EVALUATION OF SELECTED THRIPS MANAGEMENT PROGRAMS AND THE EFFECT OF THRIPS DAMAGE ON EARLY SEASON ROOT GROWTH

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Introduction

Thrips are predictable pests of seedling cotton in Georgia and other areas of the southeast. The most common species infesting cotton seedlings in Georgia is the tobacco thrips, however other species such as western flower thrips and flower thrips may sometimes be observed. Thrips become active in the spring and winged adults disperse in search of suitable host plants. Adult females insert eggs into tender plant tissues which hatch in about four days. Immature thrips feed on the plant for about six days, pupate in the soil, and adults emerge approximately 4 days later.

Both adult and immature thrips damage cotton by rasping tender leaves, especially in the terminal bud. Damaged cotyledons often have a silvery appearance on the underside of leaves whereas damaged true leaves appear crinkled and distorted as they expand. Thrips injury can cause stunted plants, delays in maturity, loss of apical dominance, and even stand loss in severe cases. Thrips infestations are generally higher on April and early May plantings compared with late May and June planting dates. Slow seedling growth associated with cool temperatures or other plant stresses exacerbates thrips injury. At plant preventive systemic insecticides provide a consistent yield response and are used by most growers for thrips control. Foliar insecticide applications may be needed to supplement preventive insecticides in some situations. The threshold for seedling thrips is 2-3 per plant, especially if immature or wingless thrips are present at threshold levels. The presence of immature thrips suggests that the preventive insecticide used at planting is not effective. Seedlings are most susceptible to thrips during early stages of development. Treatment for thrips is rarely necessary after plants attain 5 true leaves and are growing vigorously.

Significant plant stunting of seedlings is observed when excessive thrips injury occurs. A gradient of plant heights is commonly observed in small plot field trials where treatments provide varying degrees of thrips control. Is below ground plant growth also stunted when excessive thrips injury occurs? Sadras and Wilson 1998 observed early season reductions in leaf area, shoot dry weight, and tap root dry weight when significant numbers of thrips infested seedling cotton in Australia. In a study evaluating the potential interaction of pendimethalin and systemic insecticides for thrips control in cotton; Grey et.al. 2006 observed greater root weights in treatments which provided thrips control compared with untreated plots. Brown et.al. 2008 also observed an inverse relationship between thrips damage and early season root growth. Potentially, poor early season root growth could influence the plants ability to tolerate drought and other plant stresses such as nematode infestations. The objective of this study was to evaluate selected thrips management programs and further quantify the effect of thrips damage on early season root growth.

Materials and Methods

A field trial was established in Tift County Georgia during 2008. Plots were two rows wide, 40 feet in length, and arranged in a randomized complete block design with four replications. Treatments included an untreated check, the seed treatments Cruiser and Avicta Complete Cotton, Temik, and Avicta Complete Cotton treated with two foliar applications of dimethoate at 14 and 21 days after planting (DAP), 1 and 2-3 leaf cotton respectively. Dimethoate was applied at 0.25 lb ai/acre in a 12 inch band using a CO2 backpack sprayer calibrated to deliver 15 gpa. Telone was applied to the trial area which was conventional tilled and irrigated. DP 555 BR was planted on April 29, 2009. Plots were maintained according to UGA Extension recommendations.

Thrips infestations were sampled at 14, 21, and 28 DAP by randomly selecting 5 plants per plot and immediately submersing and swirling plants in 4 oz specimen cups filled with a 70% ETOH solution to dislodge and preserve thrips. Samples were returned to the laboratory and immature and adult thrips were quantified. Adult thrips were identified to species. Thrips damage ratings were conducted at 21, 28, and 35 DAP using a 1-5 scale with 0.5 increments where 1=no damage, 2=slight damage, 3=moderate (acceptable) damage, 4=heavy damage, and 5=severe damage. Plant biomass was quantified by carefully extracting five plants per plot with a narrow spade at 30 and 42 DAP. Plants were severed at the soil surface line and above ground (shoots) and below ground (roots) dry weights were attained by drying plant material at 60 degrees C for 48 hrs in a forced air oven. Plant heights were quantified by measuring shoot lengths. Plots were machine picked on September 19 using a spindle picker and a lint fraction of 42 percent was assumed for all plots to determine lint yields.

Data were subjected to analysis of variance and treatment means were separated using LSD at P=0.05. Root dry weights were regressed against shoot dry weights and thrips damage ratings.

Results and Discussion

Thrips infestations were moderate to high, exceeding the recommended threshold of 2-3 thrips per plant on all sample dates in untreated plots. All insecticide treatments significantly reduced immature thrips at 14 and 21 DAP, no significant differences were observed among insecticide treatments (Table 1). Temik and the Avicta Complete Cotton (ACC) treated with foliar applications of dimethoate significantly reduced immature thrips at 28 DAP. All insecticide treatments significantly reduced adult thrips at 14 DAP compared with the untreated, no insecticide treatments significantly reduced adult thrips at 21 and 28 DAP. Tobacco thrips was the primary thrips species infesting the trial area. At 14, 21, and 28 DAP, tobacco thrips averaged 94, 66, and 80 percent of the adult thrips infesting the treatments. Western flower thrips were observed at 2, 27, and 9 percent and flower thrips at 2, 6, and 9 percent at 14, 21, and 28 DAP respectively. Species complex among treatments was variable, at 21 DAP the percent western flower thrips infesting individual treatments ranged from 7-42 percent.

Thrips damage ratings exceeded 3 on a scale of 1-5 which is considered an acceptable level of plant injury for all treatments at 21 DAP (Table 2). However, all insecticide treatments significantly reduced thrips damage ratings compared with the untreated check. Temik and the ACC treated with foliar applications of dimethoate (ACC+dimethoate) significantly reduced thrips damage compared with Cruiser and ACC treatments. At 28 DAP thrips damage ratings were significantly greater in the untreated > Cruiser > ACC and Temik > ACC+dimethoate. At 35 DAP ACC+dimethoate had significantly lower damage ratings compared with Temik < Cruiser and ACC < untreated. Plant heights were significantly greater in insecticide treatments compared with the untreated at 30 and 42 DAP. At 42 DAP plant height was significantly greater in ACC, Temik, and ACC+dimethoate treatments compared with Cruiser > untreated. All insecticide treatments significantly increased lint yield compared with the untreated, no significant differences were observed for yield among insecticide treatments but the ACC+dimethoate was the numerically highest yielding treatment.

All insecticide treatments significantly increased both below ground (roots) and above ground (shoots) plant dry weights compared with the untreated at 30 and 42 DAP. Root dry weights were significantly greatest the Temik and ACC+dimethoate treatments at 42 DAP > Cruiser and ACC > untreated. Shoot dry weights followed a similar trend at 42 DAP, Temik and ACC+dimethoate > ACC > Cruiser > untreated. Figure 1 illustrates the correlation of root dry weight to shoot dry weights at 30 and 42 DAP. R-squared values were 0.90 and 0.96 for 30 and 42 DAP, suggesting a very strong correlation of above ground to below ground plant growth. Figure 2 illustrates the correlation of root growth with thrips injury. R-squared values of 0.68 and 0.77 indicate that thrips injury is the primary factor influencing root growth, explaining about 70 percent of the variability observed in root growth among plots.

These data strongly suggests that excessive thrips feeding on seedling cotton impacts root growth and development. Plant stunting which is observed above ground strongly correlates with below ground plant growth. Early season root development is an important factor for successful production. Poor or delayed root development may impact the plants ability to endure plant stresses such as drought or nematode attack. These data do not suggest that we need to make wholesale foliar thrips treatments. Unneeded early season foliar insecticides may create additional problems such as flaring or increasing the risk of aphid and spider mite outbreaks. The primary point is that thrips impact root development and appropriate thrips management programs are an important part of the overall production system. Additional studies investigating various interactions with thrips management are needed.

Table 1. Immature and adult thrips populations in selected preventive thrips insecticide treatments, Tift Co. GA, 2008.

	Thrips per Five Plants					
	Immatures			Adults		
Treatments	14 DAP[b]	21 DAP	28 DAP	14 DAP	21 DAP	28 DAP
Untreated	13.00 a	68.25 a	109.25 a	18.50 a	21.50 bc	14.75 a
Cruiser	1.00 b	12.25 b	221.50 a	7.50 b	43.50 a	18.75 a
Avicta Complete Cotton	2.00 b	12.00 b	107.75 a	5.75 b	25.50 abc	13.75 a
Temik 15G (5 lb/acre)	0.50 b	5.50 b	54.75 b	7.00 b	9.50 c	15.75 a
Avicta Complete Cotton +dimethoate foliar[a]	0.75 b	9.75 b	58.50 b	6.75 b	29.75 ab	11.50 a

[a] Foliar sprays applied at 14 and 21 DAP.
[b] Means in a column followed by the same letter do not significantly differ (P=0.05, LSD), data were transformed (arcsine square root percent) prior to analysis.

Table 2. Thrips damage ratings, plant heights, and yield of selected preventive thrips insecticide treatments, Tift Co. GA, 2008.

	Thrips Damage Rating			Plant Height (cm)		Yield
Treatments	21 DAP[b]	28 DAP	35 DAP	30 DAP	42 DAP	(lbs lint/acre)
Untreated	4.50 a	4.50 a	4.50 a	6.75 b	7.50 c	904 b
Cruiser	3.50 b	4.00 b	3.75 b	11.45 a	24.85 b	1575 a
Avicta Complete Cotton	3.50 b	3.50 c	3.63 b	12.08 a	26.83 a	1617 a
Temik 15G (5 lb/acre)	3.25 c	3.50 c	3.13 c	12.35 a	29.88 a	1607 a
Avicta Complete Cotton +dimethoate foliar[a]	3.13 c	3.00 d	2.63 d	13.38 a	31.40 a	1811 a

[a] Foliar sprays applied at 14 and 21 DAP.
[b] Means in a column followed by the same letter do not significantly differ (P=0.05, LSD).

Table 3. Root and shoot dry weights in selected preventive thrips insecticide treatments, Tift Co. GA, 2008.

	Plant Dry Weight (g)			
	30 DAP		42 DAP	
Treatments	Roots [b]	Shoots	Roots	Shoots
Untreated	0.16 c	1.10 c	0.33 c	1.77 d
Cruiser	0.27 b	2.67 b	2.43 b	19.43 c
Avicta Complete Cotton	0.35 ab	3.01 b	3.16 b	24.68 b
Temik 15G (5 lb/acre)	0.33 b	3.16 b	4.47 a	31.44 a
Avicta Complete Cotton +dimethoate foliar [a]	0.42 a	4.37 a	4.70 a	35.54 a

[a] Foliar sprays applied at 14 and 21 DAP.
[b] Means in a column followed by the same letter do not significantly differ (P=0.05, LSD).

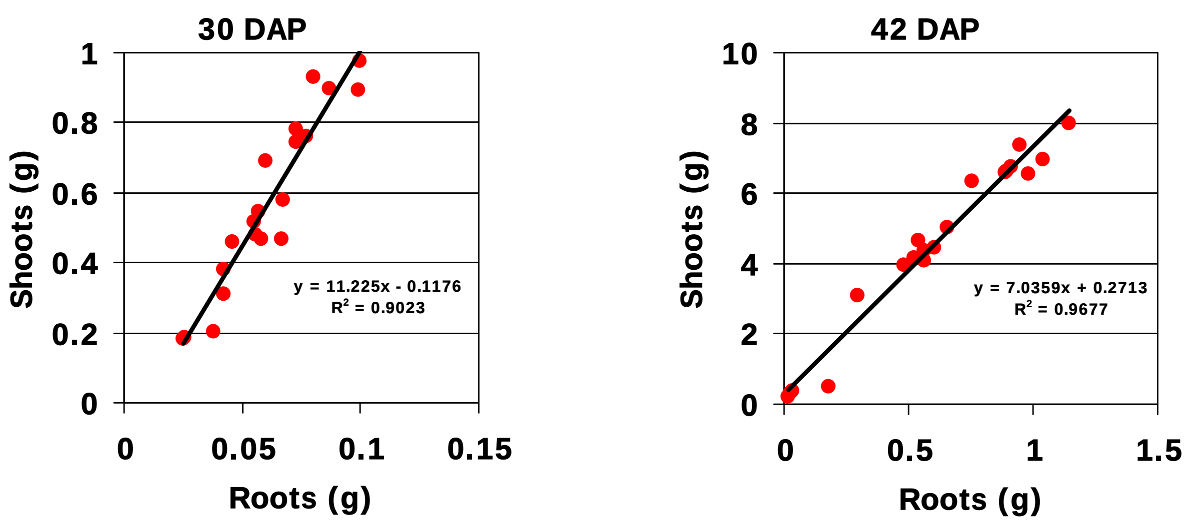

Figure 1. Correlation of root and shoot dry weights in selected preventive thrips insecticide treatments, Tift Co. GA, 2008.

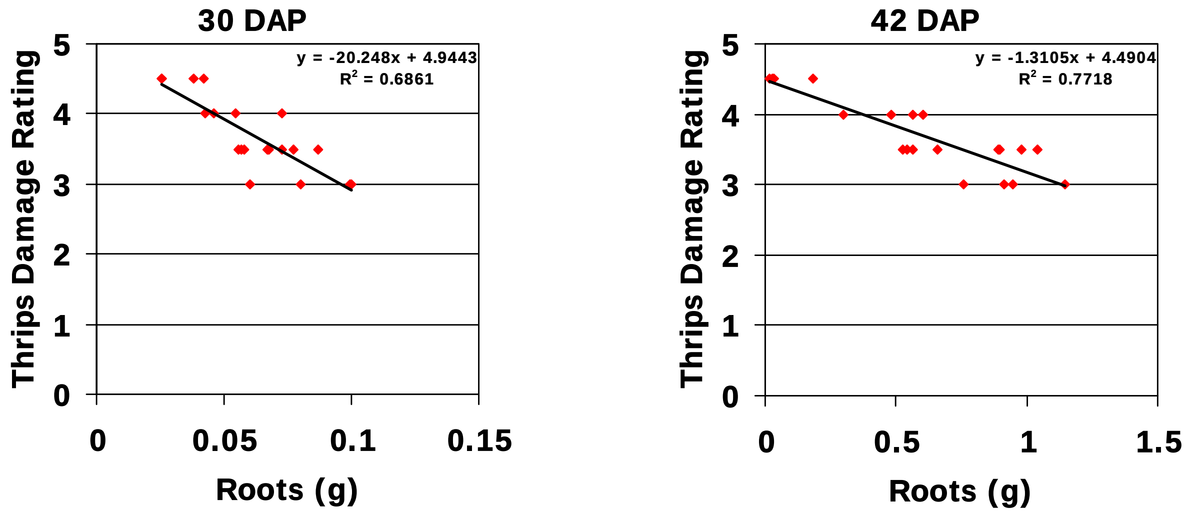

Figure 2. Correlation of thrips damage ratings with root dry weights in selected preventive thrips insecticide treatments, Tift Co. GA, 2008.

Literature Cited

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