Susceptibility of Lemons to Citrus Thrips Scarring Based on Fruit Size[1]

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Abstract

Lemons appear to be most susceptible to damage by citrus thrips from petal fall until they reach 1.0 inch in diameter. Correlation analysis suggests that fruit greater than 1.0 inch in diameter may not be highly susceptible to thrips scarring and thus may not require protection. If this relationship can be verified with additional data, late-season thrips sprays may be avoided.

Introduction

Most of the lemons grown in Yuma, AZ are grown for domestic and export fresh markets. These markets demand fruit free of cosmetic defects. Citrus thrips, *Scirtothrips citri* (Moulton), is the most severe insect pest attacking citrus in the low desert areas of Arizona, annually resulting in millions of dollars in lost revenue due to scarred fruit and insecticide costs. In order for citrus producers to grow marketable fruit, it is imperative that fruit scarring caused by citrus thrips be prevented. Pest control advisors (PCA's) and growers in the Yuma area rely heavily on insecticides for thrips control during this period. Applications of insecticides for thrips control will vary from 3 to 5 per season depending on temperatures and thrips pressure. Insecticides can be extremely costly, and many years they constitute one of the greatest production expenses. If growers could eliminate as little as one insecticide application for thrips control, the profitability of citrus production in Yuma could be greatly enhanced.

Traditionally, lemons grown in Yuma are considered susceptible to thrips scarring from petal fall, until the fruit is approximately the size of a walnut, or 1½ inches in diameter. The current recommendation for treating citrus thrips in lemons is to spray when 10% or more of the fruit is infested with immature thrips. However, there is some question as to whether this threshold should remain constant across all fruit sizes from petal fall to 1½-inch fruit. The purpose of this study was to investigate the susceptibility of lemon fruit to thrips scarring based on fruit size.

Materials and Methods

A 10 acre block of mature lemons located at the Yuma Mesa Agricultural Center, Somerton AZ, was used for this study in 1997. This study was arranged as a randomized complete block design with 5 treatments and 4 replicates. Treatments included: 1) fruit protected from petal fall through 1½ inches in diameter, 2) fruit protected from petal fall to 1.0 inch in diameter, 3) fruit protected from petal fall to ½ inch in diameter, 4) fruit protected from petal fall until the fruit reached ¼ inch in diameter and 5) fruit that was never protected from thrips, or untreated. Fruit was protected from thrips scarring by

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spraying as needed with Carzol at 1.5 lbs/ac.
Citrus thrips populations within each plot were estimated weekly by sampling fruit on 10 trees. Sampling was conducted by counting the numbers of adult and immature thrips on 20 fruit per tree, 5 sampled from each side of each tree. In August, fruit damage was estimated on by rating the degree of scarring to the rind. Scarring was rated as 1=no scarring, 2=slight scarring around the calyx, 3=significant scarring around the calyx, 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 3 or higher damage ratings, are considered significantly scarred and subject to downgrading. Using this rating scale, we could estimate the percentage of significantly scarred fruit.

Differences among treatments in scarred fruit were analyzed using analysis of variance and a F-protected LSD ($P<0.05$). To correlate fruit scarring and thrips populations within the different fruit size windows, (petal fall to ¼ inch diameter, > ¼ to ½ inch diameter, > ½ to 1.0 inch diameter, > 1.0 to 1 ½ inch in diameter, > 1 ½ to 2.0 inch diameter, and fruit > 2.0 inches in diameter), immature thrips populations by treatment within these windows was correlated to the percentage of significantly scarred fruit by treatment using Pearson's correlation coefficients ($P<0.05$).

Results and Discussion

Citrus thrips populations were low in this study until May (Fig. 1). During the ½ to 1.0-inch fruit size window, immature thrips populations in the untreated plots and those plots treated until their fruit was ¼ inch in diameter began to rapidly increase. Thrips populations in the plots treated until they reach ½ inch in diameter began to increase in late May or the 1.0 - 1½-inch fruit size window. Immature thrips populations in the plot treated until they were 1.0 inch in diameter did not begin to increase until the fruit was 1½ inches in diameter.

Based on damage ratings taken in late-August, the untreated fruit suffered the most damage, but did not statistically differ from fruit protected until it reach ¼ or ½ inch in diameter (Fig. 2). Fruit protected until it was 1½ inches in diameter did not differ in damage rating from fruit protected until it reach ½ or 1.0 inch in diameter. Damage analyzed by percentage of fruit with any scarring (Fig. 3) had a similar trend to that by damage rating (Fig. 2), but because of variability among replicates, damage analyzed by percentage of fruit with significant scarring had no statistical differences (Fig. 4). By the nature of a rating scale, because it encompasses a wider range of responses, it should be more sensitive it estimating relative differences among treatments compared to percentage estimates.

Because there are no significant differences in the damage ratings between fruit protected until it reaches 1.0 inch and 1½ inches in diameter, fruit may not require protection beyond the 1.0 inch diameter stage (Fig. 2). Especially when considering the populations of thrips present beyond the 1.0 inch stage (Fig 1). This is more strongly supported when correlating fruit size windows to fruit damage (Table 1). Fruit > ½ to 1.0 inch in diameter was the only fruit size window statistically correlated to damage. This suggests approximately 90% of the damage that occurred in the study happened during this window. Smaller sized fruit were statistically not correlated to thrips scarring in this study probably because their populations were low within these fruit size windows (Fig. 1). Larger sized fruit, although a large number of thrips were present during this time (Fig. 1), were not correlated to thrips scarring probably because the fruit lacked susceptibility. Thus, insecticide application made in late-May and June, after the lemons exceed 1.0 inch in diameter may not be needed. However, this information is based on only one year's data and should be verified.

Table 1. Correlation analysis of percentage of scarred fruit to the number of immature thrips per fruit at various fruit size windows.

	damage rating		% any scarring		% significantly scarred	
Fruit size window	R^2	*P*	R^2	*P*	R^2	*P*
petal fall to ¼ inch diameter	0.70	0.189	0.62	0.263	0.81	0.097
> ¼ to ½ inch diameter	0.74	0.156	0.63	0.256	0.86	0.062
> ½ to 1.0 inch diameter	0.93	0.022*	0.91	0.034*	0.90	0.036*
> 1.0 to 1 ½ inch in diameter	0.51	0.381	0.59	0.293	0.41	0.500
> 1 ½ to 2.0 inch diameter	0.49	0.398	0.56	0.324	0.34	0.573

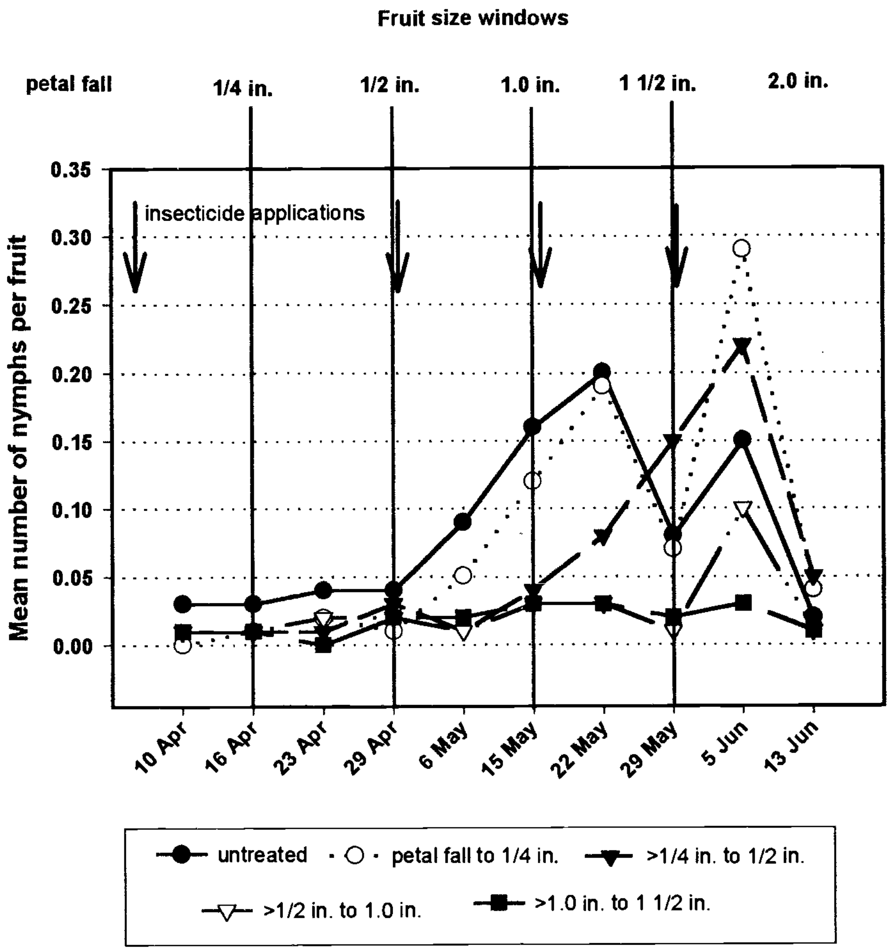

Figure 1. Seasonal immature citrus thrips populations on lemon fruit protected up to various sizes.

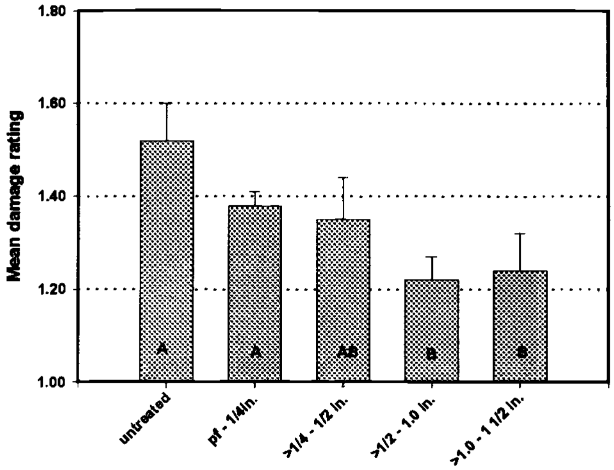

Figure 2. Mean damage rating based on a 1 to 5 scale, bars followed by the same number are not significantly different based on a F protected lsd ($P > 0.05$).

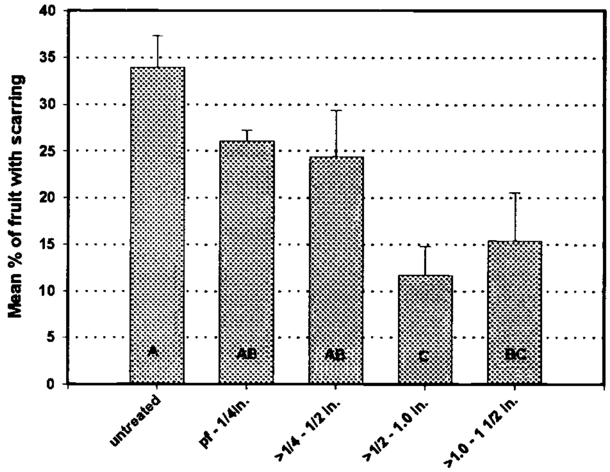

Figure 3. Mean % of fruit with scarring, bars followed by the same number are not significantly different based on a F protected lsd ($P > 0.05$).

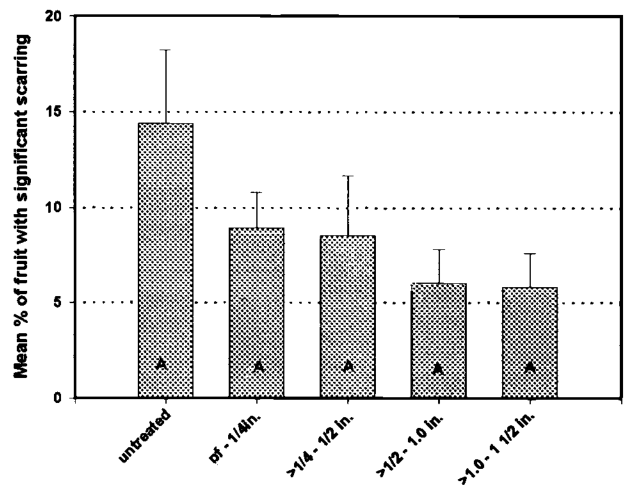

Figure 4. Mean % of fruit with significant scarring, bars followed by the same number are not significantly different based on a F protected lsd ($P > 0.05$).