

# Efficacy of Experimental Insecticides for Whitefly Control in Cotton, 1996

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## Abstract

*Experimental insecticides were evaluated for control of sweet potato whiteflies relative to a commercial standard in cotton. Ni-25 provided excellent whitefly control and was equivalent to the commercial standard (Knack followed by Danitol + Orthene). Fenoxycarb + pymetrozine provided good whitefly control but seemed to require 2 sequential applications before control was equivalent to Ni-25. Diofenolan + pymetrozine appeared to be a slightly weaker treatment, but still provided acceptable whitefly control.*

## Introduction

Sweet potato whitefly, *Bemisia tabaci* (Gennadius), is one of the most serious pests attacking cotton in Arizona. Prior to 1996, growers relied heavily on organophosphate / pyrethroid mixtures for whitefly control. Insecticide resistance and subsequent difficulty controlling whiteflies resulted in much interest in alternative insecticides. In 1996, a Section 18 emergency use permit was issued in Arizona for the use of pyriproxyfen (Knack) and buprofezin (Applaud). Use of these products appeared to greatly enhance whitefly control over previous years experiences, and set the standard for whitefly control in cotton. However, data from Israel suggests that sweet potato whitefly may quickly develop resistance to these insecticides. Therefore it is important that other alternative insecticides be developed and integrated into an insecticide resistance management program.

The objective of this study was to evaluate the efficacy of acetamiprid (Ni-25), pymetrozine + fenoxycarb (Sterling), and pymetrozine + difenolan to sweet potato whitefly. Ni-25 is being developed by Rhone-Poulenc, and is a chloronicotinyl insecticide similar to imidacloprid (Admire, Provado). Ni-25 is a nerve poison and acts binding to the nicotinic receptor. Sterling is being developed by Novartis, and is a mixture of pymetrozine and fenoxycarb. Pymetrozine inhibits feeding by paralyzing the insect's salivary pump, eventually resulting in starvation. Fenoxycarb is an IGR and mimics the action of juvenile hormone, similarly to Knack. The other product tested mixed with pymetrozine, as a possible replacement for fenoxycarb in Sterling, was diofenolan. Diofenolan is also an IGR, and acts similarly to Knack.

## Materials and Methods

This trial was conducted at the Yuma Valley Agricultural Center. Cotton, 'DPL 5416', was planted on 40 in beds on Apr 12, 1996. The test was a randomized complete block design, with 4 replicates. Plots were 4 rows X 50 ft, bordered on each side by 2 blank rows and on each end by 10 ft alleys. Applications were made on 26 Jun, 03 and 18 Jul, and 01 Aug. Treatments included Ni-25 at 0.05, 0.075 and 0.10 lbs-ai/ac, Sterling (Fenoxycarb at 0.094 lbs-ai/ac + pymetrozine at 0.063, diofenolan at 0.094 lbs-ai/ac + pymetrozine at 0.063 or 0.094 lbs-ai/ac, and a commercial standard. The commercial standard was Knack at 8 oz/ac followed no sooner than 21 days, by either Applaud at 0.35 lbs-ai/ac or Danitol at 0.20 lbs-ai/ac + Orthene at 0.5 lbs-ai/ac. Applaud was to be applied if whitefly colonization was occurring as evidenced by live nymphs; Danitol + Orthene was to be applied only if adult whiteflies were present. All

treatments included Kinetic spreader sticker at 0.01% v/v. Applications were initiated when nymphs first appeared.

Treatment were sprayed using a tractor mounted sprayer. The boom covered 4 rows, with 3 hollow cone D-2 nozzles per row, one centered over each row and two on 18 in drops on each side. The sprayer was calibrated to deliver 20 gallons per acre at 40 psi. The tractor traveled at 3 mph.

Evaluations were made on 26 Jun, 02, 08, 17 and 30 Jul, and 09 and 20 Aug. Whiteflies were sampled by counting the numbers of eggs, small nymphs, red-eyed nymphs and eclosed pupae from 1 cm<sup>2</sup> leaf discs. Ten leaves were collected from nodes 3, 4, 5, 6, 7 and 8 from each plot on all sample dates except 26 Jun and 02 Jul, when leaves were collected from only node 5. The leaf discs were taken from the area between the mid and secondary veins of the cotton leaves. Data among nodes was pooled for analysis.

Sooty mold / honey dew accumulation was evaluated on ten plants within each plot on at harvest on 26 Sept. A subjective 1-5 rating scale was used where; 1 = no contamination, 2 = foliar contamination only, 3 = light contamination of lint, 4 = moderate lint contamination and 5 = heavy contamination of the lint.

All data were analyzed using a general linear model, and an F protected ( $P < 0.05$ ) LSD for means separation.

## Results and Discussion

Precount evaluations made on 26 Jun indicated that significant whitefly colonization was beginning to occur; there were no significant differences among treatments in the numbers of small or red-eyed nymphs, or eclosed pupae (Table 1).

Six days following application 1 significant differences were detected among treatments in the numbers of eggs and small nymphs (Table 2). There were no eclosed pupae present, and there were no significant differences among treatments in the number of red-eyed nymphs. All the insecticides had fewer eggs than the untreated, and Ni-25 at all rates, and both rates of diofenolan + pymetrozine contained fewer eggs than Knack or Sterling. However, previous investigations have shown that eggs on Knack treated plants are not viable and will not hatch. Ni-25 at the medium and high rates, and diofenolan + pymetrozine at the high rate were the only treatments that contained significantly fewer small nymphs than the untreated. Low number of eggs and small nymphs in the Ni-25 and diofenolan + pymetrozine treated plots following the first application suggests that these products are active towards the adult stage either as a toxicant and/or repellent.

Following the second application (commercial standard treated plots were not sprayed), differences among treatments were more pronounced. All the insecticide treated plots contained fewer eggs, small nymphs, red-eyed nymphs and eclosed pupae than the untreated, however, differences among insecticides were evident (Table 3). Based on small nymphs, the commercial standard, Ni-25 and diofenolan + pymetrozine appeared to be superior treatments. Although the Knack treated plots did contain more eggs than the Ni-25 or diofenolan + pymetrozine treated plots, as earlier suggested, these eggs were probably not viable. Based on red-eyed nymphs, Ni-25 appeared to be the best treatment, suggesting that Ni-25 may have greater activity of later immature stages of sweet potato whitefly than the other treatments.

By 14 days after the second application, whitefly populations in the untreated plots were rapidly growing, and products that appeared to be slower acting were expressing greater activity (Table 4). All the insecticide treated plots contained fewer immature whiteflies than the untreated. Fenoxycarb + pymetrozine, which previously appeared to be slightly weaker than the other treatments now appeared similar to the commercial standard, Ni-25 and diofenolan + pymetrozine at the high rate. Diofenolan + pymetrozine at the low rate appeared to be slight inferior to the other treatments.

At application 4 (23 days since application 1), whitefly adults were becoming plentiful in the commercial standard (Table 5). However, since immature whiteflies were relatively sparse, to reduce the adult population, the commercial standard was treated with Danitol + Orthene. Twelve days following application 3, the commercial standard, Ni-25

and diofenolan + pymetrozine at the high rate, were overall the superior treatments.

Whitefly densities were at the highest levels 8 days following application 4 (Table 6). Danitol + Orthene was applied at application 4 for the commercial standard. However, in hind sight, this application was probably not necessary. Although Applaud was supposed to be used in this test as a follow up material to Knack for immature whitefly control, it was never needed. At 8 days following application 4 all the products tested significantly maintained immature densities below that of the untreated. By this time all the products appeared similar in efficacy except diofenolan + pymetrozine at the low rate. It was evident that if diofenolan is used as a substitute for fenoxycarb in Sterling, the higher rate of pymetrozine should be used.

By 19 days following application 4, whitefly counts were dropping across all treatments including the untreated. Based on eggs and small nymphs, all products appeared to be providing similar control. However, based on red-eyed nymphs the commercial standard, Ni-25 and fenoxycarb + pymetrozine appeared to have slight greater efficacy than the diofenolan + pymetrozine combinations.

All the insecticides suffered less sooty mold / honey dew accumulation than the untreated (Table 8). However, the commercial standard, Ni-25 and fenoxycarb + pymetrozine appeared to provide the best protection.

Based on these data, the commercial standard appears to be an excellent treatment regime for whitefly control in cotton. We achieved season-long whitefly control with 1 application of Knack followed by 2 applications of Danitol + Orthene. The second application of Danitol + Orthene was probably not necessary. Four applications of Ni-25 provided excellent whitefly control lasting as much as 2 weeks. Residual activity of this product needs to be determined. Fenoxycarb + pymetrozine appeared to take two applications to bring the whitefly populations to those of the commercial standard. Early in the trial, diofenolan + pymetrozine appeared to be a good treatment, but its efficacy appeared to diminish slightly as the season progressed, and sooty mold / honey dew accumulation appeared to be more severe than in the commercial standard and in the plots treated with Ni-25 at the high rate. If diofenolan is used as a substitute for fenoxycarb, it should be mixed with the higher rate of pymetrozine.

Table 1. Mean number  $\pm$  SEM of immature sweet potato whiteflies per 1 cm<sup>2</sup> collected from 5<sup>th</sup> node leaves, 25 Jun, precount evaluation.

Treatments <sup>a</sup>	Eggs	Small Nymphs	Red-eyed Nymphs	Eclosed Pupae
Untreated	NA <sup>b</sup>	8.00 $\pm$ 2.60a	0.65 $\pm$ 0.26a	0.00 $\pm$ 0.00a
Ni-25 (L)	NA	6.93 $\pm$ 0.79a	7.20 $\pm$ 1.19a	0.00 $\pm$ 0.00a
Ni-25 (M)	NA	6.40 $\pm$ 2.25a	0.38 $\pm$ 0.19a	0.00 $\pm$ 0.00a
Ni-25 (H)	NA	3.95 $\pm$ 0.60a	0.93 $\pm$ 0.39a	0.00 $\pm$ 0.00a
Fenoxo + Pym	NA	5.28 $\pm$ 0.51a	0.58 $\pm$ 0.31a	0.00 $\pm$ 0.00a
Diof + Pym (L)	NA	9.25 $\pm$ 1.83a	0.40 $\pm$ 1.19a	0.00 $\pm$ 0.00a
Diof + Pym (H)	NA	5.13 $\pm$ 1.35a	0.55 $\pm$ 0.22a	0.00 $\pm$ 0.00a
Standard	NA	7.20 $\pm$ 1.19a	0.38 $\pm$ 0.18a	0.00 $\pm$ 0.00a

Means in a column followed by the same letter are not significantly different; GLM, F protected LSD (P < 0.05).

<sup>a</sup>Ni-25 (L) = acetamiprid at 0.05 lbs-ai/ac, Ni-25 (M) = acetamiprid at 0.075 lbs-ai/ac, Ni-25 (H) = acetamiprid at 0.1 lbs-ai/ac, Fenoxo + Pym = fenoxycarb at 0.094 lbs-ai/ac + pymetrozine at 0.063 lbs-ai/ac, Diof + Pym (L) = diofenolan at 0.094 lbs-ai/ac + pymetrozine at 0.063 lbs-ai/ac, Diof + Pym (H) = diofenolan at 0.094 lbs-ai/ac + pymetrozine at 0.094 lbs-ai/ac, Standard = Knack at 8 oz/ac followed no sooner than 21 days by Danitol at 0.2 lbs-ai/ac + Orthene at 0.5 lbs-ai/ac.

<sup>b</sup>Not sampled.

Table 2. Mean number  $\pm$  SEM of immature sweet potato whiteflies per 1 cm<sup>2</sup> collected from 5<sup>th</sup> node leaves, 02 Jul, 6 DAT application 1.

Treatments <sup>a</sup>	Eggs	Small Nymphs	Red-eyed Nymphs	Eclosed Pupae
Untreated	26.50 $\pm$ 3.77a	5.30 $\pm$ 0.86ab	3.78 $\pm$ 2.64a	0.00 $\pm$ 0.00a
Ni-25 (L)	4.25 $\pm$ 0.85c	4.88 $\pm$ 1.23ab	0.48 $\pm$ 0.13a	0.00 $\pm$ 0.00a
Ni-25 (M)	5.25 $\pm$ 0.95c	2.08 $\pm$ 0.48b	0.15 $\pm$ 0.15a	0.00 $\pm$ 0.00a
Ni-25 (H)	4.00 $\pm$ 0.82c	2.60 $\pm$ 0.20b	0.38 $\pm$ 0.14a	0.00 $\pm$ 0.00a
Fenoxo + Pym	14.00 $\pm$ 0.91b	6.48 $\pm$ 1.28a	2.73 $\pm$ 1.94a	0.00 $\pm$ 0.00a
Diof + Pym (L)	8.00 $\pm$ 2.92c	7.83 $\pm$ 3.50a	0.88 $\pm$ 0.47a	0.00 $\pm$ 0.00a
Diof + Pym (H)	4.00 $\pm$ 0.41c	2.73 $\pm$ 0.61b	0.98 $\pm$ 0.39a	0.00 $\pm$ 0.00a
Knack	19.00 $\pm$ 2.48b	5.38 $\pm$ 0.71ab	0.60 $\pm$ 0.60a	0.00 $\pm$ 0.00a

Means in a column followed by the same letter are not significantly different; GLM, F protected LSD (P < 0.05).

<sup>a</sup>Ni-25 (L) = acetamiprid at 0.05 lbs-ai/ac, Ni-25 (M) = acetamiprid at 0.075 lbs-ai/ac, Ni-25 (H) = acetamiprid at 0.1 lbs-ai/ac, Fenoxo + Pym = fenoxycarb at 0.094 lbs-ai/ac + pymetrozine at 0.063 lbs-ai/ac, Diof + Pym (L) = diofenolan at 0.094 lbs-ai/ac + pymetrozine at 0.063 lbs-ai/ac, Diof + Pym (H) = diofenolan at 0.094 lbs-ai/ac + pymetrozine at 0.094 lbs-ai/ac and Knack at 8.0 oz/ac. All treatments included Kinetic at 0.01% v/v.

Table 3. Mean number  $\pm$  SEM of immature sweet potato whiteflies per 1 cm<sup>2</sup> collected from leaves from nodes 3-8, 08 Jul, 5 DAT application 2, Knack - 12 DAT application 1.

Treatments <sup>a</sup>	Eggs	Small Nymphs	Red-eyed Nymphs	Eclosed Pupae
Untreated	43.68 $\pm$ 10.02a	11.53 $\pm$ 2.16a	5.43 $\pm$ 1.19a	0.50 $\pm$ 0.09a
Ni-25 (L)	2.21 $\pm$ 1.61d	0.83 $\pm$ 0.51c	0.40 $\pm$ 0.38de	0.03 $\pm$ 0.03c
Ni-25 (M)	3.08 $\pm$ 1.11d	0.83 $\pm$ 0.27c	0.20 $\pm$ 0.10e	0.02 $\pm$ 0.01c
Ni-25 (H)	2.11 $\pm$ 1.43d	1.11 $\pm$ 0.70c	0.42 $\pm$ 0.36cde	0.03 $\pm$ 0.02c
Fenoxy + Pym	8.73 $\pm$ 3.75bc	3.26 $\pm$ 0.70b	2.86 $\pm$ 0.16b	0.31 $\pm$ 0.14b
Diof + Pym (L)	4.08 $\pm$ 1.65cd	1.52 $\pm$ 0.31c	1.38 $\pm$ 0.53c	0.15 $\pm$ 0.06bc
Diof + Pym (H)	3.12 $\pm$ 1.06d	1.86 $\pm$ 0.63bc	1.38 $\pm$ 0.59c	0.06 $\pm$ 0.02c
Knack <sup>b</sup>	9.83 $\pm$ 3.39b	1.33 $\pm$ 0.50c	1.24 $\pm$ 0.48cd	0.13 $\pm$ 0.04c

Means in a column followed by the same letter are not significantly different; GLM, F protected LSD (P < 0.05).

<sup>a</sup>Ni-25 (L) = acetamiprid at 0.05 lbs-ai/ac, Ni-25 (M) = acetamiprid at 0.075 lbs-ai/ac, Ni-25 (H) = acetamiprid at 0.1 lbs-ai/ac, Fenoxy + Pym = fenoxycarb at 0.094 lbs-ai/ac + pymetrozine at 0.063 lbs-ai/ac, Diof + Pym (L) = diofenolan at 0.094 lbs-ai/ac + pymetrozine at 0.063 lbs-ai/ac, Diof + Pym (H) = diofenolan at 0.094 lbs-ai/ac + pymetrozine at 0.094 lbs-ai/ac and Knack at 8.0 oz/ac. All treatments included Kinetic at 0.01% v/v.

<sup>b</sup>Knack was applied only on application 1.

Table 4. Mean number  $\pm$  SEM of immature sweet potato whiteflies per 1 cm<sup>2</sup> collected from leaves from nodes 3-8, 17 Jul, 14 DAT application 2, Knack - 21 DAT application 1.

Treatments <sup>a</sup>	Eggs	Small Nymphs	Red-eyed Nymphs	Eclosed Pupae
Untreated	135.08 $\pm$ 13.27a	24.02 $\pm$ 1.67a	6.53 $\pm$ 1.19a	0.91 $\pm$ 0.22a
Ni-25 (L)	12.47 $\pm$ 3.67c	2.39 $\pm$ 1.00c	0.17 $\pm$ 0.06c	0.06 $\pm$ 0.03b
Ni-25 (M)	19.63 $\pm$ 5.25c	4.17 $\pm$ 2.09c	0.26 $\pm$ 0.23c	0.09 $\pm$ 0.07b
Ni-25 (H)	9.59 $\pm$ 4.02c	2.42 $\pm$ 0.71c	0.15 $\pm$ 0.03c	0.05 $\pm$ 0.03b
Fenoxo + Pym	11.84 $\pm$ 3.72c	3.53 $\pm$ 1.23c	0.33 $\pm$ 0.16bc	0.30 $\pm$ 0.14b
Diof + Pym (L)	46.69 $\pm$ 7.55b	8.56 $\pm$ 0.44b	1.23 $\pm$ 0.29b	0.34 $\pm$ 0.10b
Diof + Pym (H)	16.01 $\pm$ 2.57c	3.58 $\pm$ 0.83c	0.48 $\pm$ 0.16bc	0.08 $\pm$ 0.03b
Knack	7.42 $\pm$ 2.15c	2.53 $\pm$ 0.32c	0.41 $\pm$ 0.14bc	0.08 $\pm$ 0.04b

Means in a column followed by the same letter are not significantly different; GLM, F protected LSD (P < 0.05).

<sup>a</sup>Ni-25 (L) = acetamiprid at 0.05 lbs-ai/ac, Ni-25 (M) = acetamiprid at 0.075 lbs-ai/ac, Ni-25 (H) = acetamiprid at 0.1 lbs-ai/ac, Fenoxo + Pym = fenoxycarb at 0.094 lbs-ai/ac + pymetrozine at 0.063 lbs-ai/ac, Diof + Pym (L) = diofenolan at 0.094 lbs-ai/ac + pymetrozine at 0.063 lbs-ai/ac, Diof + Pym (H) = diofenolan at 0.094 lbs-ai/ac + pymetrozine at 0.094 lbs-ai/ac and Knack at 8.0 oz/ac. All treatments included Kinetic at 0.01% v/v.

<sup>b</sup>Knack was applied only on application 1.

Table 5. Mean number  $\pm$  SEM of immature sweet potato whiteflies per 1 cm<sup>2</sup> collected from leaves from nodes 3-8, 30 Jul, 12 DAT application 3.

Treatments <sup>a</sup>	Eggs	Small Nymphs	Red-eyed Nymphs	Eclosed Pupae
Untreated	157.23 $\pm$ 6.54a	66.12 $\pm$ 2.71a	4.63 $\pm$ 1.53a	0.53 $\pm$ 0.15a
Ni-25 (L)	8.16 $\pm$ 1.85b	4.23 $\pm$ 0.96cd	0.37 $\pm$ 0.19cd	0.02 $\pm$ 0.01d
Ni-25 (M)	9.63 $\pm$ 3.75b	2.88 $\pm$ 1.86d	0.49 $\pm$ 0.44cd	0.01 $\pm$ 0.01c
Ni-25 (H)	16.96 $\pm$ 0.50b	6.23 $\pm$ 1.26bcd	0.29 $\pm$ 0.08cd	0.21 $\pm$ 0.15bc
Fenoxo + Pym	10.78 $\pm$ 5.22b	4.60 $\pm$ 1.01bcd	0.46 $\pm$ 0.22cd	0.11 $\pm$ 0.01cd
Diof + Pym (L)	4.08 $\pm$ 1.65b	1.52 $\pm$ 0.31b	1.38 $\pm$ 0.53b	0.15 $\pm$ 0.06b
Diof + Pym (H)	16.72 $\pm$ 2.27b	10.49 $\pm$ 2.64bc	1.11 $\pm$ 0.49c	0.09 $\pm$ 0.03cd
Dan + Orth	4.00 $\pm$ 1.29b	1.86 $\pm$ 0.18d	0.07 $\pm$ 0.07d	0.01 $\pm$ 0.01d

Means in a column followed by the same letter are not significantly different; GLM, F protected LSD (P < 0.05).

<sup>a</sup>Ni-25 (L) = acetamiprid at 0.05 lbs-ai/ac, Ni-25 (M) = acetamiprid at 0.075 lbs-ai/ac, Ni-25 (H) = acetamiprid at 0.1 lbs-ai/ac, Fenoxo + Pym = fenoxycarb at 0.094 lbs-ai/ac + pymetrozine at 0.063 lbs-ai/ac, Diof + Pym (L) = diofenolan at 0.094 lbs-ai/ac + pymetrozine at 0.063 lbs-ai/ac, Diof + Pym (H) = diofenolan at 0.094 lbs-ai/ac + pymetrozine at 0.094 lbs-ai/ac and Dan + Orth = Danitol at 0.2 lbs-ai/ac + Orthene at 0.5 lbs-ai/ac. All treatments included Kinetic at 0.01% v/v.



Table 6. Mean number  $\pm$  SEM of immature sweet potato whiteflies per 1 cm<sup>2</sup> collected from leaves from nodes 3-8, 09 Aug, 8 DAT application 4.

Treatments <sup>a</sup>	Eggs	Small Nymphs	Red-eyed Nymphs	Eclosed Pupae
Untreated	213.83 $\pm$ 21.40a	52.15 $\pm$ 11.76a	7.43 $\pm$ 0.67a	0.64 $\pm$ 0.12a
Ni-25 (L)	6.98 $\pm$ 1.86c	1.84 $\pm$ 0.59b	0.19 $\pm$ 0.08c	0.09 $\pm$ 0.04bc
Ni-25 (M)	6.33 $\pm$ 1.75c	1.45 $\pm$ 0.11b	0.62 $\pm$ 0.19c	0.12 $\pm$ 0.07bc
Ni-25 (H)	3.75 $\pm$ 0.53c	0.44 $\pm$ 0.07b	0.32 $\pm$ 0.18c	0.05 $\pm$ 0.03c
Fenoxo + Pym	8.33 $\pm$ 1.80c	2.63 $\pm$ 0.49b	1.22 $\pm$ 0.36bc	0.06 $\pm$ 0.02c
Diof + Pym (L)	31.57 $\pm$ 8.38b	7.81 $\pm$ 1.79b	0.80 $\pm$ 0.43bc	0.29 $\pm$ 0.11b
Diof + Pym (H)	12.38 $\pm$ 1.94bc	3.66 $\pm$ 0.71b	1.85 $\pm$ 0.67b	0.18 $\pm$ 0.07bc
Dan + Orth	0.97 $\pm$ 0.19c	0.55 $\pm$ 0.11b	0.07 $\pm$ 0.04c	0.02 $\pm$ 0.01c

Means in a column followed by the same letter are not significantly different; GLM, F protected LSD (P < 0.05).

<sup>a</sup>Ni-25 (L) = acetamiprid at 0.05 lbs-ai/ac, Ni-25 (M) = acetamiprid at 0.075 lbs-ai/ac, Ni-25 (H) = acetamiprid at 0.1 lbs-ai/ac, Fenoxo + Pym = fenoxycarb at 0.094 lbs-ai/ac + pymetrozine at 0.063 lbs-ai/ac, Diof + Pym (L) = diofenolan at 0.094 lbs-ai/ac + pymetrozine at 0.063 lbs-ai/ac, Diof + Pym (H) = diofenolan at 0.094 lbs-ai/ac + pymetrozine at 0.094 lbs-ai/ac and Dan + Orth = Danitol at 0.2 lbs-ai/ac + Orthene at 0.5 lbs-ai/ac. All treatments included Kinetic at 0.01% v/v.

Table 7. Mean number  $\pm$  SEM of immature sweet potato whiteflies per 1 cm<sup>2</sup> collected from leaves from nodes 3-8, 20 Aug, 19 DAT application 4.

Treatments <sup>a</sup>	Eggs	Small Nymphs	Red-eyed Nymphs	Eclosed Pupae
Untreated	57.23 $\pm$ 23.41a	55.26 $\pm$ 17.58a	2.40 $\pm$ 1.01a	0.11 $\pm$ 0.06a
Ni-25 (L)	2.03 $\pm$ 0.86b	1.29 $\pm$ 0.33b	0.27 $\pm$ 0.08c	0.00 $\pm$ 0.00a
Ni-25 (M)	2.24 $\pm$ 0.52b	0.91 $\pm$ 0.12b	0.08 $\pm$ 0.03c	0.00 $\pm$ 0.00a
Ni-25 (H)	1.00 $\pm$ 0.14b	0.74 $\pm$ 0.33b	0.25 $\pm$ 0.07c	0.01 $\pm$ 0.01a
Fenoxo + Pym	3.91 $\pm$ 0.81b	2.60 $\pm$ 0.59b	0.86 $\pm$ 0.51bc	0.02 $\pm$ 0.01a
Diof + Pym (L)	6.66 $\pm$ 2.95b	6.61 $\pm$ 1.92b	1.13 $\pm$ 0.62b	0.03 $\pm$ 0.02a
Diof + Pym (H)	6.02 $\pm$ 2.55b	7.41 $\pm$ 2.65b	2.10 $\pm$ 1.16a	0.08 $\pm$ 0.07a
Dan + Orth	1.41 $\pm$ 0.27b	0.53 $\pm$ 0.13b	0.53 $\pm$ 0.13c	0.03 $\pm$ 0.03a

Means in a column followed by the same letter are not significantly different; GLM, F protected LSD (P < 0.05).

<sup>a</sup>Ni-25 (L) = acetamiprid at 0.05 lbs-ai/ac, Ni-25 (M) = acetamiprid at 0.075 lbs-ai/ac, Ni-25 (H) = acetamiprid at 0.1 lbs-ai/ac, Fenoxo + Pym = fenoxycarb at 0.094 lbs-ai/ac + pymetrozine at 0.063 lbs-ai/ac, Diof + Pym (L) = diofenolan at 0.094 lbs-ai/ac + pymetrozine at 0.063 lbs-ai/ac, Diof + Pym (H) = diofenolan at 0.094 lbs-ai/ac + pymetrozine at 0.094 lbs-ai/ac and Dan + Orth = Danitol at 0.2 lbs-ai/ac + Orthene at 0.5 lbs-ai/ac. All treatments included Kinetic at 0.01% v/v.

Table 8. Mean sooty mold / honey dew accumulation rating  $\pm$  SEM, 26 Sept.

Treatments <sup>a</sup>	Accumulation rating 1 to 5 scale <sup>b</sup>
Untreated	4.28 $\pm$ 0.18a
Ni-25 (L)	1.80 $\pm$ 0.31bcd
Ni-25 (M)	1.90 $\pm$ 0.49bcd
Ni-25 (H)	1.53 $\pm$ 0.32cd
Fenoxo + Pym	2.08 $\pm$ 0.46bcd
Diof + Pym (L)	2.85 $\pm$ 0.48b
Diof + Pym (H)	2.45 $\pm$ 0.26bc
Standard	1.03 $\pm$ 0.03d

Means in a column followed by the same letter are not significantly different; GLM, F protected LSD ( $P < 0.05$ ).

<sup>a</sup>Ni-25 (L) = acetamiprid at 0.05 lbs-ai/ac, Ni-25 (M) = acetamiprid at 0.075 lbs-ai/ac, Ni-25 (H) = acetamiprid at 0.1 lbs-ai/ac, Fenoxo + Pym = fenoxycarb at 0.094 lbs-ai/ac + pymetrozine at 0.063 lbs-ai/ac, Diof + Pym (L) = diofenolan at 0.094 lbs-ai/ac + pymetrozine at 0.063 lbs-ai/ac, Diof + Pym (H) = diofenolan at 0.094 lbs-ai/ac + pymetrozine at 0.094 lbs-ai/ac, Standard = Knack at 8 oz/ac followed no sooner than 21 days by Danitol at 0.2 lbs-ai/ac + Orthene at 0.5 lbs-ai/ac. All treatments included Kinetic at 0.01% v/v.

<sup>b</sup>Accumulations rating: 1 = none, 2 = evident on leaves only, 3 = light accumulation on lint, 4 = moderate on the lint and 5 = heavy accumulation on the lint.