Using Feeding Stimulants to Increase Insecticidal Control of Citrus Thrips[1]

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Abstract

Carzol and Success with and without the addition of the feeding stimulants molasses and bee-collected pollen were evaluated for their control of citrus thrips on lemons on the Yuma Mesa. Although normal use rate of Carzol and Success were efficacious toward citrus thrips, the addition of either molasses or pollen to these insecticides as a means of increasing efficacy at low rates was not encouraging. At no point did the feeding stimulants appear to increase the efficacy of the same rate of Carzol when used alone, and it appeared that the additives may have actually decreased the efficacy of Success.

Introduction

Citrus thrips, *Scirtothrips citri*, continues to be the most economically important arthropod pest of Arizona citrus and insecticides are commonly utilized to control this pest. Currently, Success is the most popular insecticide utilized for citrus thrips control, and applications of this product comprises the majority of expenditures in most citrus thrips control programs. Most growers apply Success at rates of 4 to 8 fl-oz per acre. Growers could see a significant economic benefit if they were able to utilize reduced rates of Success without compromising thrips control. Although Success has contact activity, its residual activity is derived through ingestion. It is possible that feeding stimulants could be used in conjunction with Success to increase its activity at low rates. In addition to Success, there is interest in the addition of feeding stimulants with Carzol for thrips control. Although Carzol's activity is thought to be from direct contact, there is some evidence that the addition of sugar with Carzol in South Africa has resulted in increased efficacy at low rates. Sugar has been used for a number of years as a feeding stimulant for citrus thrips in California with sabadilla. However, in Arizona, we have not observed any benefit from using sugar with any insecticides for thrips control, probably due to the hot, dry climate. It has been speculated that molasses might be an alternative for sugar in Arizona. The performance of Success with other insect pests has been improved by the addition of the feeding stimulant monosodium glutamate. Against western flower thrips, *Franklinella occidentalis* in vegetables, Success efficacy has been slightly enhanced by pollen and molasses. Molasses has been used as a thrips feeding stimulant for years, but has not been evaluated in combination with the newer insecticides in citrus. Using pollen as a feeding stimulant is a new concept. Pollen is a favored food for many thrips species, and most thrips will readily feed on it. If pollen were contaminated with Success or Carzol, it is conceivable that the thrips would ingest the toxicant, essentially increasing their exposure.

In this study Success and Carzol are evaluated with the addition of molasses and pollen as a mean to increase efficacy at lower insecticide rates.

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Materials and Methods

This study was conducted on nine-year-old 'Limoneira 8A Lisbon' lemons on *Citrus volkameriana* rootstock. The trial was a randomized complete block design with four replicates per treatment. Each plot consisted of three trees. Treatments were applied using an air-assisted vertical boom, calibrated to deliver 100 gal/ac.

The treatments for the Carzol test included an untreated check, Carzol at 1.0 lb/ac, and Carzol at 0.25 lb/ac with and without molasses at 20.0 lb/ac and honeybee collected pollen at 20.0 lb/ac. Success was evaluated at 6 fl-oz/ac, and at 2 fl-oz/ac with and without molasses and pollen at 20.0 lb/ac each. All Carzol treatments included the acidifying surfactant LI-700 at 1.0% v/v and the Success treatments all included the non-ionic surfactant Kinetic at 0.1% v/v.

The initial treatments were applied on 7 May 2004. Following this application subsequent applications were applied as need based on an approximate threshold of 10% infested fruit. A second application was made on 2 July 2004. Although the second application was not within the window of fruit susceptibility to citrus thrips scarring, it was made as a mean of generating more data.

Citrus thrips populations were estimated by counting the number of fruit with at least one immature thrips. Thirty fruit were sampled per plot. Samples were taken 3 days after treatment (DAT), at 7 DAT, and thereafter at weekly intervals.

Differences among insecticide treatments for thrips infestation and fruit damage were separated using ANOVA and an F protected LSD, $P \leq 0.05$.

Results and Discussion

During 2004, April was exceptionally cool and the citrus thrips populations did not reach economically damaging levels on the fruit from the primary bloom period until May. Subsequently, the citrus thrips populations in the test block of lemons were not very high, never exceeding 23% infested fruit. On 7 May, the citrus thrips population was averaging 12% infested fruit across all treatments. Since the test exceeded the action threshold of 10% infested fruit, the initial application of the test materials was made on 7 May.

Carzol Test

At 3, 7, 12 and 18 DAT, all of the Carzol treatments contained fewer thrips infested fruit than the untreated, but there were no differences among the Carzol treatments (Table 1). On 2 June at 26 DAT, the Carzol treatments continued to have fewer infested fruit than the untreated but Carzol at 0.25 lb/ac + pollen had fewer infested fruit than the same rate of Carzol without pollen and was statistically similar to Carzol at 1.0 lb/ac. Beyond 26 DAT, there were no differences among any of the treatments. Four days following application 2, all of the Carzol treatments had fewer infested fruit than the untreated, but did not differ from each other (Table 2). At 7, 14, and 20 DAT there were no significant differences among the treatments.

Success Test

At 3 DAT following application 1, Success mixed with either molasses or pollen failed to differ from the untreated while Success used alone had fewer infested fruit (Table 3). At 7 DAT, Success + pollen still did not differ from the untreated while Success + Molasses had fewer infested fruit. By 12 DAT, all of the Success treatment had fewer infested fruit than the untreated, but at 26 DAT Success + molasses failed to differ from the untreated. The only point where the addition of pollen or molasses demonstrated an increase in efficacy over the same rate of Success alone was at 53 DAT with Success + molasses. Following application 2, the only sample where any of the Success treatments contained fewer infested fruit than the untreated occurred at 7 DAT, at which time there were no significant differences among the Success treatments.

Overall, the addition of either molasses or pollen to Carzol or Success as a means of increasing efficacy of these products at low rates was not encouraging. At no point did the feeding stimulants appear to increase the efficacy of the same rate

of Carzol used alone, and it appeared that the additives may have actually decreased the efficacy of Success.

Table 1. Efficacy of Carzol with and without feeding stimulants to citrus thrips on lemons, application 1.

		Percentage of fruit infested with immature citrus thrips							
Treatment	Rate	10 May 3 DAT	14 May 7 DAT	19 May 12 DAT	25 May 18 DAT	2 Jun 26 DAT	9 Jun 33 DAT	18 Jun 42 DAT	29 Jun 53 DAT
Untreated	--	21.67 a	22.50 a	19.17 a	16.67 a	11.67 a	11.67 a	8.33 a	15.83 a
Carzol	1.0 lb/ac	5.00 b	3.33 b	1.67 b	5.83 b	0.83 d	6.67 a	4.17 a	11.67 a
Carzol	0.25 lb/ac	6.67 b	9.17 b	5.00 b	6.67 b	7.50 b	9.17 a	7.50 a	15.00 a
Carzol + molasses	0.25 lb/ac + 20.0 lbs/ac	5.00 b	3.33 b	3.33 b	4.17 b	5.00 bc	5.00 a	6.67 a	11.67 a
Carzol + pollen	0.25 lb/ac + 20.0 lbs/ac	9.17 b	5.00b	4.17 b	4.17 b	2.50 cd	5.00 a	6.67 a	10.00 a

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

Table 2. Efficacy of Carzol with and without feeding stimulants to citrus thrips on lemons, application 2.

		Percentage of fruit infested with immature citrus thrips			
Treatment	Rate	6 Jul 4 DAT	9 Jul 7 DAT	16 Jul 14 DAT	22 Jul 20 DAT
Untreated	--	14.17 a	10.83 a	9.17 a	7.50 a
Carzol	1.0 lb/ac	5.00 b	7.50 a	6.67 a	7.50 a
Carzol	0.25 lb/ac	6.67 b	6.67 a	7.50 a	10.00 a
Carzol + molasses	0.25 lb/ac + 20.0 lbs/ac	2.50 b	5.00 a	4.17 a	3.33 b
Carzol + pollen	0.25 lb/ac + 20.0 lbs/ac	6.67 b	6.67 a	4.17 a	1.67 b

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

Table 3. Efficacy of Success with and without feeding stimulants to citrus thrips on lemons, application 1.

		Percentage of fruit infested with immature citrus thrips							
Treatment	Rate	10 May 3 DAT	14 May 7 DAT	19 May 12 DAT	25 May 18 DAT	2 Jun 26 DAT	9 Jun 33 DAT	18 Jun 42 DAT	29 Jun 53 DAT
Untreated	--	21.67 a	22.50 a	19.17 a	16.67 a	11.67 a	11.67 a	8.33 a	15.83 ab
Success	6.0 oz/ac	5.83 bc	5.83 dc	3.33 b	4.17 b	4.17 b	2.50 a	2.50 a	8.33 ab
Success	2.0 oz/ac	0.83 c	3.33 d	0.00 b	2.50 b	2.50 b	1.67 a	5.83 a	16.67 a
Success + molasses	2.0 oz/ac + 20.0 lbs/ac	16.67 a	12.50 bc	7.50 b	5.00 b	7.50 ab	5.00 a	3.33 a	7.50 b
Success + pollen	2.0 oz/ac + 20.0 lbs/ac	12.50 ab	17.50 ab	7.50 b	8.33 ab	5.83 b	7.50 a	1.67 a	10.83 ab

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

Table 4. Efficacy of Success with and without feeding stimulants to citrus thrips on lemons, application 2.

		Percentage of fruit infested with immature citrus thrips			
Treatment	Rate	6 Jul 4 DAT	9 Jul 7 DAT	16 Jul 14 DAT	22 Jul 20 DAT
Untreated	--	14.17 a	10.83 a	9.17 a	7.50 a
Success	6.0 oz/ac	8.33 a	5.00 b	4.17 a	4.17 a
Success	2.0 oz/ac	5.83 a	4.17 b	4.17 a	5.83 a
Success + molasses	2.0 oz/ac + 20.0 lbs/ac	5.83 a	3.33 b	5.83 a	1.67 a
Success + pollen	2.0 oz/ac + 20.0 lbs/ac	5.83 a	5.83 b	2.50 a	4.17 a

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