EXCESSIVE THRIPS INJURY IMPACTS ROOT GROWTH IN SEEDLING COTTON

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Introduction

Thrips are a consistent and predictable insect pest of seedling cotton in Georgia and the southeast. In general, thrips infestations are higher on early planted cotton compared with late May and June plantings. Thrips feed on cotyledon leaves initially and then move to the growing point to feed on newly forming leaves. Thrips injury results in crinkled distorted true leaves, stunted or reduced seedling growth, delays in maturity, reduced yield potential, and in severe cases loss of apical dominance or stand loss. Thrips injury is also compounded by slow seedling growth resulting from other plant stresses such as cool temperatures. Most growers choose to use a preventive systemic insecticide at planting in the form of granules applied in the seed furrow or a commercial seed treatment to aid in management and control of early season thrips. Preventive treatments vary in efficacy and residual activity, and it is important that growers understand treatment performance and attributes.

Research has demonstrated a consistent yield response when preventive systemic insecticides are used. However, supplemental treatment with a foliar insecticide is sometimes needed. The threshold for foliar application of an insecticide for early season thrips is 2-3 thrips per plant and immatures present. The presence of immature thrips suggests that the preventive insecticide used at planting is no longer active or not providing control. Foliar treatments for thrips are rarely necessary once plants reach the 4-5 leaf stage and are growing vigorously.

Plant stunting resulting from excessive thrips injury has been well documented in many studies. However, relatively few studies have investigated the impact of thrips injury on root development. Rapid and robust root development is a desired objective in cotton production systems. A strong root system improves the plants ability to endure periods of stress resulting from poor growing conditions or debilitating pests such as nematodes. Recently Roberts and Toews reported on the impact of thrips injury on root growth (2008 Cotton Research and Extension Report, found online at ugacotton.com). However, in these studies plants were dug with shovels from field plots and more precise collection and quantification of root biomass is desired. Thus the objective of this study was to more precisely quantify the impact of seedling thrips infestations on early season root growth in a more controlled environment (i.e. potted cotton seedlings).

Materials and Methods

Treatments were selected with the objective of creating three levels of thrips infestation and injury and included an untreated check, Cruiser seed treatment, and Cruiser seed treatment plus foliar applications of Orthene 97 at 3 ozs/acre applied 10, 17, and 24 days after planting (DAP). Two seeds (DP 0935 B2RF) were planted in 1 gallon pots filled with soil amendment and fertilizer. Pots were uniformly watered to ensure rapid and uniform seedling emergence. Each treatment (pot) was replicated 45 times. Pots were arranged in a randomized complete block design and placed in the row middles of a recently tilled and planted field in Tift County, GA. Pots were partially buried in the soil so that 0.5-1 inch of the pot was visible. Seedlings were thinned to one plant per pot upon emergence. Pots were uniformly hand watered as needed during the trial period. Foliar insecticide treatments were applied on May 8, 15, and 23 with a CO2 backpack sprayer and TXVS 6 nozzles calibrated to deliver 13.8 gpa in a 12 inch band.

Thrips infestation levels and plant injury and growth measurements were collected on May 12, 19, and 26 (14, 21, and 28 DAP). Data was collected from 15 of the 45 replicates on each sample date. Subjective thrips injury ratings were assigned to individual plants on a scale of 1-5 where 1=no damage, 3=moderate (acceptable damage), and 5=severe damage. To quantify thrips infestation, plants were excised at the soil surface and immediately immersed in a container filled with 70% ETOH. Thrips samples were returned to the laboratory and immature and adult thrips were enumerated. The above ground portions of plants were individually bagged and also transported to the laboratory for additional processing. Plant height was determined by measuring the distance from the base to the terminal bud. Plant nodes or true leaves were also quantified; the uppermost node was determined by the presence of an expanded leaf at least the diameter of a quarter and the cotyledon node was defined as zero. Individual plant (above ground plant parts) dry weights were quantified after drying plants for 48 hours at 60 C in a forced air oven. Roots (below ground plant parts) were collected by removing the soil and root ball from individual pots and carefully washing soil from the root mass. Root dry weights were quantified for individual plants as described above. Root and shoot growth data were subjected to analysis of variance and means were separated using LSD, p=0.05.

Results and Discussion

Thrips infestations were high during the trial period, exceeding 50 thrips per plant in some pots. Infestations of individual seedlings were much higher than cotton which had been planted in rows in the trial area. Perhaps this was due to the fact that cotton in the pots (placed in row middles) emerged approximately 2 days prior to the field planted cotton. Thrips infestations varied from low to moderate to high in respective treatments (Table 1); thus achieving the goal of having varying degrees of thrips damage. Plant height and node development were all influenced as expected by the varying levels of thrips infestation and injury. Plant height and node development were decreased as thrips injury increased.

No significant differences in above ground plant biomass (shoots) were observed at 14 DAP (Figure 1). However, at 21 DAP the shoot dry weights for the Cruiser+Orthene treatment were significantly greater than the Cruiser and the untreated; no significant difference was observed between the Cruiser and untreated on this date. At 28 DAP significant differences were observed among all treatments; shoot dry weights were greatest in the Cruiser+Orthene > Cruiser > untreated.

Table 1. Thrips damage rating, number of immature and adult thrips per plant, plant height, and total nodes at 14, 21, and 28 days after planting. Tift County GA, 2009.

Evaluation Date Treatments	Thrips Damage Rating	Thrips per Plant Immatures	Thrips per Plant Adults	Plant Height (cm)	Nodes (True Leaves)
14 DAP (May 12)					
Untreated	3.87	26.73	11.67	5.73	0
Cruiser	3.39	15.79	10.43	6.43	0
Cruiser+Orthene[a]	2.32	5.50	2.43	6.50	0
21 DAP (May 19)					
Untreated	4.14	48.29	3.29	7.64	0.93
Cruiser	3.77	50.00	7.73	8.47	1.73
Cruiser+Orthene[a]	2.17	6.87	1.07	9.53	2.67
28 DAP (May 26)					
Untreated	4.47	11.53	1.73	7.90	0.47
Cruiser	3.63	15.00	2.53	11.10	2.93
Cruiser+Orthene[a]	2.30	5.07	0.67	13.20	4.13

[a]Orthene 97 applied at 3 ozs/acre on May 12, 19, and 26 (10, 17, and 24 days after planting)

Root (below ground plant parts) dry weights followed a similar trend as shoots except at 14 DAP. At 14 DAP the Cruiser+Orthene and Cruiser treatments had significantly greater root dry weights compared with the untreated (Figure 2). At 21 DAP Cruiser+Orthene had significantly greater root dry weights compared with Cruiser and the untreated. At 28 DAP significant differences were again observed among all treatments; root dry weights were greatest in the Cruiser+Orthene > Cruiser > untreated. Figure 3 illustrates the correlation of above-ground and below-ground plant growth at 28 DAP. An R-squared value of 0.81 suggests there is a strong correlation of above-ground to below-ground plant growth.

Data from this trial which was conducted in a manner to more precisely collect root data are consistent with results reported by Roberts and Toews in the 2008 Cotton Research and Extension Report. Reduced plant growth resulting from thrips injury is directly correlated with root growth. When you observe above-ground plant stunting resulting from excessive thrips injury, root development has also been deterred to a similar degree. These data suggests that failure to adequately control thrips will delay root development. 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.

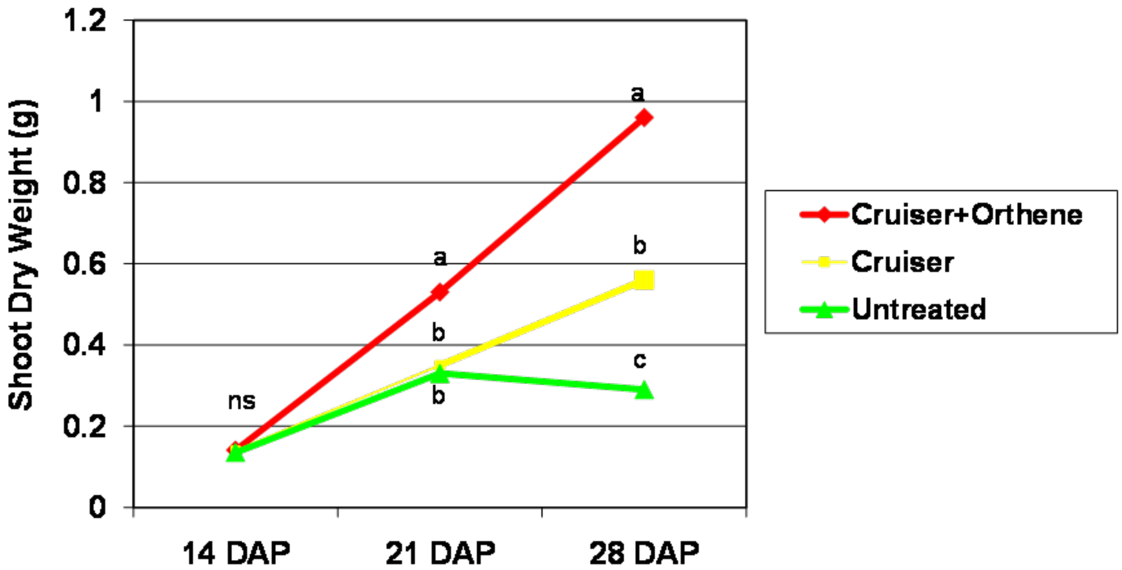

Figure 1. Root dry weights in selected treatments at 14, 21, and 28 days after planting. Tift County GA, 2009. Means followed by the same letter on a sample date are not significantly different.

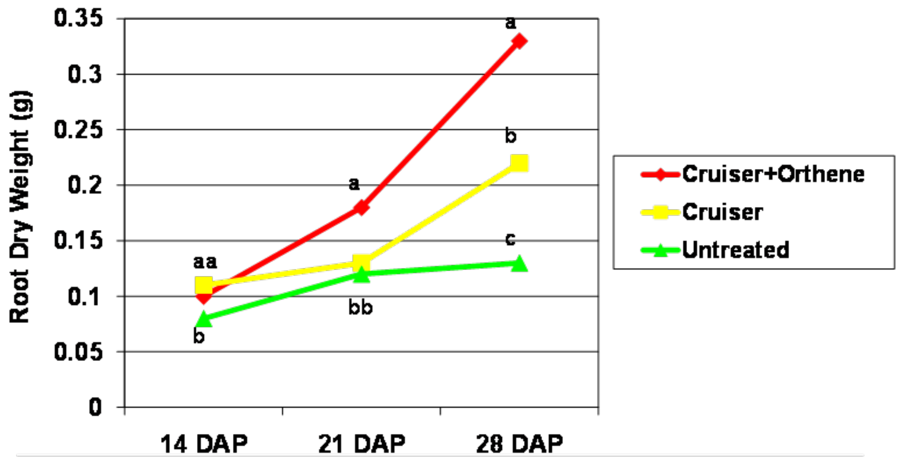

Figure 2. Root dry weights in selected treatments at 14, 21, and 28 days after planting. Tift County GA, 2009. Means followed by the same letter on a sample date are not significantly different.

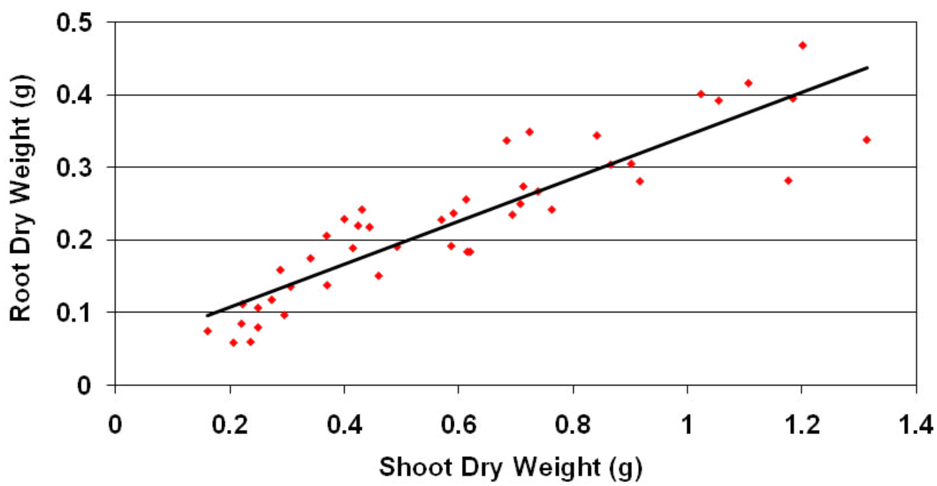

Figure 3. Correlation of root dry weights and shoot dry weights at 28 days after planting. Tift County GA, 2009.

References

Roberts, Phillip, and Mike Toews. 2009. Evaluation of thrips management programs and the effect of thrips damage on early season root growth. In: Cotton Research-Extension Report 2008 (Toews, M., G. Ritchie, and A. Smith, Eds.) UGA/CPES Research – Extension Publication No. 6, pp. 108-113. Found online at http://ugacotton.com.