EFFECTS OF SELECTED AT-PLANT SOIL RESIDUAL HERBICIDE PROGRAMS ON MANAGEMENT OF THRIPS

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Abstract

A field experiment was conducted in South Carolina during 2015 to evaluate the effects of selected at-plant, soil-applied herbicide programs on control of thrips in cotton. At-plant herbicides (fomesafen [Reflex] at 16 or 32 oz/acre or acetochlor [Warrant] at 3 pt/acre) had no impact on populations of or injury from thrips, plant heights, above-ground biomass, or yields. The addition of an at-plant insecticide (seed treatment [Aeris] or seed treatment plus an in-furrow spray of imidacloprid [Admire Pro]) significantly reduced populations of and injury from thrips and significantly increased plant heights, above-ground biomass, and yields when compared with untreated seed. Because at-plant, soil-applied herbicides and thrips can injury cotton seedlings independently, there can be additive damage from both. Correct rates of at-plant herbicides and use of a preventative at-plant insecticide are essential management practices to minimize stress on cotton seedlings.

Introduction

Thrips are the most consistent and predictable insect pests of cotton (Roberts et al. 2015). In the southeastern United States, tobacco thrips, *Frankliniella fusca* (Hinds) (Thysanoptera: Thripidae), is the predominant species infesting and injuring seedling cotton in the region. Because of the risk of injury from thrips, control of thrips in the crop is achieved primarily with prophylactic use of systemic insecticides applied during planting. Common delivery systems for these insecticides include an in-furrow application of a granular or liquid formulation with the seed during planting or applied directly to the seed coat prior to planting.

In recent years, the abundance of Palmer amaranth ("pigweed"), *Amaranthus palmeri* S. Watson resistant to glyphosate (Roundup) has forced cotton producers to use more residual herbicides before the crop emerges from the soil. These soil-applied herbicides are typically applied immediately after the crop is planted and are referred to as 'pre-emergence' herbicides. Because controlling resistant weeds is no longer possible with over-the-top post-emergence applications of broad-spectrum herbicides, the strategy of using pre-emergence materials has become essential. However, often, particularly if rates of pre-emergence herbicides are too high and/or interactions with soil type/texture and untimely heavy rainfall events occur after planting, injury to cotton seedlings can be pronounced. Delays in maturity or yield reductions can be observed with plant loss or injury from pre-emergence herbicides. Potential exists for delays or losses associated with injury from herbicides to be compounded with delays or losses associated with injury from thrips. Recent research has focused on the potential interactions of pre-emergence herbicides and at-plant insecticides for thrips (Clarkson et al. 2014; Copeland et al. 2014, 2015; Roberts et al. 2015; Vineyard et al. 2015). The objective of this research was to investigate the effects of selected at-plant soil residual herbicide programs on control of thrips in cotton grown in South Carolina.

Materials and Methods

Plots of cotton variety ST5445LLB2 were strip-till planted on 15 May 2015 at Clemson University's Edisto Research and Education Center (EREC) near Blackville, South Carolina, and maintained using production practices recommended by the Clemson University Cooperative Extension Service (Jones et al. 2015). Plots 8 rows by 40 feet on a 38-inch row spacing with 4 replications of each treatment were arranged in a factorial design with pre-emergence herbicide and at-plant insecticide as main factors. Pre-emergence herbicides were fomesafen (Reflex) at 16 (standard use rate) or 32 (twice the standard use rate) oz/acre and acetochlor (Warrant) at 3 pt/acre. At-plant insecticides were a seed treatment containing imidacloprid/thiodicarb (Aeris), the seed treatment plus an in-furrow spray (IFS) application of imidacloprid (Admire Pro) at 9.2 oz/acre, or seed untreated with insecticides (fungicide only). An additional treatment was intended to include the seed treatment, IFS of imidacloprid, and a foliar application of acephate (Orthene 97) at 3 oz/acre, but the desired foliar application window (1st leaf) was missed.

Thrips were collected by randomly pulling 10 plants from rows 2 and 7 of each plot and dipping them in 48-oz jars of 50% isopropyl alcohol (Greene et al. 2007). After filtration procedures, nymphs and adults were counted from filter paper using dissecting microscopes. Insect counts began at the cotyledon stage and continued until plant size limited sampling. Weekly ratings on insect injury to plants were conducted in all tests by observing the visible foliar damage caused by thrips and assigning a number to each plot with "0" equal to no damage and "5" equal to severe damage. Ratings of herbicide injury were taken at 7, 14, and 21 days after planting (DAP) by observing visible injury caused by at-plant herbicides. Stand counts were taken in each test by counting the number of plants in 12 row feet per plot. Plant heights were taken weekly by measuring 5 plants per plot (cm from soil to terminal). At about 42 days after planting, five plants per plot from the center four rows were cut at the soil level, weighed for fresh weights, and dried in an oven for at least 48 hr before dry weights were determined. Yields were estimated from the 4 center rows harvested with a mechanical 2-row plot cotton picker. Data were processed using Agriculture Research Manager (Gylling Data Management, Inc., Brookings, SD) and means were separated using Least Significant Difference (LSD) procedures following significant F tests using Analysis of Variance.

Results and Discussion

Reflex at 32 oz/acre (2x the standard rate) resulted in significantly higher crop injury for all evaluations (7, 14, and 21 days after planting/treatment) when compared with Warrant at 3 pt/acre or Reflex at 16 oz acre (Figure 1). However, maximum observed injury from the high rate of Reflex was under 40% and not as excessive as expected.

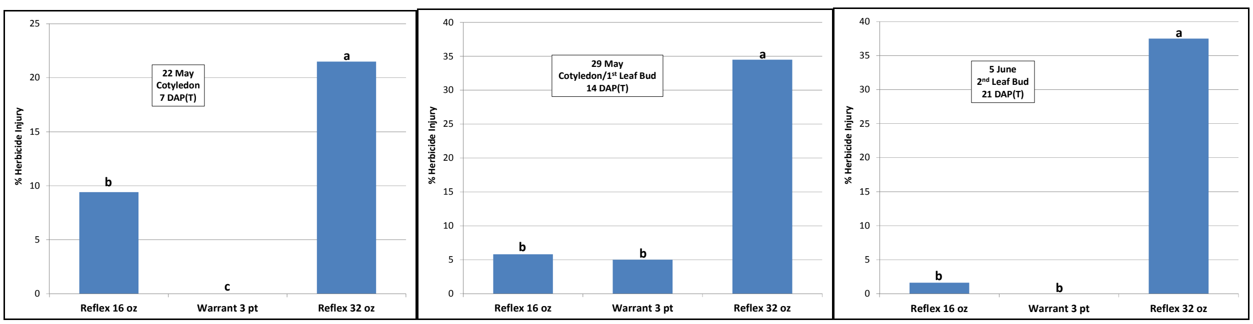

Figure 1. Ratings of visible symptoms of injury to cotton seedlings at 7, 14, and 21 days after planting/treatment (DAP) caused by soil-applied, pre-emergence herbicides in Blackville, SC, during 2015.

Densities of thrips were not significantly different across at-plant herbicide programs, indicating that herbicides had no effect on populations of thrips. However, at 14, 21, and 28 DAP, at-plant insecticides (seed treatment and seed treatment plus in-furrow spray) were effective in reducing populations of thrips (Figure 2).

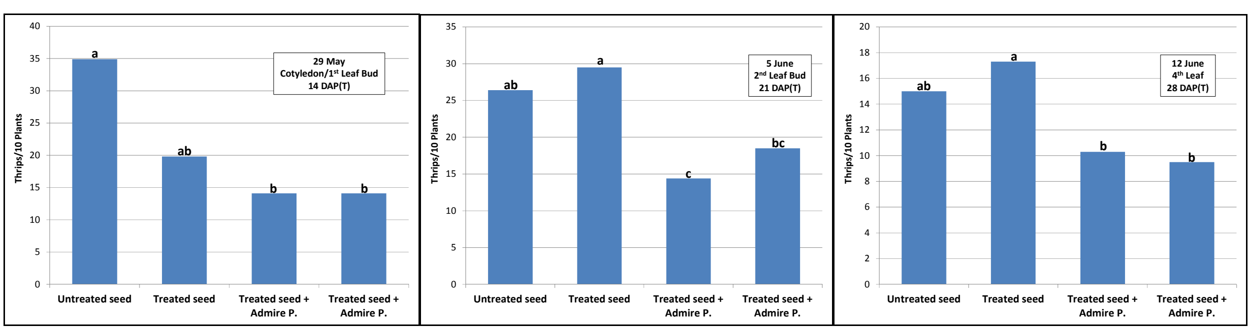

Figure 2. Densities of thrips at 14, 21, and 28 days after planting (DAP) in plots of cotton with at-plant insecticides (treated seed or treated seed plus in-furrow spray) or untreated for thrips in Blackville, SC, during 2015.

Ratings of injury from thrips were also not significantly affected by herbicide program, but they were reduced numerically with protection from at-plant insecticides. Plant heights were also not impacted by at-plant herbicides, but plant heights were significantly increased when at-plant insecticides were used (Figure 3). Dry plant biomass and seed cotton yields were not significantly impacted by at-plant herbicide, but use of an at-plant insecticide significantly increased above-ground biomass and yields (Figure 4).

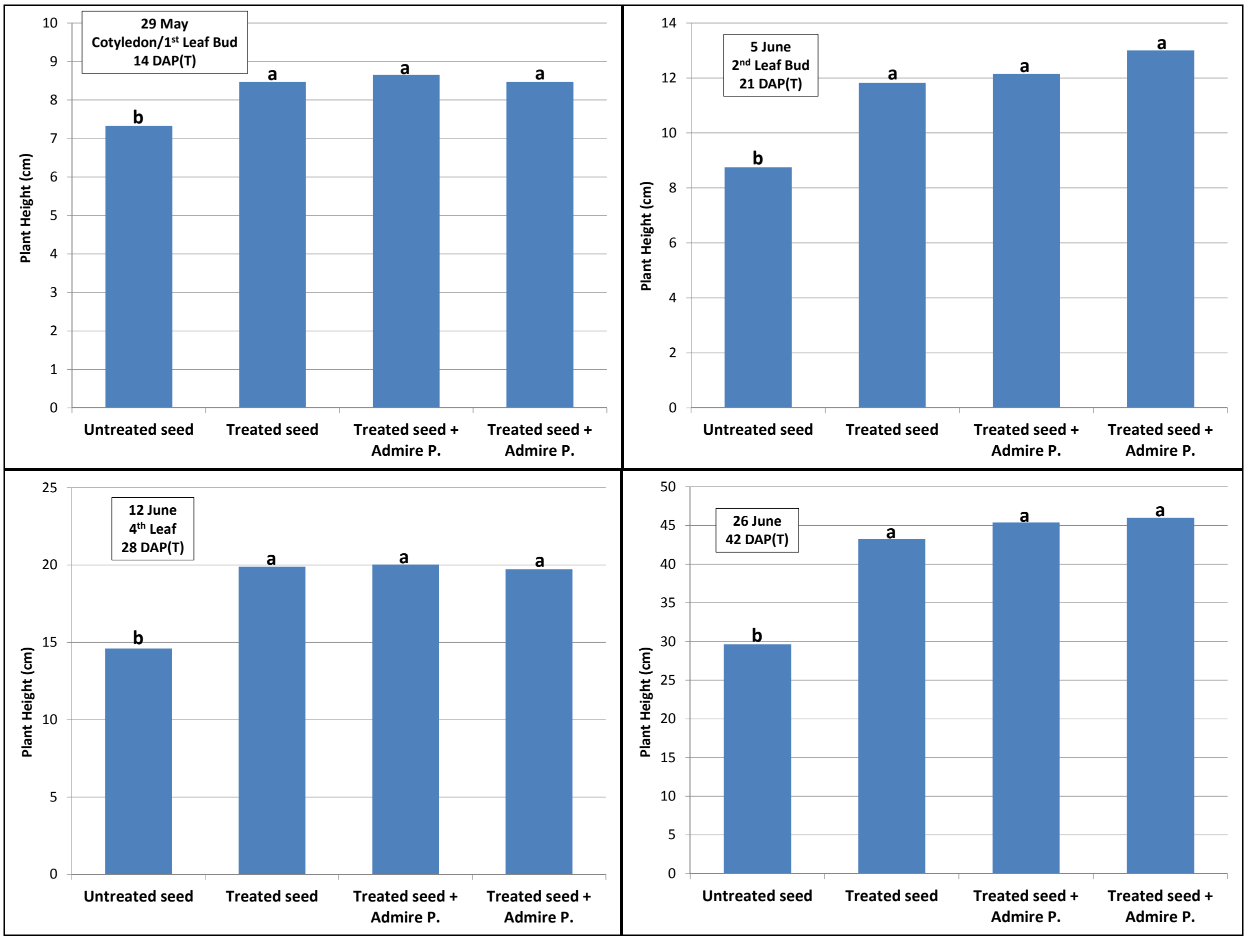

Figure 3. Plant heights at 14, 21, 28, and 42 days after planting (DAP) in plots of cotton with at-plant insecticides (treated seed or treated seed plus in-furrow spray) or untreated for thrips in Blackville, SC, during 2015.

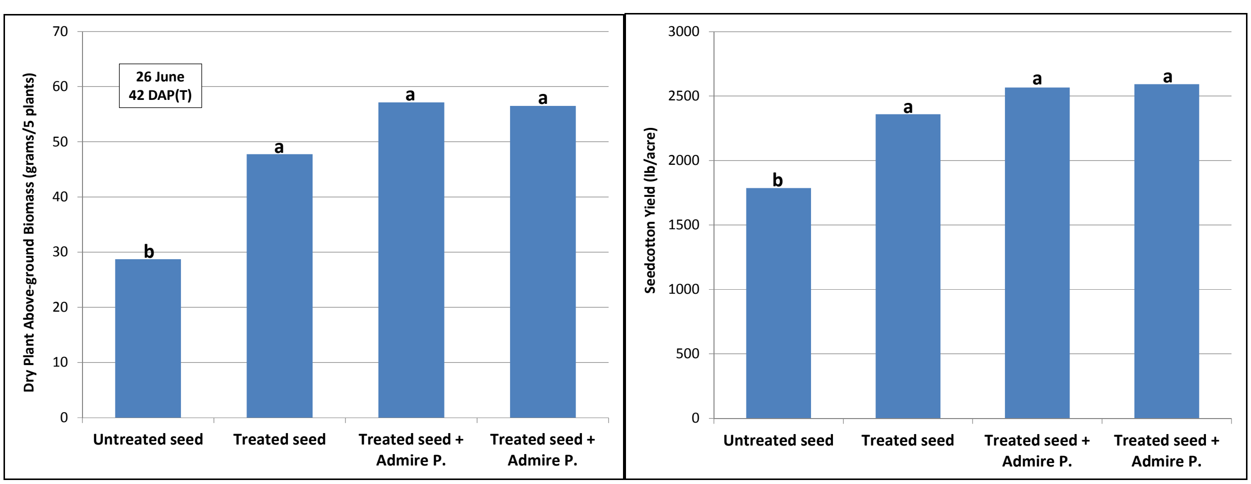

Figure 4. Dry, above-ground biomass at 42 days after planting (DAP) and seed cotton yields from plots of cotton with at-plant insecticides (treated seed or treated seed plus in-furrow spray) or untreated for thrips in Blackville, SC, during 2015.

Summary

Under certain circumstances (rate too high, soil type/texture, excessive rainfall and splash injury, etc.), pre-emergence herbicides used in cotton can stunt the growth of the crop and potentially result in a delay in maturity or yield reduction. Potential exists for delays or losses associated with injury from herbicides to be compounded with delays or losses associated with injury from thrips. Some research has indicated that increased numbers of thrips were observed where at-plant herbicides were applied (Vineyard et al. 2015), but other research findings addressing at-plant herbicides and insecticides have reported no interactions (Clarkson et al. 2014; Copeland et al. 2014, 2015). We did not see any effect of herbicide program on thrips in our study, but, because injury from herbicides and pressure from thrips were not excessive in our experiment, it was difficult to make inference about potential interactions or additive effects of insect and chemical injury. However, the impact that thrips can have on plant injury and yield are increased when seedlings are stressed, as can occur with injury from herbicides (Roberts et al. 2015). Stress to cotton seedlings should be minimized by using proper rates of herbicides and a preventative at-plant treatment for thrips. Proper scouting and treatment with a foliar application of insecticide for thrips at recommended thresholds will also minimize stress on young cotton plants.

Acknowledgements

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