DEVELOPING AN ACTION THRESHOLD FOR THRIPS IN THE TEXAS HIGH PLAINS

David Kerns
Megha Parajulee
Texas AgriLife Research and Extension Center, Lubbock, TX
Monti Vandiver
Texas AgriLife Extension Service, Farwell, TX
Manda Cattaneo
Texas AgriLife Extension Service, Seminole, TX
Kerry Siders
Texas AgriLife Extension Service, Levelland, TX

Abstract

Thrips are a significant economic pest of cotton during the pre-squaring stage of growth and development in most of the cotton growing areas of the United States. On the Texas High Plains, the western flower thrips, *Frankliniella occidentalis* (Pergande), is the predominate thrips species comprising 95% of the population infesting cotton. In irrigated cotton where thrips populations are historically high many growers opt to utilize preventative insecticide treatments such as in-furrow applications or seed treatments to control thrips. However, where thrips populations are not "guaranteed" to be especially troublesome, preventive treatments may not be necessary and represent an unnecessary expense. In these situations, well timed banded foliar insecticide applications for thrips control may be more profitable. In this study we studied the impact of different foliar spray intervals targeting thrips in seedling cotton on yield. Using this data we hope to develop a robust action threshold for management of thrips in seedling cotton with foliar insecticides. In 2007, temperatures were cool (low 50s to low 80s ^{o}F) and we observed a significant yield reduction due to thrips impact during the first two week following plant emergence. Correlation analysis suggested that the current action threshold of 1 thrips per true leaf is too high under these environmental conditions, and that the threshold should probably be closer to 0.5 thrips per plant. In 2008, temperatures were much warmer than in 2007, and despite greater thrips densities in 2008, there was no observable impact on yield. Under warm conditions, (high 50s to low 90s ^{o}F) the current action threshold appears to be too low.

Introduction

Thrips are a significant economic pest of cotton during the pre-squaring stage of growth and development in most of the cotton growing areas of the United States (Williams 2008, Harp and Turner 1976, Sadras and Wilson 1998, Hawkins et al. 1966). On the Texas High Plains, the western flower thrips, *Frankliniella occidentalis* (Pergande), is the predominate thrips species comprising 95% of the population infesting cotton. In irrigated cotton where thrips populations are historically high (usually areas where there is a significant acreage of wheat) many growers opt to utilize preventative insecticide treatments such as in-furrow applications or seed treatments to control thrips. However, where thrips populations are not "guaranteed" to be especially troublesome, preventive treatments may not be necessary and represent an unnecessary expense. In these situations, well timed banded foliar insecticide applications for thrips control may be more profitable. Currently, for the initial foliar application, the treatment threshold for thrips on irrigated cotton on the Texas High Plains is when the average total thrips per plant equals or exceeds the number of true leaves (Kerns et al. 2008). Subsequent applications are recommended when the average total thrips per plant equals or exceeds the number of true leaves and the population is composed of at least 30% larvae. The presence of larvae indicates that the previous insecticide application is no longer able to control adult thrips and that eggs are being laid and are hatching. The problem with using larvae to time insecticide applications is that under heavy immigration, the adults themselves may be causing significant damage and waiting on the appearance of larvae may be unwise.

The objectives of this study were to 1) determine at what population density western flower thrips should be subjected to control tactics to prevent yield reduction and significant delayed maturity and 2) compare action thresholds for thrips with and without the 30% thrips larvae requirement.

Materials and Methods

This study was conducted in irrigated cotton in Bailey County in 2007 and in Bailey, Crosby, Gaines, Hale, Hockely and Lubbock counties in 2008 (Table 1). Plots at all locations were 2-rows wide × 100-ft long, except for Gaines

County which had 50-ft long plots. Plots were arranged in a RCB design with 4 replicates. The foliar treatment regimes are outlined in Table 2. All foliar sprays consisted of Orthene 97 S applied at 3 oz-product/acre with a CO_2 pressurized hand boom calibrated to deliver 10 gallons/acre.

Table 1. Test sites and details.

County	Year	Variety	Row spacing	Planting date
Bailey	2007	FM 960BR	30 inch	17 May
Bailey	2008	FM 9063B2F	30 inch	13 May
Crosby	2008	FM 9063B2F	40 inch	23 May
Gaines	2008	FM 9063B2F	40 inch	13 May
Hale	2008	FM 9063B2F	40 inch	13 May
Hockley	2008	FM 9063B2F	40 inch	22 May
Lubbock	2008	DP 141B2RF	40 inch	14 May

Table 2. Foliar treatment regime timings.
1) Untreated check
2) Automatic treatment on week 1
3) Automatic treatment on weeks 1 and 2 (only week 2 in 2008)
4) Automatic treatment on weeks 1, 2 and 3
5) Automatic treatment on weeks 2 and 3
6) Treatment based on the Texas AgriLife Extension Threshold *(One thrips per plant from plant emergence through the first true leaf stage, and one thrips per true leaf thereafter until the cotton has 4 to 5 true leaves)*
7) Treatment based on the Texas AgriLife Extension Threshold with 30% larvae consideration *(One thrips per plant from plant emergence through the first true leaf stage, and one thrips per true leaf with at least 30% larvae until the cotton has 4 to 5 true leaves)*

Thrips were counted weekly by counting the number of larvae and adult thrips from 10 plants per plot. Whole plants were removed and inspected in the field. Each plot was harvested in entirety in 2007, using a stripper with a burr extractor, and a 1/1000th acre portion was harvested from each plot using an HB hand stripper from tests in 2008.

Data were analyzed using linear regression models and PROC MIXED with means separated using an F protected LSD ($P \leq 0.05$) (SAS Institute 2003).

Results and Discussion

In 2007, we had only one test site. At this location the thrips numbers were relatively low throughout the test period (Figure 1). The thrips did not exceed the action threshold in the untreated plots until week 3. All of the treatment regimes that were sprayed during week 1 yielded significantly more lint than the untreated (Figure 2), although the thrips populations were below 0.5 thrips per plant during this period (Figure 1). Although both of the threshold treatment regimes were sprayed at the same time, and did not differ from each other, the threshold regime that did not depend on the occurrence of thrips larvae yielded significantly more than the untreated. The treatment regime sprayed on weeks 2 and 3 failed to produce significantly more lint than the untreated.

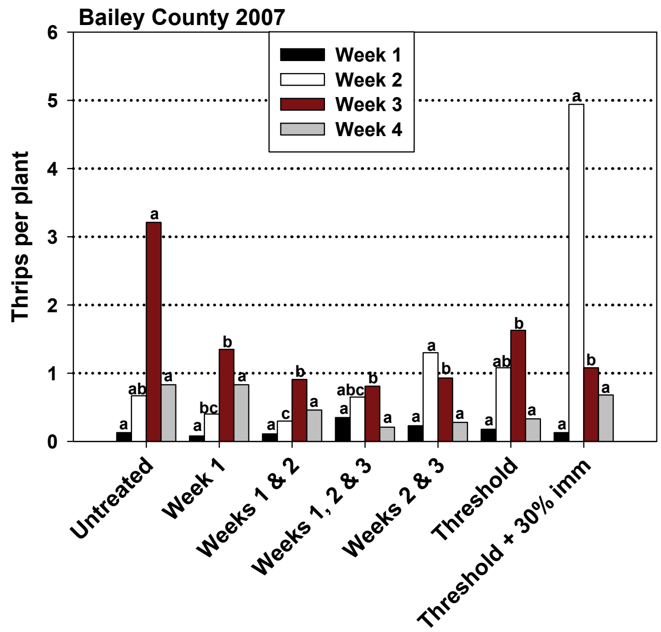

Figure 1. Mean number of thrips subjected to 7 treatment regimes at the Bailey Co. test site in 2007. Same colored bars capped by the same letter are not significantly different based on an F protected LSD ($P < 0.05$). The treatment threshold was 1 thrips on weeks 1 and 2, 2 thrips on week 2, and 4 thrips on week 4. Both threshold treatments were treated on week 2.

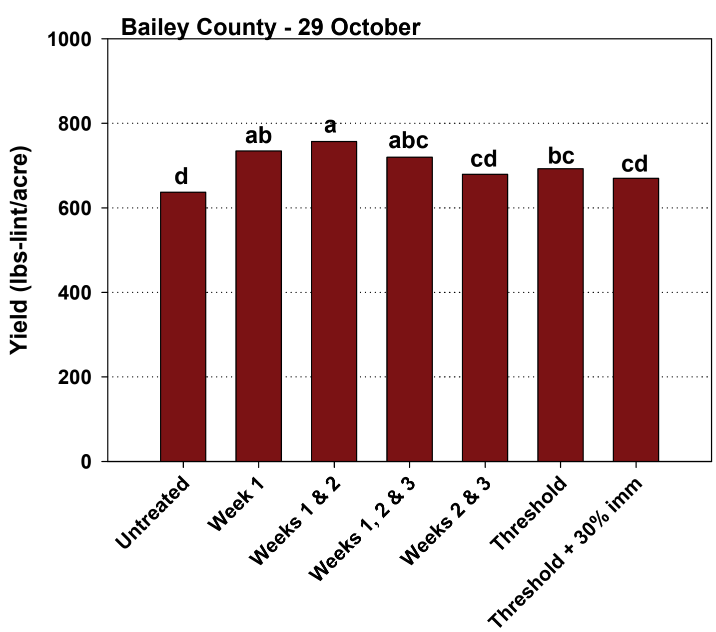

Figure 2. Mean yield of plots subjected to 7 treatment regimes at the Bailey Co. test site in 2007. Bars capped by the same letter are not significantly different based on an F protected LSD ($P < 0.05$).

Based on a standard four parameter logistic curve, there was a significant correlation between the thrips population and yield at the 1 and 2 true leaf stages. At the 1 true leaf stage there was a distinct break between yields and thrips numbers at approximately 0.3 to 0.5 thrips per plant (Figure 3), which is ≤ 50% of the current recommended threshold.

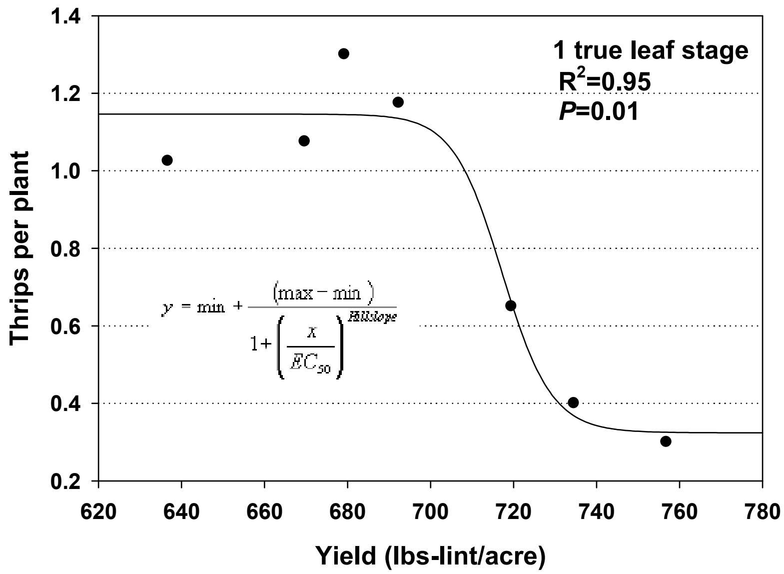

Figure 3. Relationship between thrips density and yield at the 1 true leaf stage.

There was also a significant correlation between thrips numbers at the 2 true leaf stage to yield (Figure 4). At this stage of growth the break between high and low yields was less distinctive but appeared to be about 0.6 and 0.8 thrips per plant, or 0.3 and 0.4 thrips per true leaf. Again, well below the current action threshold of 1 thrips per true leaf. Regression analyses at the cotyledon and 4 leaf stage were non-significant at the Bailey County 2007 test site.

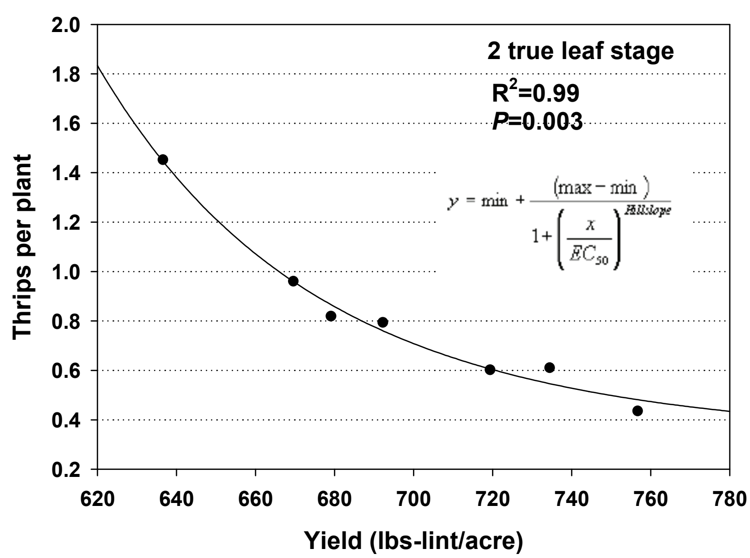

Figure 4. Relationship between thrips density and yield at the 2 true leaf stage.

For the 2008 tests, the data for thrips densities and yields were pooled across locations for presentation. Additionally, yields were normalized across locations to account for variation due to other factors. In 2008, overall thrips densities where greater than in 2007, particularly during the first 2 weeks of development (Figure 5).

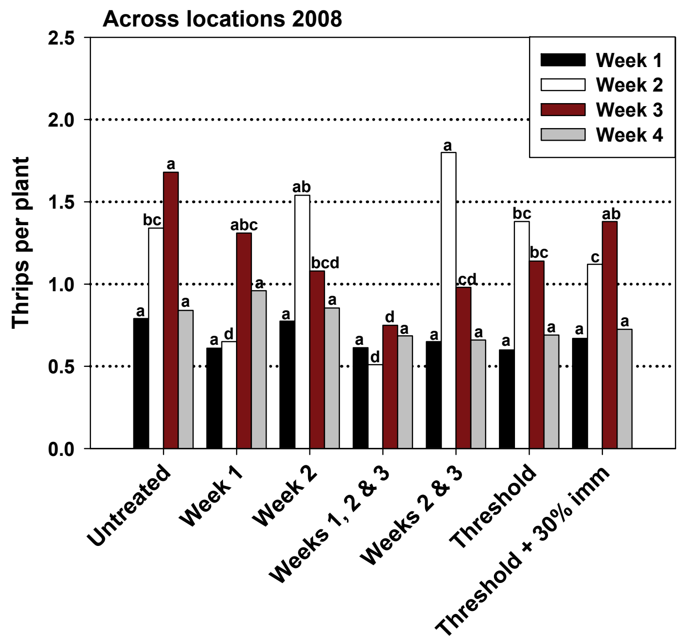

Figure 5. Mean number of thrips subjected to 7 treatment regimes across locations in 2008. Same colored bars capped by the same letter are not significantly different based on an F protected LSD ($P < 0.05$).

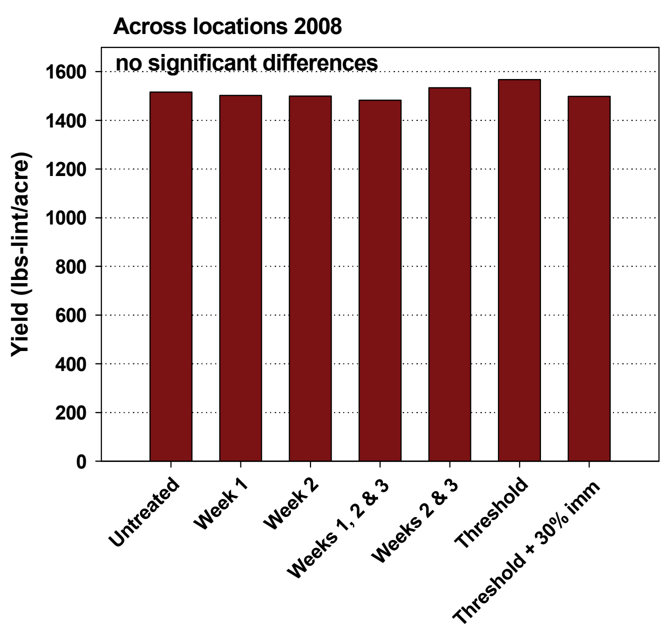

Figure 6. Mean yield of plots subjected to 7 treatment regimes at across locations in 2008. No significant differences were detected among treatments based on an F protected LSD ($P < 0.05$).

Based on data pooled across locations, there were significant differences in the thrips populations among treatments during weeks 2 and 3. Invariably, plots receiving an insecticide application the previous week tended to have lower thrips numbers than those than were not treated. Despite higher thrips numbers, unlike 2007 there were no significant differences in yield across tests when pooled, or by test that could be attributed to thrips damage despite obvious injury due to thrips at several locations (Figure 6). Similarly, regression analyses of the 2008 data could not detect any significant relationships between thrips density and yield.

Table 3. Test sites plant growth and climatic conditions.

County	Week 1 Growth stage Avg Temp ^{o}F (min-max)	Week 2 Growth stage Avg Temp ^{o}F (min-max)	Week 3 Growth stage Avg Temp ^{o}F (min-max)	Week 4 Growth stage Avg Temp ^{o}F (min-max)
		2007		
Bailey	Cotyledon	1 true leaf	2 true leaves	4 true leaves
	52-79	54-82	57-82	56-86
		2008		
Bailey	Cotyledon	2 true leaves	4 true leaves	6 true leaves
	68-100	61-93	62-97	62-90
Crosby	Cotyledon	2 true leaves	5 true leaves	--
	68-102	66-95	67-98	--
Gaines	Cotyledon	1 true leaf	2 true leaves	5 true leaves
	59-95	63-91	68-102	65-95
Hale	Cotyledon	1 true leaf	3 true leaves	5 true leaves
	56-74	58-93	57-93	60-94
Hockley	Cotyledon	2 true leaves	4 true leaves	6 true leaves
	67-103	64-95	67-100	63-90
Lubbock	Cotyledon	2 true leaves	4 true leaves	5 true leaves
	61-91	68-96	65-95	70-99

The lack of impact of thrips on yield in 2008 despite higher thrips densities during the first few weeks of plant development (critical time period based on 2007), appears to be related to temperature and subsequent rapidity of plant growth (Table 3). Although sites such as Hale County in 2008 had temperatures similar to those experienced at week 1 in Bailey County in 2007, subsequent temperatures were much warmer.

Conclusion

Based on limited data, under cool conditions (minimum temperatures in the low 50's ^{o}F to maximum highs in the low 80's ^{o}F), the current action threshold of 1 thrips per true leaf appears to be too high. Current data suggests that this threshold may be closer to 0.5 thrips per true leaf. Under the hotter conditions experienced in 2007 with minimum temperatures in the low 60's ^{o}F to high in the low 90's ^{o}F) the threshold appears to be too low. At this time we do not have enough data to approximate a threshold under warm conditions. We were unable to validate the justification for basing the threshold of 1 thrips per true leaf in addition to the occurrence of 30% immature thrips. In the two years we have conducted these tests, we have never observed a situation where this threshold has been met. It is likely that this recommendation should be discontinued.

Acknowledgements

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