.71bc</td>
<td>1.75d</td>
</tr>
<tr>
<td>GWN 1708 + 435 Oil</td>
<td>30 oz + 2%</td>
<td>0.40b</td>
<td>0.34cd</td>
<td>1.37cde</td>
<td>2.00cd</td>
</tr>
<tr>
<td>Supracide 2E</td>
<td>1 qt</td>
<td>0.29bc</td>
<td>0.37cd</td>
<td>1.52de</td>
<td>2.42abc</td>
</tr>
</tbody>
</table>

Means in a column followed by the same letter are not significantly different (\(P = 0.05, \text{LSD}\)).