Evaluation of Pre-Petal Fall Citrus Thrips Control[1]

David L. Kerns and Tony Tellez

Abstract

A small plot trial was conducted to evaluate the benefit of applying insecticides for citrus thrips management pre-petal fall. Because of low thrips densities during the pre-petal period, we were not able to discern tangible benefits from making pre-petal applications. However, in situations where fruit is present and petal fall has not fully occurred, these applications may be useful to protect these fruit. Of the acute toxicants evaluated pre-petal fall (Assail and Success), Assail appeared to be the best choice. However, if temperatures are approaching 95°F, Assail should be avoided. Pre-petal fall applications of Surround and Snow are beneficial in respect that several applications of these products may be required to obtain adequate coverage, and by making these applications during the pre-petal fall period, thrips can be managed before many susceptible fruit are present.

Introduction

Traditionally, citrus thrips, *Scirtothrips citri*, control programs begin at petal fall and continue until a majority of the fruit is ca. 1 inch in diameter. However, there are times when petal fall is extremely non-uniform and it is desirable to apply insecticides to protect the early fruit. But because of potential honeybee toxicity problems with many insecticides, these fruit are often left at the mercy of the thrips. Beside the possibility of protecting fruit during periods of non-uniform petal fall, there may be other benefits to pre-petal fall thrips control programs. If early pre-petalfall thrips egg hatches can be chemically mediated, later populations when susceptible fruit is present may be greatly reduced. Today we have several products that are safe towards honeybees, and effective toward thrips. These materials include: 1) Surround. Surround is a mineral particle film white wash that has been shown to effectively repel and/or kill thrips, 2) Success. Success has been used commercially for several years and has proven to be extremely efficacious against citrus thrips; although toxic to bees if sprayed on them, it is safe after it dries, and 3) Assail. Assail is an experimental insecticide being developed by Aventis; although ineffective at high temperatures, it has proven efficacious early in the season. Like Success, Assail may be toxic to bees on contact, but is safe after it dries. In addition to these products, the crop sun protectant Snow, may have insect control properties. This product is similar to Surround. Both are kaolin based, but Snow lacks the degree of refinement or purity compared to Surround.

In this study, we investigate the use of these insecticides for pre-petal fall thrips management, compared to standard insecticide rotation programs.

[1]The authors wish to thank the Arizona Citrus Research Council for financial support for this project. This is a portion of the final report for project 2000-03 'Evaluation of pre petal fall citrus thrips control'.

This is a part of publication az1275: "2001 Citrus and Deciduous Fruit and Nut Research Report," College of Agriculture and Life Sciences, the University of Arizona, Tucson, Arizona, 85721.

Materials and Methods

Seven year old 'Limoneira 8A Lisbon' lemon trees grown at the Yuma Mesa Agricultural Center were used in this study. The test was a randomized complete block design consisting of four replicates. Each plot consisted of three trees in a row spaced ca. 30 ft apart. Treatment regimes are outlined in Table 1. Pre-petal fall treatments were applied based on physiological timing of the trees. Subsequent applications of Surround and Snow were based on visual perception of coverage by these products. All other treatments were applied as needed based on a 10% fruit infested with immature thrips action threshold. Although 3 or 4 treatments are outlined for each treatment regime, some were not necessary due to inadequate thrips populations (Table 1). Applications of Assail, Lorsban, or Success contained the non-ionic surfactant Kinetic at 0.1%v/v. Applications of Carzol or Dimethoate contained the acidifying surfactant LI-700 at 1.0%v/v. All 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 05 Oct, by rating the degree of scarring to the rind. Scarring was rated as 1=no 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 1, were considered Fancy grade, while those with a rating of 2 or 3 were considered choice. Fruit with damage ratings of 4 or 5 were graded as juice. Differences among insecticide treatments for thrips infestation, fruit grade and the cost effectiveness index were separated using ANOVA and an F protected LSD, $P<0.05$.

Results and Discussion

The pre-petal fall applications were made on 24 Mar while the thrips populations were low across all the plots averaging about 1.0% infested fruit (Table 2). Following the pre-petal fall application, temperatures were cool with maximum daily temperatures averaging in the low and mid-80's. By 16 days after treatment (DAT), the thrips populations had declined to undetectable levels. During the period between the pre-petal fall application and the petal fall, there were no significant differences among the treatments. The first post-petal fall applications occurred on 17 Apr, when Surround and Snow were re-applied to achieve adequate coverage although the thrips populations were very low (Table 1). There were no detectable differences among treatments until 16 days after the 2nd application. At that time, all the treatments applied up to that point were significantly lower than the untreated.

On 05 May, the treatments that had not been sprayed up to that point were applied (Table 3). Additionally, since the pre-petal fall application of Success was near the 10% threshold, Assail was applied in that treatment regime. By 5 DAT, all the treatments had significantly fewer infested fruit than the untreated. However, the pre-petal fall application of Success followed by Assail, the pre-petal fall application of Assail, Dimethoate, and the post-petal fall application of Surround all had infestations approaching the action threshold. The fact that the post-petal fall application of Assail did not perform well was not unexpected. In previous tests, Assail has not performed well at high temperatures. In this study, the maximum daily temperatures were averaging ca. 95°F. Thus, Assail should not be considered for thrips control once the temperatures approach 95°F. Additionally, Surround applied beginning at post-petal fall required an additional application probably because of inadequate coverage by a single application. The 05 May treatments of Carzol did not require additional applications for the remainder of the study. The final applications were made on 15 May (Table 3). Following this application the thrips population gradually declined across the entire test and all the treatment regimes provided good control.

Fruit scarring was low in this study, and we were not able to detect any differences in the percentages of fancy, choice, or juice grade fruits due to thrips scarring (Figure 1).

Because of the low thrips numbers, we could not detect any tangible benefit from making pre-petal fall applications of insecticides for citrus thrips management. However, because multiple applications of Surround and Snow are required to achieve adequate coverage with these coating type products, pre-petal fall applications before susceptible fruit is present is a good use strategy. Used in this manner, both Surround and Snow offered good thrips control. Previous studies have shown that Surround does not interfere with photosynthesis or stomatal conductance; whether or not Snow has this ability is not known. During the pre-petal fall period when there is a significant amount of susceptible fruit present and bee kill is of concern, Assail, Surround and Snow appear to be good choices. In this study Success did not appear to be as

effective in this use window. In other studies, for unknown reasons, Success has performed inconsistently very early in the season as well. Thus, Success may not be the product of choice for pre-petal fall applications.

Table 1. Treatment schedule.[1,2]

Treat. Regime	Pre-petal fall	Post-petal fall #1	Post-petal fall #2	Post-petal fall #3
1.	Untreated	Untreated	Untreated	Untreated
2.	Assail (0.1 lbs-ai/ac)	Success (6oz/ac)	Dimethoate (2.0 lbs-ai/ac)[3]	Success (6oz/ac)[3]
3.	Success (6oz/ac)	Assail (0.1 lbs-ai/ac)	Dimethoate (2.0 lbs-ai/ac)	Success (6oz/ac)[3]
4.	Surround (75 lbs/ac)	Surround (50 lbs/ac)	Surround (50 lbs/ac)[3]	Surround (50 lbs/ac)[3]
5.	Snow (100 lb/ac)	Snow (80 lbs/ac)	Snow (80 lbs/ac)[3]	Snow (80 lbs/ac)[3]
6.	none	Dimethoate (2.0 lbs-ai/ac)	Success (6oz/ac)	Baythroid (6.4 oz/ac)[3]
7.	none	Carzol (1.25 lbs/ac)	Success (6oz/ac)[3]	Baythroid (6.4 oz/ac)[3]
8.	none	Lorsban (2 qt/ac)	Success (6oz/ac)	Baythroid (6.4 oz/ac)[3]
9.	none	Carzol (1.25 lbs/ac)	Lorsban (2 qt/ac)[3]	Success (6oz/ac)[3]
10.	none	Carzol (1.25 lbs/ac)	Surround (75 lbs/ac)[3]	Surround (50 lbs/ac)[3]
11.	none	Surround (75 lbs/ac)	Surround (50 lbs/ac)	Surround (50 lbs/ac)[3]

[1]Treatments were applied as need when the percentage of fruit infested with immature thrips approached or exceeded 10%.
[2]Assail, Success, and Lorsban were applied with Kinetic non-ionic surfactant at 0.1% v/v; Carzol and Dimethoate were applied with LI-700 acidifying surfactant at 0.1 % v/v.
[3]These treatments were never applied because the thrips did not reach the action threshold.

Table 2. Percentage of fruit infested with immature citrus thrips on lemons following two pre-petal fall applications.

	Applications and mean percentage fruit infested with immature citrus thrips (CT)					
	24 Mar	05 Apr 10 DAT	11 Apr 16 DAT	17 Apr	26 Apr 9 DAT	03 May 16 DAT
Treatment Regime[ab]	Application # 1	CT (83.6°F)[c]	CT (86.8°F)	Application # 2	CT (87.9°F)[c]	CT (91.9°F)[c]
1. wht	Untreated	1.67 a	0.00 a	none	5.00 a	19.17 a
2.pink	Assail	2.50 a	0.00 a	none	2.50 a	3.33 b
3.blue	Success	0.00 a	0.00 a	none	4.17 a	8.33 b
4.w/yel	Surround	0.83 a	0.00 a	Surround	0.00 a	1.67 b
5.w/oran	Snow	0.00 a	0.00 a	Snow	0.00 a	1.67 b
6.oran	none	NA	NA	none	NA	NA
7.yel	none	NA	NA	none	NA	NA
8.gren	none	NA	NA	none	NA	NA
9.blk	none	NA	NA	none	NA	NA
10.blk/yel	none	NA	NA	none	NA	NA
11.blk/or	none	NA	NA	none	NA	NA

Means in a column followed by the same letter are not significantly different (F protected LSD $P < 0.05$).
[a]Rates: treatment regime 1. = untreated; treatment regime 2. app. 1 = Assail 70 WP (0.1 lbs-ai/ac), app. 4 = Success (6 oz/ac); treatment regime 3. app. 1 = Success (6oz/ac), app. 3 = Assail 70 WP (0.1 lbs-ai/ac), app. 4 = Dimethoate 3EC (2.0 lbs-ai/ac); treatment regime 4. app. 1 = Surround (75 lbs/ac), app. 2 = Surround (50 lbs-ai/ac); treatment regime 5. app. 1 = Snow (100 lbs/ac), app. 2 = Snow (80 lbs/ac); treatment regime 6. app. 3 = Dimethoate 3EC (2.0 lbs-ai/ac), app. 4 = Success (6.0 oz/ac); treatment regime 7. app. 3 = Carzol (1.25 lbs/ac); treatment regime 8. app. 3 = Lorsban 4E (2 ac/ac), app. 4 = Success (6oz/ac); treatment regime 9. app. 3 = Carzol (1.25 lbs/ac); treatment regime 10. app. 3 = Carzol (1.25 lbs/ac); treatment regime 11. app. 3 = Surround (75 lbs/ac), app. 4 = Surround (50 lbs/ac).
[b]Treatments containing Assail 70WP, Lorsban 4E or Success were applied with Kinetic non-ionic surfactant at 0.1% v/v; treatments containing Dimethoate 4E or Carzol were applied with LI-700 acidifier at 1.0% v/v.
[c]Average maximum daily temperature °F, from time of most recent application.

Table 3. Percentage of fruit infested with immature citrus thrips on lemons following two post petal fall applications.

	Applications and mean percentage fruit infested with immature citrus thrips (CT)							
	05 May	11 May 5 DAT	15 May	19 May 4 DAT	24 May 9 DAT	31 May 16 DAT	08 Jun 24 DAT	14 Jun 30 DAT
Treatment Regime[ab]	Application # 3	CT (95.3EF)[c]	Application # 4	CT (90.6°F)[c]	CT (97.9°F)[c]	CT (99.8°F)[c]	CT (101.4°F)[c]	CT (101.1°F)[c]
1.	Untreated	24.17 a	Untreated	12.50 a	19.17 a	10.00 a	12.50 a	3.33 a
2.	none	7.50 bc	Success	0.00 c	7.50 b	0.83 b	1.67 b	1.67 a
3.	Assail	8.33 b	Dimethoate	0.00 c	2.50 c	0.83 b	1.67 b	0.83 a
4.	none	2.50 bcd	none	0.83 c	2.50 c	2.50 b	0.00 b	2.50 a
5.	none	4.17 bcd	none	5.83 b	5.00 bc	0.83 b	1.67 b	0.83 a
6.	Dimethoate	8.33 b	Success	0.00 c	2.50 c	0.83 b	0.83 b	0.00 a
7.	Carzol	1.67 cd	none	0.83 c	5.00 bc	2.50 b	3.33 b	1.67 a
8.	Lorsban	8.33 b	Success	2.50 bc	0.83 c	0.00 b	1.67 b	0.83 a
9.	Carzol	1.67 cd	none	0.00 c	1.67 c	0.83 b	2.50 b	2.50 a
10.	Carzol	0.83 d	none	0.83 c	2.50 c	0.83 b	3.33 b	2.50 a
11.	Surround	7.50 bc	Surround	0.83 c	0.83 c	0.00 b	0.83 b	0.00 a

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

[a]Rates: treatment regime 1. = untreated; treatment regime 2. app. 1 = Assail 70 WP (0.1 lbs-ai/ac), app. 4 = Success (6 oz/ac); treatment regime 3. app. 1 = Success (6oz/ac), app. 3 = Assail 70 WP (0.1 lbs-ai/ac), app. 4 = Dimethoate 3EC (2.0 lbs-ai/ac); treatment regime 4. app. 1 = Surround (75 lbs/ac), app. 2 = Surround (50 lbs-ai/ac); treatment regime 5. app. 1 = Snow (100 lbs/ac), app. 2 = Snow (80 lbs/ac); treatment regime 6. app. 3 = Dimethoate 3EC (2.0 lbs-ai/ac), app. 4 = Success (6.0 oz/ac); treatment regime 7. app. 3 = Carzol (1.25 lbs/ac); treatment regime 8. app. 3 = Lorsban 4E (2 ac/ac), app. 4 = Success (6oz/ac); treatment regime 9. app. 3 = Carzol (1.25 lbs/ac); treatment regime 10. app. 3 = Carzol (1.25 lbs/ac); treatment regime 11. app. 3 = Surround (75 lbs/ac), app. 4 = Surround (50 lbs/ac).

[b]Treatments containing Assail 70WP, Lorsban 4E or Success were applied with Kinetic non-ionic surfactant at 0.1% v/v; treatments containing Dimethoate 4E or Carzol were applied with LI-700 acidifier at 1.0% v/v.

[c]Average maximum daily temperature °F, from time of most recent application.

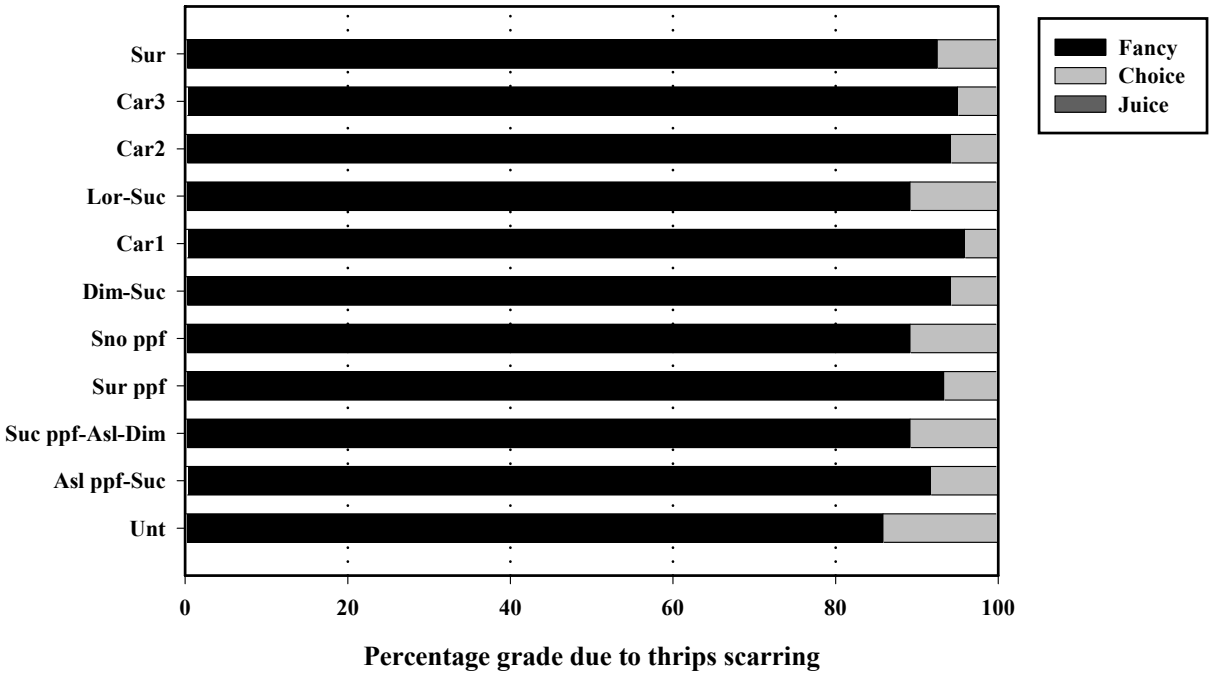

Figure 1. Percentages of grades of lemons managed under 11 treatment regimes. Unt = untreated; Asl ppf-Suc = Assail applied pre-petal fall followed by Success; Suc ppf-Asl-Dim = Success applied pre-petal fall followed by Assail and Dimethoate; Sur ppf = Surround applied pre-petal fall followed by Surround; Sno ppf = Snow applied pre-petal fall followed by Snow; Dim-Suc = Dimethoate applied post petal fall followed by Success; Car1 = Carzol applied post petal fall (second rotation product not needed); Lor-Suc = Lorsban applied post petal fall followed by Success; Car2 = Carzol applied post petal fall (second rotation product not needed); Car3 = Carzol applied post petal fall (second rotation product not needed); Sur = Surround applied post petal fall followed by Surround.