EFFECTS OF INSECTICIDAL TREATMENTS ON THRIPS ABUNDANCE, COTTON GROWTH AND YIELD IN SOUTH GEORGIA

Russell J. Ottens, J. David Griffin, John R. Ruberson and Phillip M. Roberts
Dept. of Entomology, Univ. of Georgia, Tifton, GA

Introduction

Thrips in the genus *Frankliniella* are perennial pests of cotton in Georgia, and can have various substantive impacts on cotton production, ranging from minor cosmetic damage, to delay of crop maturity, or even stand destruction (Watts 1937, Hawkins et al. 1966). Thrips begin feeding on cotton in Georgia immediately after seedling emergence. The plants are at greatest risk early in the season when the seedlings can be quite susceptible to thrips damage on the leaves and growing meristem. In some instances, damage is severe enough to cause abortion of the terminal and loss of apical dominance. Thrips populations vary greatly from year to year, but in severe infestations, they can reduce yields by as much as 50 or 60 percent if not controlled by insecticides applied in-furrow, as seed treatments, or foliar sprays (Johnson et al. 2001). Lambert (1985) states that dealing with the thrips problem in cotton is complex. Universities in many cotton-producing states offer suggestions for thrips control, though their research rarely shows yield increases attributable to these control measures. Increased industry-grower interest in early season pest management has prompted us to evaluate the efficacy of insecticides for thrips management in south Georgia.

Materials and Methods

Cotton (variety DPL 555B/RR) was planted on 24 May 2006 at the Lang-Rigdon Farm of the Coastal Plain Experiment Station in Tift County, Georgia, using a Monosem pneumatic planter equipped to add granular insecticides in the furrow. Plots were 4 rows by 50 ft long, with a 36-inch row spacing and 4 replications per treatment. Eight replications were used for the untreated control because an anticipated treatment was never applied and the additional 4 replications were pooled with the original 4 untreated plots. Throughout the course of the season, all plots were irrigated for optimum growth. The treatments were (1) an untreated control, (2) V-10193 10% WP at 22 grams ai/acre foliar spray, (3) V-10193 10% WP at 45 grams ai/acre foliar spray, (4) V-10193 10% WP at 90 grams ai/acre foliar spray, (5) Orthene 97 pellets at 0.5 lb ai/acre foliar spray, (6) V-10193 10% WP at 100 grams ai/acre in-furrow spray, (7) V-10193 10% WP at 200 grams ai/acre in-furrow spray, (8) V-10193 10% WP at 400 grams ai/acre in-furrow spray, and (9) Temik 15G at 5 lb product/a in-furrow. The in-furrow and foliar treatments were applied with a CO_2-powered backpack sprayer using a single TX6 nozzle calibrated to deliver 4.7 GPA. The Temik treatment was applied with the Monosem planter. For the in-furrow treatments, the planter press wheels were secured

to allow the furrows to remain open and the insecticides were applied immediately after planting with the backpack sprayer. Upon completion of the sprays, the furrows were covered with soil using a hoe. The foliar sprays were applied 8 June 2006.

Thrips were sampled 1, 2, 3, and 4 weeks after planting. Each sample consisted of five plants that were picked and swirled in a 1-pint jar containing ca. 300 ml of water, with several drops of liquid dishwashing detergent added as a surfactant. Samples were returned to the laboratory for counting. Each sample was poured through a 120-mesh sieve (Hubbard Scientific Co., Northbrook, IL) and rinsed with tap water. The thrips were then flushed into a 100 x 15 mm plastic petri dish for microscopic examination. Both adults and nymphs were counted, though the numbers were pooled for statistical analysis. Visual ratings were made on 22 June 2006, with each plot assigned a damage rating from 1 to 5, where 1 equaled no visible thrips damage and 5 equaled severe thrips damage. Open flower counts were made on 27 July 2006. Height measurements and node counts were taken on 27 July and 1 Sept. Seed cotton yields were taken by mechanically picking the middle 2 rows of each plot 20 October 2006.

Data (thrips numbers, visual ratings, height measurements, node counts, flower counts, and yield) were analyzed using the general linear models procedure, followed by separation of significantly different means using Duncan's New Multiple Range Test, with $p<0.05$ as the upper limit for significance (SAS Institute 1999).

Results and Discussion

In samples taken 2 and 4 weeks after planting, there were no significant differences in thrips numbers (Tables 1-3). Foliar sprays were not applied until after thrips samples were collected 2 weeks post-planting, thus these treatments should be viewed as equivalent to the untreated control until sample weeks 3 and 4. Significant differences occurred in the week 1 and 3 samples, though some they may have been due to clumped thrips populations. However, there was a significant reduction generally in those treatments applied at planting (Temik, Orthene, and V10193). Foliar applications had not yet been made, so one would not expect a reduction in the foliar-treated plots at this stage of the trial. However, in week 1, plots assigned to the Orthene foliar spray had significantly fewer thrips than the untreated plots even though the actual Orthene application did not occur until one week later (Table 3), suggesting that there was significant noise in the data. Overall, thrips numbers in our experimental plots were generally lower than previous years.

With the visual damage ratings, all treatments had significantly less thrips damage than the untreated control plots (Table 4). The in-furrow treatments, including Temik, had numerical ratings with the least damage. The foliar treatments had higher numerical damage ratings, probably because they were not applied until 8 June, allowing thrips damage to occur during a period of two weeks post-planting (Table 4).

No significant differences were seen among treatments for our height measurements and node samples on either 27 July or 1 September (Table 5). This was also true for open flower samples taken on 27 July, though numerically, plots receiving Temik® or a foliar spray of 45 g ai/acre of V-10193 10% WP had nearly twice as many open flowers as the untreated plots (Table 5).

None of the treated plots differed significantly from untreated plots in seed cotton yield. In some instances, treated plots actually resulted in a lower numerical yield than the untreated plots (Table 6). The highest numerical yield was in plots treated with aldicarb (Temik® 15G) at 5.0 lbs per acre.

Our insecticidal treatments failed to significantly improve yields relative to the untreated plots, even in those instances where thrips abundance was reduced. This may be due to the low thrips numbers in 2006. Even in years with higher thrips populations, the extended growing season in south Georgia may allow the plants to compensate for damage incurred early in the season, effectively masking any potential yield effects.

Acknowledgment

We thank Alton Hudgins and Javier Madrigal-Sanchez for their technical assistance in this research and Valent Corporation for their provision of materials and financial support.

References Cited

Hawkins, B. S., H. A. Peacock, and T. E. Steele. 1966. Thrips injury to upland cotton (*Gossypium hirsutum* L.) Varieties. Crop Sci. 6: 256-8.

Johnson, D.R., J.D. Hopkins, G.M. Lorenz, III and J.D. Reaper, III. 2001. Evaluation of thrips management options in cotton. *In* Proceedings, 2001 Beltwide Cotton Production Conferences, National Cotton Council of America, Memphis, TN, 2: 1086-1088.

Lambert, W. R. 1985. The thrips problem. *In* Proceedings, Beltwide Cotton Production Conference, National Cotton Council of America, Memphis, TN,: 130-131.

SAS Institute. 1999. SAS/STAT User's guide, version 8.02. SAS Institute, Cary, NC.

Watts, J. G. 1937. Reduction of cotton yields by thrips. J. Econ. Entomol. 30: 860-863.

Table 1. Numbers of immature thrips per plant in relation to insecticide treatment (foliar treatments applied on 8 June 2006 [15 DAP], following sampling on that date). Significant differences were observed on 15 June.

Treatment	Application	Sample dates[a]			
		1 June	8 June	15 June	22 June
Untreated	NA	0.13 ± 0.15	1.03 ± 1.35	0.55 ± 0.50 A	0.48 ± 0.45
V10193 22 g ai	Foliar spray	**0.20 ± 0.28**	**1.85 ± 2.64**	0.55 ± 0.38 A	0.25 ± 0.25
V10193 45 g ai	Foliar spray	**0.0 ± 0.00**	**1.10 ± 0.74**	0.0 ± 0.00 B	0.10 ± 0.20
V10193 90 g ai	Foliar spray	**0.0 ± 0.00**	**1.30 ± 0.60**	0.0 ± 0.00 B	0.20 ± 0.23
V10193 100 g ai	In-furrow spray	0.0 ± 0.00	0.20 ± 0.40	0.10 ± 0.20 B	0.45 ± 0.44
V10193 200 g ai	In-furrow spray	0.0 ± 0.00	0.45 ± 0.77	0.20 ± 0.16 AB	0.50 ± 0.60
V10193 400 g ai	In-furrow spray	0.0 ± 0.00	0.70 ± 0.66	0.05 ± 0.10 B	0.15 ± 0.19
Orthene 0.5 lbs./A	Foliar spray	0.0 ± 0.00	1.65 ± 2.37	0.0 ± 0.00 B	0.35 ± 0.30
Temik 5 lb product	In-furrow granule	0.0 ± 0.00	0.35 ± 0.70	0.05 ± 0.10 B	0.05 ± 0.10
	df	8,31	8,31	8,31	8,31
	F	2.00	0.72	3.46	1.03
	P	0.0796	0.6764	0.0058	0.4379

[a]Means in columns followed by the same letters are not significantly different (Waller-Duncan Bayesian *k* ratio, *k* = 100).
Foliar sprays were not applied until 8 June 2006, thus the bold numbers represent thrips samples that were essentially equivalent to the untreated control group.

Table 2. Numbers of adult thrips per plant in relation to insecticide treatment (foliar treatments applied on 8 June 2006 [15 DAP], following sampling on that date).

Treatment	Application	Sample dates[a]			
		1 June	8 June	15 June	22 June
Untreated	NA	0.55 ± 0.45 AB	0.20 ± 0.19 B	0.13 ± 0.15	0.23 ± 0.23 AB
V10193 22 g ai	Foliar spray	**0.60 ± 0.16 A**	**0.10 ± 0.12 B**	0.05 ± 0.10	0.0 ± 0.00 B
V10193 45 g ai	Foliar spray	**0.50 ± 0.34 AB**	**0.20 ± 0.16 B**	0.10 ± 0.20	0.0 ± 0.00 B
V10193 90 g ai	Foliar spray	**0.40 ± 0.28 AB**	**0.65 ± 0.47 A**	0.05 ± 0.10	0.05 ± 0.10 AB
V10193 100 g ai	In-furrow spray	0.10 ± 0.12 B	0.25 ± 0.19 **B**	0.05 ± 0.10	0.20 ± 0.16 AB
V10193 200 g ai	In-furrow spray	0.15 ± 0.19 AB	0.20 ± 0.28 B	0.10 ± 0.12	0.25 ± 0.10 A
V10193 400 g ai	In-furrow spray	0.30 ± 0.12 AB	0.10 ± 0.12 B	0.10 ± 0.20	0.0 ± 0.00 B
Orthene 0.5 lbs./A	Foliar spray	0.20 ± 0.16 AB	0.30 ± 0.26 AB	0.05 ± 0.10	0.15 ± 0.19 AB
Temik 5 lb product	In-furrow granule	0.10 ± 0.12 B	0.05 ± 0.10 B	0.05 ± 0.10	0.0 ± 0.00 B
	df	8,31	8,31	8,31	8,31
	F	2.30	2.36	0.30	2.76
	P	0.0462	0.0412	0.9607	0.0199

[a]Means in columns followed by the same letters are not significantly different (Waller-Duncan Bayesian *k* ratio, *k* = 100).
Foliar sprays were not applied until 8 June 2006, thus the bold numbers represent thrips samples that were essentially equivalent to the untreated control group.

Table 3. Numbers of total thrips per plant (adults and immatures) in relation to insecticide treatment (foliar treatments applied on 8 June 2006 [15 DAP], following sampling on that date).

Treatment	Application	Sample dates[a]			
		1 June	8 June	15 June	22 June
Untreated	NA	0.68 ± 0.41 AB	1.23 ± 1.43	0.68 ± 0.58 A	0.70 ± 0.63
V10193 22 g ai	Foliar spray	**0.80 ± 0.43 A**	**1.95 ± 2.57**	0.60 ± 0.43 AB	0.25 ± 0.25
V10193 45 g ai	Foliar spray	**0.50 ± 0.36 ABC**	**1.30 ± 0.68**	0.10 ± 0.20 B	0.10 ± 0.20
V10193 90 g ai	Foliar spray	**0.40 ± 0.28 ABC**	**1.95 ± 0.79**	0.05 ± 0.10 B	0.25 ± 0.19
V10193 100 g ai	In-furrow spray	0.10 ± 0.12 C	0.45 ± 0.53	0.15 ± 0.19 AB	0.65 ± 0.57
V10193 200 g ai	In-furrow spray	0.15 ± 0.19 C	0.65 ± 1.05	0.30 ± 0.26 AB	0.75 ± 0.57
V10193 400 g ai	In-furrow spray	0.30 ± 0.12 BC	0.80 ± 0.77	0.15 ± 0.19 AB	0.15 ± 0.19
Orthene 0.5 lbs./A	Foliar spray	0.20 ± 0.16 C	1.95 ± 2.34	0.05 ± 0.10 B	0.50 ± 0.42
Temik 5 lb product	In-furrow granule	0.10 ± 0.12 C	0.40 ± 0.80	0.10 ± 0.20 B	0.05 ± 0.10
	df	8,31	8,31	8,31	8,31
	F	3.56	0.84	2.67	1.84
	P	0.0049	0.5719	0.0235	0.1078

[a]Means in columns followed by the same letters are not significantly different (Waller-Duncan Bayesian *k* ratio, *k* = 100).

Means followed by the same letter are not significantly different (P>0.05).

Foliar sprays were not applied until 8 June 2006, thus the bold numbers represent thrips samples that were essentially equivalent to the untreated control group.

Table 4. Visual damage ratings for various thrips control treatments, where 1 equals no visible thrips damage and 5 equals severe thrips damage. Tift Co., GA, 22 June 2006.

Insecticide Treatment		Damage Rating
Untreated		3.9 ± 0.64 A
V-10193 10% WP at 22 grams ai/acre foliar spray		2.6 ± 0.25 B
V-10193 10% WP at 45 grams ai/acre foliar spray		2.0 ± 0.41 CD
V-10193 10% WP at 90 grams ai/acre foliar spray		2.0 ± 0.41 CD
V-10193 10% WP at 100 grams ai/acre in-furrow spray		1.9 ± 0.48 CD
V-10193 10% WP at 200 grams ai/acre in-furrow spray		1.9 ± 0.48 CD
V-10193 10% WP at 400 grams ai/acre in-furrow spray		1.6 ± 0.48 CD
Orthene 97 pellets at 0.5 lb ai/acre foliar spray		2.1 ± 0.25 BC
Temik 15G at 5 lb product/a in-furrow		1.5 ± 0.00 D
df		8,31
	F	16.50
	P	<0.0001

Means followed by the same letter are not significantly different (P>0.05).

Table 5. Average height of 10 consecutive plants, average total nodes per 10 consecutive plants, and average no. open flowers per 10 consecutive plants on cotton with various insecticidal thrips treatments. Tift Co., GA. 2006. None of the means were significantly different

		Avg. height (cm) 27 July	Avg. height (cm) 1 Sept	Avg. total nodes per plant 27 July	Avg. total nodes per plant 1 Sept	Avg. open flowers per plant 27 July
Untreated		57.9 ± 19.65	79.8 ± 18.98	14.3 ± 2.00	22.8 ± 1.93	0.27 ± 0.18
V-10193 10% WP at 22 grams ai/acre foliar spray		50.8 ± 13.47	81.8 ± 15.63	13.6 ± 1.66	22.8 ± 1.75	0.38 ± 0.17
V-10193 10% WP at 45 grams ai/acre foliar spray		64.3 ± 16.45	77.9 ± 16.09	14.4 ± 1.71	21.1 ± 2.15	0.35 ± 0.33
V-10193 10% WP at 90 grams ai/acre foliar spray		61.7 ± 23.60	81.9 ± 20.25	14.1 ± 2.48	22.3 ± 1.76	0.25 ± 0.29
V-10193 10% WP at 100 grams ai/acre in-furrow spray		53.4 ± 22.69	75.9 ± 16.54	13.3 ± 1.95	22.4 ± 1.29	0.25 ± 0.19
V-10193 10% WP at 200 grams ai/acre in-furrow spray		65.4 ± 14.55	86.4 ± 18.78	14.0 ± 1.25	21.8 ± 2.51	0.25 ± 0.13
V-10193 10% WP at 400 grams ai/acre in-furrow spray		58.0 ± 27.59	73.3 ± 17.73	13.4 ± 3.04	20.3 ± 1.37	0.23 ± 0.22
Orthene 97 pellets at 0.5 lb ai/acre foliar spray		66.4 ± 16.47	78.5 ± 19.68	14.9 ± 1.04	21.6 ± 1.58	0.48 ± 0.39
Temik 15G at 5 lb product/a in-furrow		74.6 ± 7.62	88.3 ± 9.54	14.9 ± 1.00	22.1 ± 1.83	0.50 ± 0.34
df		8,31	8,31	8,31	8,31	8,31
	F	0.60	0.30	0.40	0.90	0.69
	P	0.7690	0.9610	0.9105	0.5310	0.6970

Table 6. Seed cotton yields of insecticide treatments for thrips control. Tift Co., GA, 2006. No significant differences were detected.

Insecticide Treatment		Pounds Seed Cotton/Acre
Untreated		3753 ± 1082.3
V-10193 10% WP at 22 grams ai/acre foliar spray		3659 ± 701.3
V-10193 10% WP at 45 grams ai/acre foliar spray		4185 ± 747.8
V-10193 10% WP at 90 grams ai/acre foliar spray		3568 ± 1416.8
V-10193 10% WP at 100 grams ai/acre in-furrow spray		3576 ± 944.5
V-10193 10% WP at 200 grams ai/acre in-furrow spray		3975 ± 1058.3
V-10193 10% WP at 400 grams ai/acre in-furrow spray		3935 ± 1345.6
Orthene 97 pellets at 0.5 lb ai/acre foliar spray		4007 ± 1086.3
Temik 15G at 5 lb product/a in-furrow		4585 ± 349.4
df		8,27
	F	0.41
	P	0.9022