THE INTERACTION OF PRE-EMERGE HERBICIDES AND INSECTICIDE SEED TREATMENTS AND ITS EFFECTS ON EARLY SEASON COTTON

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Abstract

Thrips (*Frankliniella fusca* and *Frankliniella occidentalis*) are among the most important pests during the early growing season of Mid-south, cotton (*Gossypium hirsutum* L.). In most years it is not uncommon to over spray 20-30% of cotton acres for thrips. However, within the last two years, thrips pressure has increased. In 2011 and 2012 more than 70% of cotton acreage received supplemental insecticide application apart from insecticide seed treatments for control of thrips. Due to declining efficacy of insecticide seed treatments and an increase in the use of pre-emerge herbicides; a route for an herbicide/insecticide interaction has emerged. This experiment was designed to investigate the interaction between insecticide seed treatments and pre-emerge herbicides, how this interaction effects cotton growth, and how this interaction effects the efficacy of insecticide seed treatments on thrips. Treatments consisted of two insecticide seed treatments and a control crossed with 3 commonly used pre-emerge herbicides and a control, making a 3x4 factorial. Thrips densities were estimated 3 times at 13, 20, and 26 days after emergence. Thrips densities were variably effected only by insecticide seed treatments. Our studies indicate that while pre-emerge herbicides may impact growth, the interaction between insecticide seed treatments and pre-emerge herbicides had no effect on thrips densities.

Introduction

Primary control methods for reduction of thrips densities have evolved over the years. Before the rapid adoption of insecticide seed treatments, Temik (aldicarb) was the primary method of control to reduce thrips densities. However, due to off-target impacts in the early 1990's Temik was phased out and alternative methods of control were identified. Around the same time period insecticide seed treatments (IST) were introduced. Several benefits result from IST, including increased vigor and equivalent efficacy in combination with a cheaper method of application, convenience, and reduction in equipment cost. These benefits allowed for the rapid adoption of IST. The use of IST has continued to increase, as of 2012, 99% of all Arkansas cotton acreage was planted with an insecticide treated seed (Williams, 2012). Even in fields planted with treated seed, foliar applications are common, with 20-30% of cotton acres for thrips. However, within the last two years, thrips pressure has increased. In 2011 and 2012 more than 70% of cotton acreage was over sprayed for thrips control, independent of insecticide seed treatments (Williams, 2012). This increase of foliar applications leads to a conclusion that the efficacy of seed treatments has declined in recent years. Coinciding with the observed loss of thrips control has been the issue of roundup resistance in pigweeds. Once resistance was discovered in 2005 there was a major shift in weed control practices and pre-emerge herbicide use is now at an all-time high (Steckel, 2012). Within the last two years (2011 and 2012) a new potential has developed for the interaction of IST and pre-emerge herbicides. This potential interaction has led to the hypothesis that pre-emerge herbicides are interacting with IST to cause a change in efficacy of the insecticide. During the same time period another observation was made, that under normal conditions, early season cotton growth has slowed. The objective of this study is to determine if there is an interaction between pre-emerge herbicides and IST that is affecting IST efficacy and/or early season cotton growth.

Methods

This study was conducted at two locations: the Lonn Mann Cotton Branch Experiment Station in Marianna, Arkansas and the Rowher Research Station in Rohwer, Arkansas. Treated seed (Variety ST 4946) was planted on May 5 and May 25, 2013, respectively. Plot sizes were 12.5 ft. (4 rows) by 50 ft. (replicated complete blocks). There were 12 different treatments (Table 1) arranged in 3x4 factorial. Pre-emerge herbicides were applied post planting with a John Deere 5210 multi boom attachment, fitted with Green Leaf 11001 AirMix® tips. Spray volume was 10 GPA at 50-55 psi. Thrips counts were made at 13, 20, and 26 days after emergence. Five randomly selected plants per treatment were clipped at ground level, placed into jars filled with 70% alcohol, and then taken back to the lab to be counted under microscopes. Plant heights were taken once weekly from the time of emergence until first bloom. Measurements were taken by randomly selecting five plants per plot and measuring from the ground surface to the end of terminal growth. Stand counts were taken ten days after emergence. Stand counts were estimated by placing a 10 ft. pole randomly in each plot and counting the number of plants within the section. Herbicide injury ratings were taken 5-7 days after emergence and after the application of a foliar herbicide. Injury was split into two categories (chlorosis and necrosis). A scale of 0-100% was used with 0= no damage and 100= total loss. Nodes above white flower counts were made once near physiological cut-out to determine differences in maturity. All plots were then treated identically for the remainder of the growing season, with insects kept at threshold and weeds removed by hand. Yield was taken in pounds of seed cotton per plot and later transformed into pounds of seed cotton per acre. All data were analyzed using analysis of variance tests (JMP11) with Tukey's Highest Significant Difference method, when significant differences were detected among means.

Table 1. Treatments.

Treatment	Insecticide Seed Trt	Herbicide
1	Untreated	Untreated
2	Untreated	Cotoran 1 qt/a
3	Untreated	Diuron 1 pt/a
4	Untreated	Reflex 1 pt/a
5	Aeris 0.75 mg AI/seed	Untreated
6	Aeris 0.75 mg AI/seed	Cotoran 1 qt/a
7	Aeris 0.75 mg AI/seed	Diuron 1 pt/a
8	Aeris 0.75 mg AI/seed	Reflex 1 pt/a
9	Avicta Duo 0.525 mg AI/seed	Untreated
10	Avicta Duo 0.525 mg AI/seed	Cotoran 1 qt/a
11	Avicta Duo 0.525 mg AI/seed	Diuron 1 pt/a
12	Avicta Duo 0.525 mg AI/seed	Reflex 1 pt/a

Results

Visual differences in plant appearance among treatments approximately 60 days after emergence were observed. Plots with Aeris treated seed contained the healthiest more vigorous plants followed by Avicta treated seed and then untreated seed. No significant differences were observed in stand counts, chlorosis damage, and Nodes above White Flower. Thrips populations were significantly effected by insecticide seed treatments alone. However, no differences were observed for thrips numbers by pre emerge herbicides or the interaction between pre-emerge herbicides and ISTs. Avicta (thiamethoxam) reduced thrips numbers compared to an untreated seed and Aeris (imidacloprid) had fewer than Avicta (Fig 1). All thrips populations were based on the sum of three collection periods.

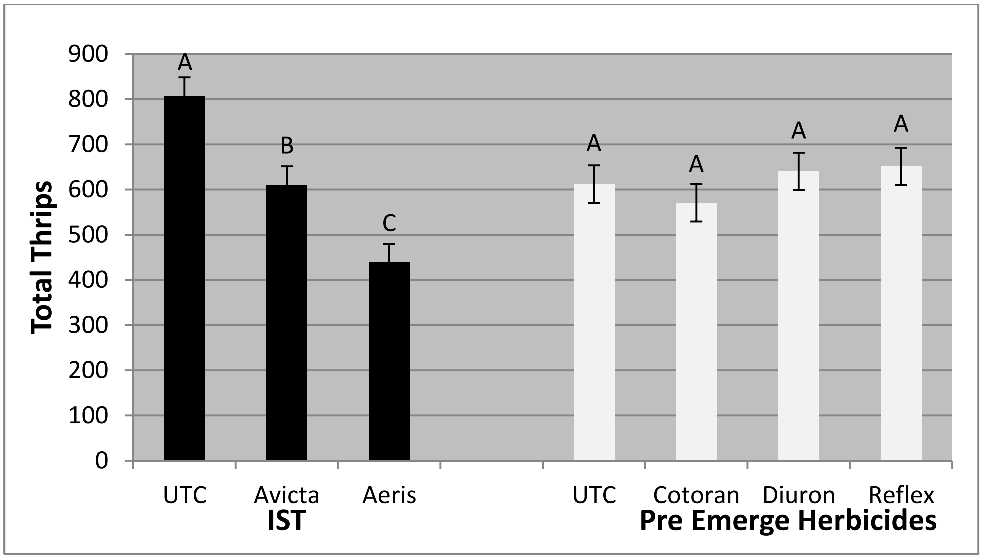

Figure 1. Thrips vs. IST and Pre Emerge Herbicides

Plant heights were also significantly effected by IST alone, but were not influenced by pre-emerge herbicides or the interaction effect, each having no statistical separation. As seen in (Figure 2) Aeris treatments showed taller plants at 15 days after emergence but only separated statistically from the untreated check. Both seed treatments separated with taller plants than the untreated check approximately 45 days after emergence but the two seed treatments did not separate among themselves. Comparatively, pre-emerge herbicides showed no separation in plant heights at both 15 and 45 days after emergence.

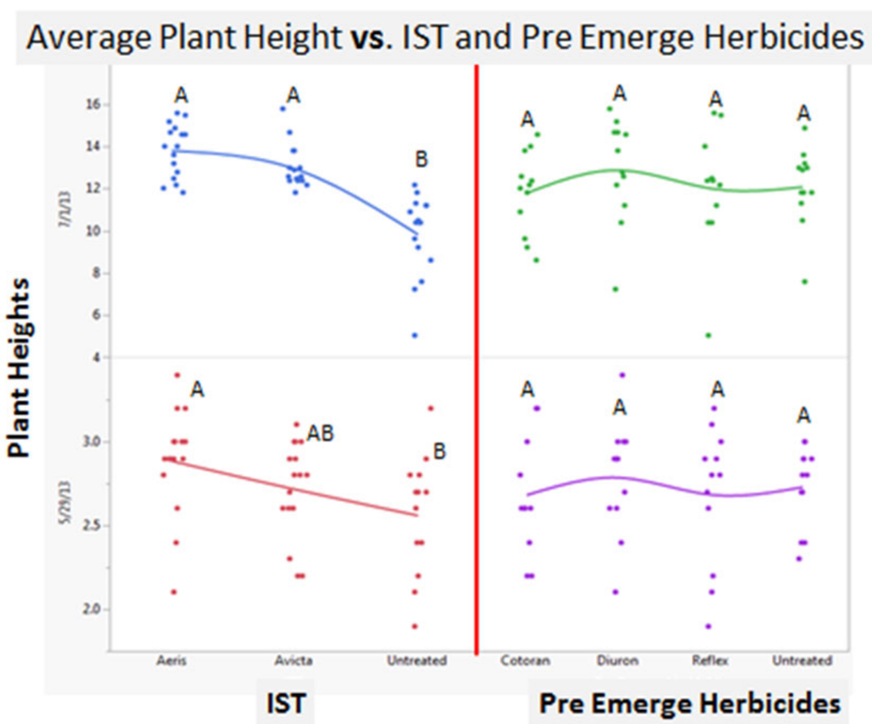

Figure 2. Average Plant Heights vs IST and Pre Emerge Herbicides

After the event of a foliar application of Ignite (45 days after emergence) plants showed signs of necrosis damage. Necrosis damage was highest at 50% in the untreated check while less damage was observed in Avicta treatments (25%). Aeris treatments had the least necrosis damage at 9% (Figure 3). Pre-emerge herbicides exhibited no significant impact on necrosis damage.

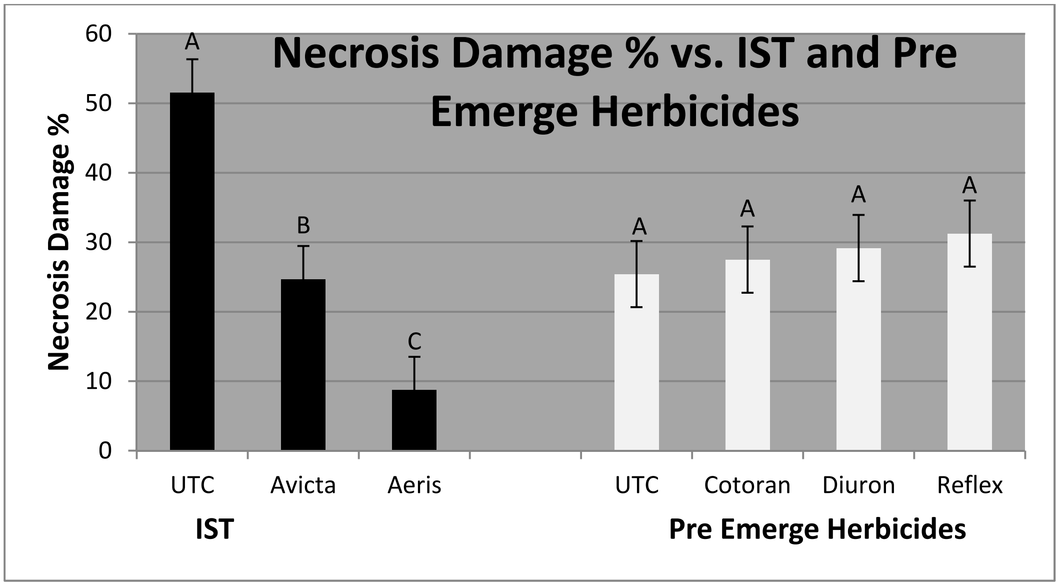

Figure 3. Necrosis Damage %.

Summary

The results suggest that thrips populations are impacted only by IST and the hypothesis that pre-emerge herbicides may impact IST efficacy is not correct. Cotton growth rates were only effected through the action of IST. Stunting did not occur from pre emerge herbicides possibly due to the proper timing of rain event, just behind application. More thrips damage seemed to correlate with greater necrosis damage after the application of Ignite 45 days after emergence. However, herbicide injury may have been compounded by plant stress caused by thrips damage earlier in the growing season. Aeris insecticide seed treatment performed much greater than Avicta-Duo seed treatment across the majority of data collected, exhibiting taller plants, less thrips damage, and less Necrosis damage. In 2013, preliminary studies were conducted testing populations of thrips throughout the south for resistance to neonicotinoids. Results indicated reduced control of thrips with thiamethoxam. This data and preliminary studies suggest that reduced efficacy of IST is not through the interaction of IST and pre-emerge herbicides but, may actually be the loss of control of IST. Data collected in this trial supports this hypothesis. More data will need to be collected in order to determine if this resistance trait is heritable.

Acknowledgements

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References

Steckel, L. (2012). *The Double Edged Sword of Preemergence Herbicides*. Paper presented at the Beltwide Cotton Conference, Orlando, FL.

Williams, M. R. (2012). *At planting Insecticide Applications (2012).*