NAVEL ORANGEWORM CONTROL


ABSTRACT

Preliminary experiments were conducted on NOW egg trap improvement and on a husk-split insecticide treatment program for NOW control. In the egg trap improvement studies, changing the color of NOW egg traps from the clear plastic standard to black or green greatly improved trap catch, and changing the bait formulation from almond press cake to almond press cake and almond oil also greatly improved trap catch. Hopefully through trap modifications the NOW trap will better reflect the true population dynamics of this pest. In the insecticide screening program, Guthion, Diazinon, and Guthion and Diazinon in combination were tested in two locations. The NOW population was low in both locations and never developed damaging levels. There was no difference between the various treatments.

OBJECTIVES

To develop a husk-split treatment scheme for NOW control and to develop phenological models for NOW to predict which years will be outbreak years and which orchards will be most likely to become heavily infested.

PROCEDURES

I. NOW egg trap improvement studies

The color of NOW egg traps was studied in 2 locations. In the first study in walnuts, the traps were painted one of 4 colors (yellow, black, lime green, or blue) and were compared to a clear plastic standard. The experiment was set up in a Latin square design with 5 replicates and 5 treatments. The traps were rotated once a week and the almond press cake bait (15 grams) was changed once a week. The traps were placed in the orchard on June 24 and removed on Aug. 9. The readings (number of eggs per trap) were made weekly from June 24 through July 12 then twice a week for the remainder of the study.

In the second study in almonds, the traps were painted one of 5 colors (yellow, black, lime green, dark green, or blue) and were compared to a clear plastic standard. The experiment was set up in a randomized complete block design with 5 replicates of each color. The traps were rotated once a week and the almond press cake (15 grams) was changed once a week. The traps were placed in the orchard on Aug. 19 and monitored twice a week through Sept. 22.

The bait formulation used in the egg traps was also studied in the same two locations. In the first study in walnuts, 4 bait formulations in standard clear plastic traps were compared to empty traps. The bait formulations were: 1) 10 grams bran formulation (bran 24: honey 2: glycerol 2: water 1), 2) 15 grams almond press cake, 3) 13.5 grams almond press cake and 1.5 grams refined almond oil, and 4) 1.5 grams refined almond oil soaked on a 25 mm dental wick. The traps were rotated once a week and the bait formulation changed once a week. The traps were placed in the orchard on June 24 and removed on Aug. 9.
The readings were made weekly from June 24 through July 12 then twice a week for the remainder of the study.

In the second study in almonds, 6 bait formulations in standard clear traps were compared to empty traps. The bait formulations were: 1) 10 grams bran formulation, 2) 15 grams almond press cake, 3) 13.5 grams almond press cake and 1.5 grams refined oil, 4) 13.5 grams almond press cake and 1.5 grams crude almond oil, 5) 1.5 grams refined almond oil soaked on a 25 mm dental wick, and 6) 1.5 grams crude almond oil soaked on a 25 mm dental wick. The traps were rotated once a week and the bait formulations changed once a week. The traps were placed in the orchard on Aug. 19 and monitored twice a week through Sept. 22.

II. Insecticide screening studies for NOW control

Two studies were conducted in the Chico and Porterville areas. In both studies, Guthion (2.0 lbs. AI/Ac at Porterville and 1.5 lbs. AI/Ac at Chico), Diazinon (2.0 lbs. AI/Ac at Porterville and 1.5 lbs. AI/Ac at Chico), and a combination of both Guthion and Diazinon (both 2.0 lbs. AI/Ac at Porterville and both 1.5 lbs. AI/Ac at Chico) were compared to an untreated check. The 4 treatments were replicated 4 times in a randomized complete block design with each plot one acre in size. The insecticides were applied by commercial air blast speed sprayer at the beginning of husk-split (Aug. 25 at Porterville and Sept. 1 at Chico) with a delivery rate of 200 gals. water/acre at Porterville and 300 gals. water/acre at Chico.

At Chico, the NOW population was monitored with standard NOW egg traps. The traps were placed in the orchard on Aug. 5 and removed Oct. 8. Trap readings were made twice a week from Aug. 9 through 19, then once a week or every other week for the remainder of the study. One hundred split nuts were picked from several trees near the center of each plot. The samples were taken at weekly intervals from one week after the insecticide application until the last commercial harvest. The nuts were hulled and then inspected for worms and/or worm damage. There were two commercial harvests, the first on Sept. 21 and the second on Oct. 8.

At Porterville, the NOW population was monitored with standard NOW egg traps. The traps were placed in the orchard on Aug. 5 and removed Sept. 30. Trap readings were made twice weekly from Aug. 9 until harvest. One hundred split nuts were picked from several trees near the center of each plot. The samples were taken at weekly intervals from one week after the insecticide application until commercial harvest (Sept. 30). The nuts were hulled and inspected for worms and/or worm damage.

RESULTS AND CONCLUSIONS

I. NOW egg trap improvement studies

In the first color study with NOW egg traps in walnuts, lime green and black traps had more eggs deposited on them than the clear plastic standard (Table 1). However, the differences were not significant. This lack of difference may have been due to the very low NOW population. In the second study in almonds, the population of NOW was much higher. In this study black, dark green, and blue were significantly more attractive than the clear plastic standard (Table 2). From these preliminary findings it appears that color is an
important cue in NOW oviposition. However, further studies are needed to corroborate these findings.

**TABLE 1.** The effect of NOW egg trap color on egg deposition in walnuts, Gustine, CA, 1982

<table>
<thead>
<tr>
<th>Color</th>
<th>Mean* total eggs/trap</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lime Green</td>
<td>20.0 a</td>
</tr>
<tr>
<td>Black</td>
<td>12.0 ab</td>
</tr>
<tr>
<td>Yellow</td>
<td>4.8 ab</td>
</tr>
<tr>
<td>Standard (clear plastic)</td>
<td>2.0 ab</td>
</tr>
<tr>
<td>Blue</td>
<td>1.4 b</td>
</tr>
</tbody>
</table>

* Means followed by the same letter are not significantly different at the 5% level (DMRT). Data analyzed with a square root transformation.

**TABLE 2.** The effect of NOW egg trap color on egg deposition in almonds, Fresno, CA, 1982

<table>
<thead>
<tr>
<th>Color</th>
<th>Mean* total eggs/trap</th>
</tr>
</thead>
<tbody>
<tr>
<td>Black</td>
<td>386.8 a</td>
</tr>
<tr>
<td>Dark Green</td>
<td>245.8 b</td>
</tr>
<tr>
<td>Blue</td>
<td>204.2 bc</td>
</tr>
<tr>
<td>Lime Green</td>
<td>160.4 cd</td>
</tr>
<tr>
<td>Standard (clear plastic)</td>
<td>111.4 de</td>
</tr>
<tr>
<td>Yellow</td>
<td>67.6 e</td>
</tr>
</tbody>
</table>

* Means followed by the same letter are not significantly different at the 5% level (DMRT).

In the first bait formulation study in walnuts, almond press cake and refined almond oil traps had significantly more eggs deposited on them than any other bait formulation despite a low NOW population (Table 3). The oil alone had very few eggs on the traps and was similar to the empty traps. Thus, there may be synergistic activity occurring between the almond press cake and almond oil. In the second study in almonds, the results were quite similar to the previous study. Almond press cake and crude almond oil traps had more eggs deposited on them than any other bait formulation (Table 4). However, they were not significantly different from press cake and refined oil or from press cake alone. As in the previous study, traps with oil alone had very few eggs deposited on them. Crude almond oil slightly outperformed refined almond oil. Thus, from these studies, it appears that a change from the standard almond press cake to press cake and oil will greatly increase egg
deposition. With improvement in the effectiveness of the egg trap, it might be possible to more accurately monitor the actual orchard population of NOW.

TABLE 3. The effect of NOW egg trap bait formulation on egg deposition in walnuts, Gustine, CA, 1982

<table>
<thead>
<tr>
<th>Bait formulation</th>
<th>Mean* total eggs/trap</th>
</tr>
</thead>
<tbody>
<tr>
<td>Press cake + refined almond oil</td>
<td>37.8 a</td>
</tr>
<tr>
<td>Press cake</td>
<td>19.0 b</td>
</tr>
<tr>
<td>Bran</td>
<td>5.8 bc</td>
</tr>
<tr>
<td>Refined almond oil</td>
<td>0.4 c</td>
</tr>
<tr>
<td>Empty</td>
<td>0.2 c</td>
</tr>
</tbody>
</table>

* Means followed by the same letter are not significantly different at the 5% level (DMRT).

TABLE 4. The effect of NOW egg trap bait formulation on egg deposition in almonds, Fresno, CA, 1982

<table>
<thead>
<tr>
<th>Bait formulation</th>
<th>Mean* total eggs/trap</th>
</tr>
</thead>
<tbody>
<tr>
<td>Press cake + crude almond oil</td>
<td>213.4 a</td>
</tr>
<tr>
<td>Press cake + refined almond oil</td>
<td>186.6 a</td>
</tr>
<tr>
<td>Press cake</td>
<td>139.2 ab</td>
</tr>
<tr>
<td>Bran</td>
<td>87.8 bc</td>
</tr>
<tr>
<td>Crude almond oil</td>
<td>28.4 c</td>
</tr>
<tr>
<td>Refined almond oil</td>
<td>24.6 c</td>
</tr>
<tr>
<td>Empty</td>
<td>20.4 c</td>
</tr>
</tbody>
</table>

* Means followed by the same letter are not significantly different at the 5% level (DMRT).

II. Insecticide screening studies for NOW control

The NOW egg traps in both studies had very low counts, never exceeding 5 eggs/trap/day and usually less than 1 egg/trap/day. There was no significant difference in egg trap counts among the various treatments. The mean percent nuts infested by NOW was also very low throughout both studies. At Porterville, the mean percent was less than 0.5% in the various treatments and did not increase after husk-split. At Chico, the mean percent infestation increased from 0.5% on the first sampling date (9/8) to 2.75% on the last sampling date (10/6). There was no difference among the various treatments.