

Impact of Insecticides Targeting Woolly Whitefly on Citrus Thrips and Mites¹

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Abstract

Nine foliar insecticide treatments with potential use for managing early-season populations of woolly whitefly were evaluated for their secondary impact on Texas citrus mites and citrus thrips. Assail provided efficacy towards thrips, but flared mites. Similarly, Provado provided activity towards thrips and there was weak evidence that it may flare mites as well. Applaud and Esteem appeared to have no appreciable impact on the mite or thrips population, and Danitol, Lorsban, Dimethoate and their combinations appear to be effective towards Texas citrus mite. However, Danitol used alone may aggravate thrips problems.

Introduction

In the past years considerable effort has been made in the evaluation of insecticides for their efficacy to woolly whitefly (WWF), *Aleurothrixus floccosus*. Among the insecticides evaluated was the combination of Lorsban or Dimethoate with Danitol. These combinations have proven to be extremely efficacious towards WWF, but their use has been discouraged in most cases, except late-season emergency clean-up situations, because of their harsh impact on WWF parasitoids. However, because they are such efficacious treatments, these products are still used in other situations including early-season when citrus thrips, *Scirtothrips citri*, are of concern. Although all of these products have efficacy towards citrus thrips, there is concern that their use may be causing rapid resurgence of citrus thrips populations resulting in additional insecticide applications for thrips control. This impact and effect are not certain at this point, but speculative based on casual observations. If citrus thrips populations are intensified by some insecticides used for WWF it is not known if this is due to the destruction of natural enemies of citrus thrips or if it is related to hormoligosis (direct stimulation of thrips reproduction) or trophobiosis (indirect stimulation of thrips reproduction).

In addition to Lorsban or Dimethoate with Danitol combinations, it is possible that other insecticides used for WWF may have an impact on citrus thrips and/or mites. Provado at the rates used for WWF control, is thought to have a detrimental impact on parasitoids, but little is known on its effect on the citrus thrips and mites. Esteem, Applaud and Assail are all thought to be relative safe to parasitoids, and although Assail has demonstrated some efficacy towards citrus thrips, little is known regarding their impact on thrips resurgence. In cotton, the active ingredient for Esteem (known as Knack in cotton) is frequently used for whitefly control. However, some have noticed that aphid populations in cotton frequently decline following Knack applications targeting whiteflies even though Knack is not

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known to impact aphids. Research has demonstrated that Knack has a subtle impact on aphid reproduction. It is possible that this same impact could occur with citrus thrips.

The objective of this study was to determine the impact of insecticides targeting WWF on citrus thrips and mites directly through toxicity or reproductive development, and indirectly via destruction of natural enemies of citrus thrips, primarily predaceous mites.

Materials and Methods

The test was conducted in 2006 on 8-yr-old lemons located at the Yuma Mesa Agricultural Center near Somerton, AZ. The test was a RCB design with four replicates. Each plot was 25 ft wide and 75 ft in length consisting of three trees. Treatments were applied on 21 April and 2 June depending on the occurrence of mites and/or citrus thrips. Treatments were applied using an air-assisted vertical boom delivering 100 gpa at 80 psi. The treatments tested consisted of nine insecticides used alone or in combinations for woolly whitefly control. These included: Applaud 70 DF at 0.5 lb/ac, Assail 30SG at 5.3 oz/ac, Esteem 0.86EC at 10 fl-oz/ac, Dantol 2.4EC at 21 fl-oz/ac, Dimethoate 4EC at 2 lbs-ai/ac, Lorsban 4EC at 1.5 qt/ac, Provado at 10 fl-oz/ac, Danitol at 16 fl-oz/ac + Lorsban at 1.33 qt/ac, and Danitol at 16 fl-oz/ac + Dimethoate at 2 lbs-ai/ac.

Mites were evaluated by collect five fully expanded leaves per plot and transporting them to the laboratory where the eggs, larvae and adult mites were counted with a dissecting microscope. Thrips were evaluated by tapping three flush terminal growths onto a black, 8 × 12-inch cake pan covered with 0.25-inch wire hardware cloth, and counting the number of nymph and adult thrips.

All data were analyzed using ANOVA and an F protected LSD ($P \leq 0.05$).

Results and Discussion

Mites

The incidence of predaceous mites was low throughout the trial and no meaningful data was collected, thus this data is not presented. By far the most common mite encountered was the Texas citrus mite (TCM); other phytophagous mite species were relatively rare.

At 4 days after treatment (DAT), all of the insecticides except Esteem had fewer TCM larvae, adults and motiles (larvae + adults) than the untreated (Table 1). Esteem did not differ from the untreated. Esteem is an IGR that mimics juvenile hormone and is not thought to have mite activity. Applaud is also an IGR, but is a chitin synthesis inhibitor. Applaud is not thought to have mite activity either, and based on its mode of action should not impact the mite population at 4 DAT if it did. The reason it demonstrated activity here is not certain, but when evaluating mite tests, evaluations at 2-4 DAT often provide unreliable results. At 11 DAT, Danitol, Dimethoate, Lorsban and their combinations all had fewer TCM eggs, larvae, adults and motiles than the untreated, whereas the other treatments did not differ from the untreated. Based on these results, applications of Danitol, Dimethoate, Lorsban or their combinations targeting woolly whitefly appear to be viable choices for control TCMs as well.

At 20 DAT, Assail appeared to be beginning to flare the mite population. At this time, the Assail treated plots contained more eggs and larval TCMs than the untreated. Applaud, Esteem and Provado were not affecting the mite populations, and the Danitol, Dimethoate, Lorsban and combination treatments were providing control. By 25 DAT, the TCM population was beginning to decline and there were no significant differences among the treatments for TCM eggs, and none of the treatments differed from the untreated for TCM larvae. However, Assail contained more larvae than then other insecticides except Dimethoate. At 25 DAT, Assail had significantly more adults and motiles than any other treatments. At this time, Provado had significantly more adults than the untreated as well.

Assail and Provado are both neonicotinoid insecticides and have both been implicated in flaring mites in a number of ornamental and row crops. In this test Assail definitively flared TCM whereas Provado did not appear to have as

great of an impact. Assail is considered to have more activity as a foliar spray than Provado, and it is possible that a higher rate of Provado may demonstrate similar results, but further testing is required.

Thrips

Following the first application on 21 April, the citrus thrips population was low and differences were not common. At 4 DAT, the Applaud treated plots contained more adult and total thrips than the untreated (Table 2). Against the mites at 4 DAT, Applaud had fewer mites than the untreated (Table 1); this relationship between TCM and citrus thrips has been casually noted before where high TCM numbers appear to correlate with low thrips numbers and vice versa. At this point I am not certain if this relationship is valid, but it is worthy of further investigation. The only treatments that had fewer adult and total thrips than the untreated were Provado and Danitol + Dimethoate (Table 2). At 11 DAT, Danitol when used alone appeared to be flaring the thrips. At this time it contained significantly more immature and total thrips than the untreated. Danitol has been shown to “aggravate” thrips problem in citrus trials and commercial groves in previous years, and this increase in thrips over the untreated has been blamed on the destruction of predatory mites. However, since we did not detect many predatory mites in this test, we can not be certain that this was the case. Studies with other thrips species have shown that sub-lethal dosages of some pyrethroids may increase thrips reproduction. Whether that is happening here or not is not certain.

The second application was applied on 2 June, which was towards the end of the thrips fruit susceptibility window. At 3 DAT, all of the treatments except Applaud and Esteem demonstrated some activity towards thrips (Table 3). Thus it appears that Danitol does have activity towards thrips but under certain conditions as the product degrades it may result in aggravated thrips problems. Beyond 3 DAT following application 2, we did not detect any differences among the treatments.

Overall, when selecting an insecticide treatment for managing woolly whitefly early in the season when mites and thrips may be present as well, Assail appears to provide efficacy towards thrips, but flares mites. Similarly, Provado provides activity towards thrips, and there is weak evidence that it may also flare mites. Applaud and Esteem appear to have no appreciable impact on mites or thrips, and Danitol, Lorsban, Dimethoate and their combinations appear to be effective towards mites, but Danitol alone may aggravate thrips problems.

Table 1. Mean number of Texas citrus mites per fully expanded lemon leaf.

Treatment	Rate amt product/acre	25 April (4 DAT)				2 May (11 DAT)				11 May (20 DAT)				16 May (25 DAT)			
		eggs	larvae	adults	motiles	eggs	larvae	adults	motiles	eggs	larvae	adults	motiles	eggs	larvae	adults	motiles
Untreated	--	11.80ab	8.70a	21.45a	30.15a	11.55ab	3.95ab	14.50a	18.45a	6.15b	4.30b	13.30ab	17.60ab	1.05a	0.20ab	0.20c	0.40bcd
Applaud 70DF	0.5 lbs	12.70a	2.70cd	4.65cd	7.35cd	7.90bc	1.95bcd	7.55abc	9.50abc	3.10bcd	1.40cd	3.50cde	4.90cd	0.40a	0.00b	0.20c	0.20cd
Assail 30SG	5.3 oz	9.40a-d	4.30bc	9.00bc	13.30bc	15.00a	5.20a	12.70a	17.90a	11.85a	7.70a	15.80a	23.50a	1.40a	0.50a	3.40a	3.90a
Esteem 0.86EC	10 fl-oz	7.05b-e	8.15ab	14.50ab	22.65ab	10.00ab	3.95ab	13.35a	17.30a	5.35bc	4.90b	9.70abc	14.60b	1.10a	0.05b	0.30c	0.35cd
Danitol 2.4EC	21 fl-oz	7.85a-e	1.00cd	2.90cd	3.90cd	0.85d	0.40cd	1.05c	1.45c	3.15bcd	1.10cd	3.55cde	4.65cd	1.35a	0.00b	0.00c	0.00d
Dimethoate 4EC	2 lbs-ai	5.05de	0.70cd	0.70cd	1.40d	3.85cd	1.05cd	3.90bc	4.95c	1.80cd	0.65cd	1.90de	2.55cd	0.45a	0.25ab	0.80bc	1.05bc
Lorsban 4E	1.5 qt	4.15e	0.20d	0.15d	0.35d	1.50d	0.10d	1.20c	1.30c	1.95cd	0.20cd	1.05e	1.25d	0.85a	0.00b	0.00c	0.00d
Provado 1.6F	10 fl-oz	6.85b-e	1.40cd	2.05cd	3.45cd	6.80bc	2.35bc	10.75ab	13.10ab	5.05bcd	2.75bc	7.80bcd	10.55bc	0.95a	0.00b	1.40b	1.40b
Danitol 2.4EC + Lorsban 4E	16 fl-oz + 1.5 qt	6.65cde	0.30d	0.50d	0.80d	0.95d	0.10d	0.05c	0.15c	1.35d	0.40cd	0.25e	0.65d	0.00a	0.00b	0.05c	0.05cd
Danitol 2.4EC + Dimethoate 4E	16 fl-oz + 2 lbs-ai	11.15abc	0.05d	0.05d	0.10d	0.95d	0.00d	0.00c	0.00c	1.50d	0.00d	0.20e	0.20d	0.40a	0.00b	0.00c	0.00d

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

Table 2. Mean number of citrus thrips per flush lemon growth following application 1.

Treatment	Rate amt product/acre	25 April (4 DAAP1)			2 May (11 DAAP1)			11 May (20 DAAP1)			16 May (25 DAAP1)		
		nymphs	adults	total	nymphs	adults	total	nymphs	adults	total	nymphs	adults	total
Untreated	--	1.08a	3.00b	4.08b	1.09b	1.08a	2.17b	1.83a	4.00a	5.83a	3.08a	3.42a	6.50a
Applaud 70DF	0.5 lbs	2.33a	8.42a	10.75a	1.00b	1.25a	2.25b	1.67a	4.59a	6.25a	4.08a	4.08a	8.17a
Assail 30SG	5.3 oz	0.08a	0.75bc	0.83bcd	0.50b	0.67a	1.17b	1.25a	4.00a	5.25a	2.34a	2.67a	5.00a
Esteem 0.86EC	10 fl-oz	0.67a	1.33bc	2.00bcd	0.34b	0.50a	0.84b	1.59a	5.33a	6.92a	10.08a	4.92a	15.00a
Danitol 2.4EC	21 fl-oz	2.17a	1.75bc	3.92bc	8.58a	1.42a	10.00a	3.17a	6.25a	9.42a	8.42a	6.50a	14.92a
Dimethoate 4EC	2 lbs-ai	0.25a	0.67bc	0.92bcd	0.67b	0.50a	1.17b	1.58a	4.42a	6.00a	6.50a	4.50a	11.00a
Lorsban 4E	1.5 qt	0.25a	1.00bc	1.25bcd	0.25b	1.00a	1.25b	1.25a	2.08a	3.33a	3.92a	3.00a	6.92a
Provado 1.6F	10 fl-oz	0.34a	0.33c	0.67d	0.33b	0.92a	1.25b	0.59a	2.34a	2.92a	3.58a	4.42a	8.00a
Danitol 2.4EC + Lorsban 4E	16 fl-oz + 1.5 qt	0.67a	1.17bc	1.83bcd	2.50b	0.92a	3.42b	3.42a	6.09a	9.50a	7.33a	5.17a	12.50a
Danitol 2.4EC + Dimethoate 4E	16 fl-oz + 2 lbs-ai	0.25a	0.33c	0.59d	0.42b	1.17a	1.59b	2.08a	3.42a	5.50a	9.25a	3.00a	12.25a

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

Table 2. Mean number of citrus thrips per flush lemon growth following application 2.

Treatment	Rate amt product/acre	5 June (3 DAAP2)			13 June (11 DAAP2)			21 June (19 DAAP2)		
		nymphs	adults	total	nymphs	adults	total	nymphs	adults	total
Untreated	--	33.00a	18.50a	51.50a	10.67a	8.83a	19.50a	11.67a	7.75a	19.42a
Applaud 70DF	0.5 lbs	17.67abc	13.59a	31.25abc	9.25a	2.84a	12.08a	13.83a	6.92a	20.75a
Assail 30SG	5.3 oz	2.58bc	7.75a	10.34cd	11.33a	7.42a	18.75a	30.17a	3.84a	34.00a
Esteem 0.86EC	10 fl-oz	18.75ab	8.08a	26.83a-d	2.67a	3.34a	6.00a	8.67a	4.83a	13.50a
Danitol 2.4EC	21 fl-oz	9.58bc	31.92a	41.50ab	15.25a	6.42a	21.67a	5.16a	3.00a	8.17a
Dimethoate 4EC	2 lbs-ai	12.58bc	12.83a	25.42bcd	5.00a	5.92a	10.92a	7.00a	6.50a	13.50a
Lorsban 4E	1.5 qt	1.17c	5.58a	6.75cd	13.50a	2.92a	16.42a	15.34a	8.58a	23.92a
Provado 1.6F	10 fl-oz	2.17bc	4.00a	6.17d	5.50a	8.84a	14.33a	13.67a	11.08a	24.75a
Danitol 2.4EC + Lorsban 4E	16 fl-oz + 1.5 qt	7.58bc	12.25a	19.83bcd	10.00a	7.42a	17.42a	6.67a	2.75a	9.42a
Danitol 2.4EC + Dimethoate 4E	16 fl-oz + 2 lbs-ai	3.58bc	10.42a	14.00cd	10.67a	3.75a	14.42a	12.09a	5.08a	17.17a

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