# Effect of Assail and Danitol on Mite Management in Ohio Apples

Supplemental Report for Codling Moth Management Trials in Apples, Northern Ohio, 2003

3/29/04

Celeste Welty (Department of Entomology, Ohio State University, Columbus OH),
Ron Becker (OSU Extension, Wayne County, Wooster OH),
and Ted Gastier (OSU Extension, Huron County, Norwalk OH)

## Methods:

Trial locations: Two commercial orchards were used. Eshleman Fruit Farm in Clyde, Sandusky County, northwest Ohio, is a large orchard of apples and peaches. This orchard was plagued by heavy damage from caterpillars in apples and peaches in 2002 in a Guthion-based program, thus the grower was anxious to test alternative materials in 2003. The trial block was 19 acres of mixed cultivars, predominantly Fuji and Gala. Moreland Fruit Farm, Moreland, Wayne County, northeast Ohio, is a small diversified farm with many fruit and vegetable crops. Apples are managed as five blocks of large trees, each about 3 acres, of mixed cultivars usually with a different cultivar in every row. This orchard has been in an IPM program for many years and had been using a reduced number of insecticide sprays, usually one spray per codling moth generation, until heavy damage from codling moth during the previous two years had caused a shift back to a regular spray schedule.

Insect treatments: Insect treatments were Assail 70WP at 3.4 oz/A, Avaunt 30WG at 6 oz/A, Danitol 2.4EC at 21 fl oz/A, Intrepid 2F at 16 fl oz/A, and Imidan 70WP at 4 lb/A. At Clyde, a randomized complete block design was used with three replicates of five treatments; each plot was 5 rows wide and about 1.2 acres in area. At Moreland, an unreplicated large plot trial was done in five apple blocks with one treatment in each block. All sprays were applied by airblast sprayer with volume of 50 gal/A at Clyde and 50 gal/acre at Moreland. All treatments were applied three times and targeted the first brood of codling moth. The first spray was targeted at 150 degree days (DD) after trap-based biofix, followed by the second and third sprays at 14-day intervals. At Moreland, biofix was on 2 May, and first treatment was applied at on 15 May at 157 DD, followed by second and third sprays on 30 May and 16 June. At Eshleman's, biofix was 30 May and first treatment was applied on 13 June at 265 DD, followed by second and third sprays on 30 June and 14 July. After the three experimental sprays at Moreland, two insecticide sprays were applied: Lannate alone on all plots on 13 July, and on 2 August with Imidan alone on all plots except the Intrepid block which was treated with Imidan plus Lannate. After the three experimental sprays at Eshleman's, two insecticide sprays were applied on all plots: Imidan plus Lannate on 31 July, and Imidan alone on 18 August.

Mite treatments: At each of the two orchards, an experiment on transfer of the predatory mite *Typhlodromus pyri* was set up in a randomized complete block design with two treatments and six replicates. The two treatments were: predator seeded and an unseeded check. Three replicates were placed in Danitol plots and three replicates in Assail plots. These two insecticide treatments were chosen due to concern that these insecticides might flare European red mite due to toxicity to indigenous predatory mites. The strain of *T. pyri* used is known to be tolerant of pyrethroids. Each treatment replicate was one Red Delicious tree. For the seeded treatment, each tree was seeded by stapling six bands on scaffold branches on 22 April. In the unseeded check treatment, no bands were used. Bands were made of 4-inch paper tree wrap lined with burlap. Bands had been wrapped around tree trunks in a predator source orchard in Columbus in October 2002 and removed in March 2003 then refrigerated. Examination of seven bands showed that they sheltered 3 to >100 *T. pyri* per band, with a mean of about 40 per band. Mite counts were taken from treatment trees in the Danitol and Assail blocks on 7/7 and 8/11 at Moreland and on 7/17 and 9/9 at Clyde. At Moreland, two additional samples were taken on 8/11 from the Imidan block where European red mite was at high density. Due to outbreak of European red mite, Pyramite was applied at Moreland on 7/13/03 in the Assail block. Data were subjected to analysis of variance with mean separations by LSD tests using the SAS microcomputer system.

## Results:

At Clyde, European red mite density in mid-July was lower in the Danitol treatment than in the Assail treatment but density did not differ significantly between treatments (Table 1). Phytoseiids were found only in Assail plots not in Danitol plots but the two treatments did not differ significantly (Table 1). Analysis of variance showed no significant difference between the two predator transfer treatments either in European red mite density or predator density (Table 2). Phytoseiids were found only in seeded trees not in unseeded check trees. The 10 phytoseiids recovered from seeded trees were 9 *T. pyri* and one *N. fallacis*. These results show that initial establishment of *T. pyri* was successful.

At Clyde, European red mite density in early September was significantly lower in the Danitol treatment than in the Assail treatment but both were above the late-season threshold of 7.5 mites per leaf (Table 1). Phytoseiids were found in both Assail and Danitol plots but their density did not differ significantly between treatments (Table 1). Analysis of variance showed no significant difference between the two predator transfer treatments either in European red mite density or predator density (Table 2). Phytoseiids were found in seeded and unseeded trees. The 10 phytoseiids recovered from seeded trees in early September were all *N. fallacis*.

At Moreland, European red mite density in early July was well below the mid-summer threshold of 5 mites per leaf in the Danitol block and well above threshold in the Assail block (Table 3). Analysis of variance showed no significant difference between the two predator transfer treatments either in European red mite density or predator density (Table 4). In the Danitol block, phytoseiid predatory mites were found in seeded trees but not in unseeded check trees. The 14 phytoseiid specimens recovered from seeded trees in the Danitol block were all *T. pyri*. In the Assail block, phytoseiid predatory mites were found both in seeded trees and in unseeded check trees (Table 3). The 15 specimens of phytoseiids recovered from seeded trees in the Assail block were identified as 14 *T. pyri* and one *N. fallacis*. The 5 phytoseiid specimens recovered from check trees in the Assail block were all *N. fallacis*. This indicates that initial establishment of *T. pyri* was successful.

At Moreland, European red mite density in mid-August was below the late-summer threshold of 7.5 mites per leaf in both Danitol and Assail blocks, but well above threshold in the Imidan block (Table 3). Analysis of variance showed no significant difference between the two predator transfer treatments either in European red mite density or predator density (Table 4). Phytoseiid predatory mites were found in seeded trees but not in check trees in the Assail block, and in check trees but not in seeded trees in the Danitol block. Only two phytoseiid specimens were recovered in the August sample; one mite from a seeded tree in the Assail block was *N. fallacis*, and one mite from a check tree in the Danitol block was also *N. fallacis*.

Conclusions:

Use of Assail at a high rate in three applications in early summer caused European red mite density to exceed threshold by early summer at one site and by mid-summer at the other site. Use of Danitol at a high rate in three applications in early summer did not cause mites to exceed threshold for most of the summer, although the threshold was exceeded in early September. In blocks where Assail is used, mites should be monitored regularly so that a miticide can be applied before bronzing occurs.

The experiment to introduce a pyrethroid-tolerant strain of *T. pyri* was successful in initial establishment at both orchards, although the predator density was too low in the initial year to have a significant effect on suppression of European red mite. These blocks need to be monitored in 2004 to determine whether or not the *T. pyri* populations reach a density high enough to adequately suppress the European red mite population below threshold.

Table 1. Mite density in insecticide trial at Eshleman Fruit Farm in Clyde, Ohio on two sampling dates, 2003.

| Insect-icide Treat-ment | Number of replicate blocks | Mean number of mites per leaf | | | | Species & number of phytoseiid specimens recovered | Apple rust mite, rating on scale 0 to 3 |
|---|---|---|---|---|---|---|---|
| | | European red mite motiles | European red mite eggs | Stig-maeid predators | Phyto-seiid predators | | |
| 7/17/03: | | | | | | | |
| Assail | 3 | 1.84 | 3.7 | 0 | 0.13 | *T. pyri* (9); *N. fallacis* (1) | 1.2 |
| Danitol | 3 | 0.11 | 0.2 | 0 | 0 | – | 0.5 |
| *Probability value from ANOVA (trtmt effect)* | | *0.29* | *0.13* | – | *0.36* | – | *0.18* |
| 9/9/03: | | | | | | | |
| Assail | 3 | 103.5 A | 76.4 | 0 | 0.39 | *N. fallacis* (10) | 1.0 |
| Danitol | 3 | 11.4 B | 45.6 | 0 | 0.07 | – | 0.3 |
| *Probability value from ANOVA (trtmt effect)* | | *0.02* | *0.54* | – | *0.42* | – | *0.27* |

Table 2. Mite density in predator transfer trial at Eshleman Fruit Farm in Clyde, Ohio on two sampling dates, 2003.

| Predator treat-ment | Number of replicate blocks | Mean number of mites per leaf | | | | Species & number of phytoseiid specimens recovered | Apple rust mite, rating on scale 0 to 3 |
|---|---|---|---|---|---|---|---|
| | | European red mite motiles | European red mite eggs | Stigmaeid predators | Phytoseiid predators | | |
| 7/17/03: | | | | | | | |
| Check | 6 | 1.09 | 1.8 | 0 | 0.00 | – | 1.2 |
| Seeded | 6 | 0.85 | 2.1 | 0 | 0.13 | *T. pyri* (9); *N. fallacis* (1) | 0.5 |
| *Probability value from ANOVA (treatment effect)* | | *0.30* | *0.44* | – | *0.31* | – | *0.10* |
| 9/9/03: | | | | | | | |
| Check | 6 | 51.2 | 48.9 | 0 | 0.09 | – | 0.8 |
| Seeded | 6 | 63.6 | 73.0 | 0 | 0.36 | *N. fallacis* (10) | 0.5 |
| *Probability value from ANOVA (treatment effect)* | | *0.79* | *0.41* | – | *0.48* | – | *0.53* |

Table 3. Mite density on Red Delicious apple trees under two insecticide regimes at Moreland Fruit Farm on two sampling dates, 2003.

| Insecticide block | Predator treatment | Number of trees sampled | Mean number of mites per leaf | | | | Species & number of phytoseiids recovered | Apple rust mite rating (scale 0 to 3) |
|---|---|---|---|---|---|---|---|---|
| | | | European red mite motiles | European red mite eggs | Stigmaeid (yellow) predators | Phytoseiid (white) predators | | |
| 7/7/03: | | | | | | | | |
| Danitol block | check | 3 | 0.19 | 0.6 | 0 | 0 | – | 1.3 |
| Danitol block | seeded | 3 | 0.03 | 0.3 | 0 | 0.36 | *T. pyri* (14) | 1.0 |
| Danitol block, mean of 6 trees | | | 0.11 | 0.4 | 0 | 0.18 | – | 1.2 |
| Assail block | check | 3 | 55 | 128 | 0.48 | 0.19 | *N. fallacis* (5) | 3.0 |
| Assail block | seeded | 3 | 105 | 201 | 0.22 | 0.45 | *T. pyri* (14); *N. fallacis* (1) | 3.0 |
| Assail block, mean of 6 trees | | | 79.6 | 164 | 0.35 | 0.32 | – | 3.0 |
| 8/11/03: | | | | | | | | |
| Danitol block | check | 3 | 3.5 | 9.0 | 0 | 0.027 | *N. fallacis* (1) | 2.0 |
| Danitol block | seeded | 3 | 4.8 | 12.6 | 0 | 0 | – | 2.3 |
| Danitol block, mean of 6 trees | | | 4.1 | 10.8 | 0 | 0.013 | – | 2.2 |
| Assail block | check | 3 | 0.13 | 51.7 | 0 | 0 | – | 2.0 |
| Assail block | seeded | 3 | 0.40 | 65.8 | 0 | 0.027 | *N. fallacis* (1) | 1.3 |
| Assail block, mean of 6 trees | | | 0.27 | 58.7 | 0 | 0.013 | – | 1.7 |
| Imidan | check | 2 | 140.2 | 264.6 | 0 | 0.155 | – | 3.0 |

Table 4. Mite density in predator transfer trial at Moreland Fruit Farm on two sampling dates, 2003.

| Predator treatment | Number of replicate blocks | Mean number of mites per leaf | | | | Species & number of phytoseiids recovered | Apple rust mite rating (scale 0 to 3) |
|---|---|---|---|---|---|---|---|
| | | European red mite motiles | European red mite eggs | Stigmaeid (yellow) predators | Phytoseiid (white) predators | | |
| 7/7/03: | | | | | | | |
| Check | 6 | 27.4 | 64.5 | 0.240 | 0.093 | *N. fallacis* (5) | 2.2 |
| Seeded | 6 | 52.3 | 100.6 | 0.109 | 0.406 | *T. pyri* (28); *N. fallacis* (1) | 2.0 |
| *Probability (trtmt effect)* | | *0.10* | *0.15* | *0.25* | *0.07* | – | *0.36* |
| 8/11/03: | | | | | | | |
| Check | 6 | 1.8 | 30.3 | 0 | 0.013 | *N. fallacis* (1) | 2.0 |
| Seeded | 6 | 2.6 | 39.2 | 0 | 0.013 | *N. fallacis* (1) | 1.8 |
| *Probability (trtmt effect)* | | *0.13* | *0.21* | – | *1.00* | – | *0.61* |