Insecticide Rotation and Pre-Petal Fall Applications for Citrus Thrips Management[1]

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Abstract

Under low citrus thrips pressure and cool temperatures, Alert, Baythroid, Carzol, Success and Acetamiprid applied at petal fall were all effective control agents. Mid-season applications of Baythroid and Danitol were also effective but appeared to be slightly inferior to Success and Alert in residual control. Despite the prolonged blooming and petal drop period experienced during this trial, plots receiving pre-petal fall applications of Acetamiprid did not produce higher quality fruit than treatments where applications began following petal fall. The fact that thrips densities were low during this period may be the reason. Before pre-petal fall insecticide applications can be deemed useful and economically justifiable, evaluations must be made at higher thrips infestation levels.

Introduction

Although citrus thrips, *Scirtothrips citri* (Moulton), are considered an economically damaging pest of mature citrus only after petal fall, under certain conditions control may be advisable prior to petal fall. During years with warm temperatures in January and February, lemons will sometimes bloom early and over an extended period of 3 to 4 weeks. During this time, although petal fall (>75% petal drop) hasn't completed, there are many susceptible fruit present, and due to the presence of honeybees, insecticide use is greatly restricted. Whether of not treating under these conditions is economically beneficial is questionable, but should be investigated. Furthermore we need to identify efficacious insecticides that are safe towards bees for use during this window. Acetamiprid may fit this role. Acetamiprid (Rhone-Poulenc) is considered safe towards honeybees and has demonstrated thrips activity, but only early in the season when temperatures are moderate. In this study we report the activity of Acetamiprid toward citrus thrips pre-petal fall and at petal fall. We also report efficacy of a variety of insecticides to citrus thrips in several rotation regimes.

Materials and Methods

Eleven-year old 'Limoneira 8A Lisbon' lemon trees grown on the Yuma Mesa were used in these studies. The test was a randomized complete block design consisting of four replicates. Each plot consisted of three trees in a row spaced about 30 ft apart. Treatments included eight insecticide regimes and an untreated check (rates and treatments provided in Tables 1 and 2. Treatments were applied on an as needed basis, when the number of fruit infested with immature citrus thrips was ≥10%. Applications were made using a backpack air-blast sprayer calibrated to deliver 100 gal/acre.

Percent-infested fruit were estimated by sampling ten fruit per tree for the presence or absence of immature citrus thrips. Fruit damage was estimated on 19 Aug, by rating the degree of scarring to the rind. Scarring was rated as 1=no

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scarring, 2=slight scarring around the stem, 3=significant scarring around the stem, 4=slight scarring on the side of the fruit and 5=major scarring on the side of the fruit. Fruit with a damage rating of 2, are not considered to be scarred heavy enough to cause a downgrade in quality. Fruit with a 3 damage rating, are considered slightly scarred and subject to downgrading to choice, while fruit with damage ratings of 4 or 5 are graded as juice. Differences among insecticide treatments for thrips infestation and fruit grade were separated using ANOVA and an F protected LSD, $P<0.05$.

Results and Discussion

Environmental conditions in 1999 were conducive for an extended bloom and petal drop period. Petal drop and fruit set began in late March but due to cool temperatures in late March and April, petal fall did not occur until mid to late April. To protect the early fruit set, Acetamiprid was applied on 25 March. However this application did not appear to provide adequate control based on a 10% infestation threshold, and another treatment was applied on 9 April (Table 1). The reason for this lack of control is not certain. Although this test received approximately 1 inch of precipitation on 2 April, this was probably not the reason for the lack on control with Acetamiprid detected on 5 April (11 DAT, Days after treatment). Acetamiprid is toxic to citrus thrips for only a few days following application and under conditions where thrips eggs are hatching asynchronously, thrips hatching after the application may not be controlled. A follow-up application of Acetamiprid on 9 April effectively controlled the thrips (Table 1).

Insecticides scheduled to be sprayed following petal fall were applied on 20 April (Table 1). All the treatments were highly effective, and did not require another application until 14 May (Table 2). Following this application Success and Alert provided effective control and did not require any more applications (Table 2). Baythroid appeared slightly weaker than Success and Alert by 11 DAT, but never exceeded the 10% infestation threshold for the remainder of the season. The effectiveness of Danitol was similar to Baythroid, but for an unknown reason had one tree in one plot on which thrips were not controlled. This resulted this treatment exceeding the action threshold and requiring a follow up application of Success on 26 May (Table 2).

Based on fruit scarring damage ratings, all of the insecticide treatment regimes outperformed the untreated, and produced equivalent percentages of fancy, choice and juice fruits (Table 2). Under the conditions experienced in this trial, the advantages of using Acetamiprid pre-petal fall were not apparent. Despite the prolonged blooming and petal drop period experienced during this trial, plots receiving pre-petal fall applications of Acetamiprid did not produce higher quality fruit than treatments where applications began following petal fall. The fact that thrips densities were low during this period may be the reason. Before pre-petal fall insecticide applications can be deemed useful and economically justifiable, evaluations must be made at higher pre-petal fall thrips infestation levels. Additional, the 10% infestation threshold used in this study may be to low and may need to be modified for triggering pre-petal fall applications.

Table 1. Percentage of fruit infested with immature citrus thrips on lemons following applications 1, 2 and 3.

	Applications and mean percentage fruit infested with immature citrus thrips (CT)							
	25 Mar	5 Apr 11 DAT	9 Apr	15 Apr 6 DAT	20 Apr	27 Apr 7 DAT	6 May 16 DAT	13 May 23 DAT
Treatment Regime[ab]	Applications # 1	CT (79.2°F)[c]	Applications # 2	CT (75.7°F)	Application #3	CT (85.9°F)	CT (83.7°F)	CT (86.5°F)
1.	Untreated	18.83 a	Untreated	15.00 a	Untreated	7.50 a	15.00 a	39.17 a
2.	none	15.00 a	none	12.50 a	Alert	0.83 b	0.83 b	13.33 b
3.	none	13.33 a	none	10.00 a	Success	0.00 b	2.50 b	14.17 b
4.	none	11.66 a	none	10.00 a	Baythroid	0.00 b	2.50 b	25.83 ab
5.	none	13.33 a	none	11.67 a	Alert	0.00 b	4.17 b	15.00 b
6.	none	12.50 a	none	10.00 a	Alert	0.83 b	4.17 b	16.67 b
7.	Acetamiprid	10.00 a	Acetamiprid	0.83 b	Carzol	0.00 b	0.83 b	22.50 b
8.	none	10.00 a	none	8.33 a	Acetamiprid	0.00 b	2.50 b	13.34 b
9.	none	21.67 a	none	16.67 a	Carzol	0.83 b	0.83 b	11.67 b

Means in a column followed by the same letter are not significantly different (F protected LSD $P < 0.05$).
[a]Rates: Acetamiprid (0.1 lbs-ai/ac), Alert (0.3 lbs-ai/ac), Baythroid (6.4 oz/ac), Carzol (1.5 lbs/ac), and Success (6 oz/ac).
[b]All treatments were applied with Kinetic non-ionic surfactant at 0.1% v/v, Carzol also included Neutralizer buffer at 0.125 % v/v.
[c]Average maximum daily temperature °F, from time of most recent application.

Table 2. Percentage of fruit infested with immature citrus thrips on lemons following applications 4 and 5, and fruit grade based on thrips scarring.

	Applications and mean percentage fruit infested with immature citrus thrips (CT)										Percent Grade based on thrips scarring		
	14 May	18 May 4 DAT	20 May 6 DAT	25 May 11 DAT	26 May	2 June 7 and 18 DAT	10 June 15 and 26 DAT	15 June 20 and 31 DAT	22 June 27 and 38 DAT				
Treatment Regime[ab]	Application # 4	CT (93.8°F)	CT (94.7°F)	CT (94.2°F)	Application # 5	CT (97.9°F)	CT (94.7°F)	CT (96.9°F)	CT (102.7°F)	No. appl.	Fancy	Choice	Juice
1.	Untreated	35.84 a	37.50 a	26.65 a	Untreated	22.49 a	17.50 a	17.48 a	5.00 ab	0	43.25 a	52.45 a	4.30 a
2.	Success	3.34 cd	2.50 b	3.33 cd	none	0.00 b	4.17 bc	4.17 b	4.17 abc	2	77.50 b	22.50 b	0.00 b
3.	Alert	0.00 d	1.67 b	3.33 cd	none	5.84 b	5.00 bc	4.17 b	0.00 c	2	76.67 b	23.33 b	0.00 b
4.	Success	1.67 cd	2.50 b	0.83 d	none	5.83 b	2.50 c	1.67 b	5.83 a	2	76.67 b	23.33 b	0.00 b
5.	Baythroid	7.50 bc	2.50 b	9.18 bc	none	5.00 b	8.33 b	6.67 b	4.17 abc	2	89.17 b	10.83 b	0.00 b
6.	Danitol	10.83 b	5.75 b	13.33 b	Success	4.18 b	5.84 bc	3.33 b	7.50 a	3	76.68 b	22.50 b	0.83 b
7.	Success	2.50 cd	3.33 b	4.18 c	none	3.33 b	3.33 bc	4.17 b	4.17 abc	4	80.83 b	18.33 b	0.83 b
8.	Success	1.67 cd	1.67 b	0.00 d	none	1.67 b	2.50 c	1.67 b	0.00 c	2	79.18 b	19.98 b	0.83 b
9.	Success	0.83 d	2.50 b	4.17 c	none	2.50 b	4.17 bc	3.33 b	0.83 bc	2	77.50 b	20.83 b	1.67 b

Means in a column followed by the same letter are not significantly different (F protected LSD $P < 0.05$).
[a]Rates: Alert (0.3 lbs-ai/ac), Baythroid (6.4 oz/ac), Danitol (21 oz/ac), and Success (6 oz/ac).
[b]All treatments were applied with Kinetic non-ionic surfactant at 0.1% v/v.
[c]Average maximum daily temperature °F, from time of most recent application.