POTENTIAL INTERACTION OF THRIPS MANAGEMENT AND PRE HERBICIDES IN COTTON

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Abstract

Field experiments were conducted in Alabama, Georgia, South Carolina and Virginia during 2013 and 2014 evaluating the potential interaction of thrips management programs and the use of preemergence herbicides. Thrips management programs evaluated included no insecticide, a neonic seed treatment, and a neonic seed treatment plus a foliar application of acephate at the 1-leaf stage. Preemergence herbicide treatment included No PRE, PRE(1X), and PRE(2X). Although additional statistical analyses are needed before drawing conclusions from these trials some interesting trends appear obvious. Preventive treatments, in the form of a seed treatment, provided thrips control and increased yield in these studies. There was also evidence that additional thrips management, such as a foliar application of acephate may be needed to supplement thrips control by a seed treatment and further preserve yield in some environments. These data suggest that the impact of thrips on plant injury and yield are increased when seedlings are stressed (i.e. when a PRE(2X) herbicide program was used). Pre-emergent herbicides are and will remain a necessity in southeastern cotton production and a better understanding of the relationship of thrips management in environments where stress occurs will allow better management decisions to be made. In environments where seedlings are stressed, thrips scouting and management should be a priority.

Introduction

Thrips, primarily tobacco thrips, *Franliniella fusca* (Hines), are predictable and economic insect pests of seedling cotton in the southeastern US. Symptoms of injury from thrips include leaf distortion, stunted plants, and delays in maturity, reduced yield potential, and, in severe cases, loss of apical dominance and stand loss. Most growers use a neonicotinoid seed treatment as a preventive treatment. Preventive thrips insecticide use at planting in the Southeast has historically provided a consistent yield response. However, supplemental foliar insecticide sprays may be needed in some environments to further preserve yield potential.

The widespread presence of glyphosate resistant Palmer amaranth in the region has led to increased use of preemergence (PRE) residual herbicides. An unfortunate potential side effect of PRE herbicides is that plant injury may occur depending upon environmental conditions and/or other factors. Previous research and observations have shown that rapid seedling growth is a desirable component of a thrips management program. Potential stress from PRE herbicides may delay seedling growth and development resulting in increased susceptibility to thrips feeding and prolonging the “thrips susceptible” window; cotton is generally considered susceptible to thrips until seedlings reach the 4-leaf stage and are growing rapidly. The use of PRE herbicides is mandated for effective management of Palmer amaranth and potential interactions of PRE herbicide use and thrips management programs warrant further investigation. Our hypothesis is that a specific stress or multiple general stressors create a “High-Risk” environment for yield loss resulting from thrips feeding. This could be created by early planting and associated cool conditions, conventional tillage, herbicide injury, etc. As a specific stress, plant injury and yield loss resulting from thrips injury may increase when PRE herbicide injury occurs. PRE herbicide injury will result in poor seedling growth that will reduce cotton seedlings ability to tolerate thrips feeding and extend the thrips susceptible window. By identifying this association, it may be possible to focus thrips management programs on the High-Risk environment possibly created by the use of PRE herbicides and their associated stress.

Materials and Methods

Field experiments were conducted in Alabama, Georgia, South Carolina, and Virginia during 2013 and 2014. Generally field experiments were established early during the recommended planting window to encourage high thrips infestations. Trials were maintained following local Extension recommendations. Treatments were arranged in a factorial design with four replications. Trial locations were maintained weed-free using post-emergence herbicides and hand weeding.

Insecticide treatments included:

1) No at-plant thrips insecticide
2) Neonic seed treatment (thiamethoxam)
3) Neonic seed treatment (thiamethoxam) + acephate applied as a foliar spray at the 1-leaf stage

PRE herbicide treatments included:

1) No PRE herbicide
2) PRE herbicide 1X rate (local standard which varied by location)
3) PRE herbicide 2X rate (local standard which varied by location)

Thrips Estimation and Plant Sampling

Populations of adult and immature thrips, visual plant injury ratings, plant height, plant biomass, and yield were assessed in all trials. Thrips populations were sampled weekly beginning at 7-14 days after plant emergence and continuing until seedlings reached the 5-leaf stage by randomly selecting 5 plants per plot and placing seedlings in a jar partially filled with 70% ethyl alcohol (or soapy water). Visual damage ratings were rated on a per plot basis on a scale of 0 to 5 (no damage to dead plants) with 3 being designated as acceptable thrips control for commercial growers. Plant height was estimated by measuring the total height (cm) from ground level to the tip of the growth terminal on 5 plants per plot. Plant maturity was estimated by recording the number of true leaves (expanded to the size of a quarter) on those same 5 plants. Plant stand was estimated by counting the total number of plants in one entire row, while plant biomass was estimated by cutting 5 random plants per plot at soil level and pooling those samples into labeled paper bags. The samples were dried in a forced air oven at 60 degrees C for 48 h and then weighed (to hundredths of a gram). Final yield data were also collected at the end of the season.

Results and Discussion

Thrips infestations and associated plant injury ratings were highly variable in the eleven trials conducted. Six of the trials experienced moderate to high thrips populations and damage ratings consistently greater than 3.0 in no insecticide treatments (Table 1); these locations included Alabama 2013, Alabama (Prattville) 2014, Georgia 2013 and 2014, and Virginia 2013 and 2014. Thrips injury ratings and yield data from these six trials are included in this summary.

Table 1. Thrips injury ratings 4-5 weeks after planting; 2013-2014.

PRE	**Thrips**	**AL 13**	**GA 13**	**SC 13 low**	**SC 13 high**	**VA 13**
None	Untreated	**4.25**	**4.13**	2.25	2.75	**3.56**
None	Seed Treatment	**3.25**	**3.75**	2.00	**3.25**	0.75
None	Seed Treatment + Orthene	1.88	2.63	2.25	2.75	0.56
PRE (1X)	Untreated	**4.13**	**4.50**	2.00	2.50	**3.81**
PRE (1X)	Seed Treatment	**3.25**	**3.75**	2.00	2.00	**3.06**
PRE (1X)	Seed Treatment + Orthene	2.00	2.75	2.25	3.00	1.56
PRE (2X)	Untreated	**4.50**	**4.50**	2.50	3.00	**4.50**
PRE (2X)	Seed Treatment	**3.25**	**3.88**	2.50	2.75	**4.00**
PRE (2X)	Seed Treatment + Orthene	2.50	2.88	2.00	3.00	**3.69**
		AL 14pr	**AL 14bm**	**GA 14**	**SC 14e**	**SC 14l**
None	Untreated	**3.50**	2.75	**3.75**	3.0	2.5
None	Seed Treatment	**3.25**	2.00	**3.13**		
None	Seed Treatment + Orthene	2.00	1.25	2.25		
PRE (1X)	Untreated	**3.75**	2.88	**4.38**	2.60	2.37
PRE (1X)	Seed Treatment	**3.25**	2.00	**3.75**	3.00	2.53
PRE (1X)	Seed Treatment + Orthene	2.25	1.25	2.75	2.17	1.17
PRE (2X)	Untreated	**3.50**	2.75	**4.50**		
PRE (2X)	Seed Treatment	2.75	2.00	**4.38**		
PRE (2X)	Seed Treatment + Orthene	3.00	1.50	**3.75**		

In all herbicide systems there was a trend for lower thrips damage ratings (Figure 1) as thrips management increases (untreated > seed treatment > seed treatment + acephate). There was also a trend for thrips damage ratings to increase for individual thrips management treatments as herbicide rates increased (PRE(2X) > PRE(1X) > No PRE). Interestingly the seed treatment provided acceptable thrips control where no PRE was used (damage rating < 3) whereas thrips injury was unacceptable in PRE(1X) and PRE(2X) herbicide treatments. Inclusion of a 1-leaf acephate foliar insecticide application provided acceptable thrips control in the PRE(1X) whereas no thrips management program provided acceptable thrips control in the PRE(2X) herbicide treatment. These trends support our hypothesis that thrips damage will be increased when plants are stressed.

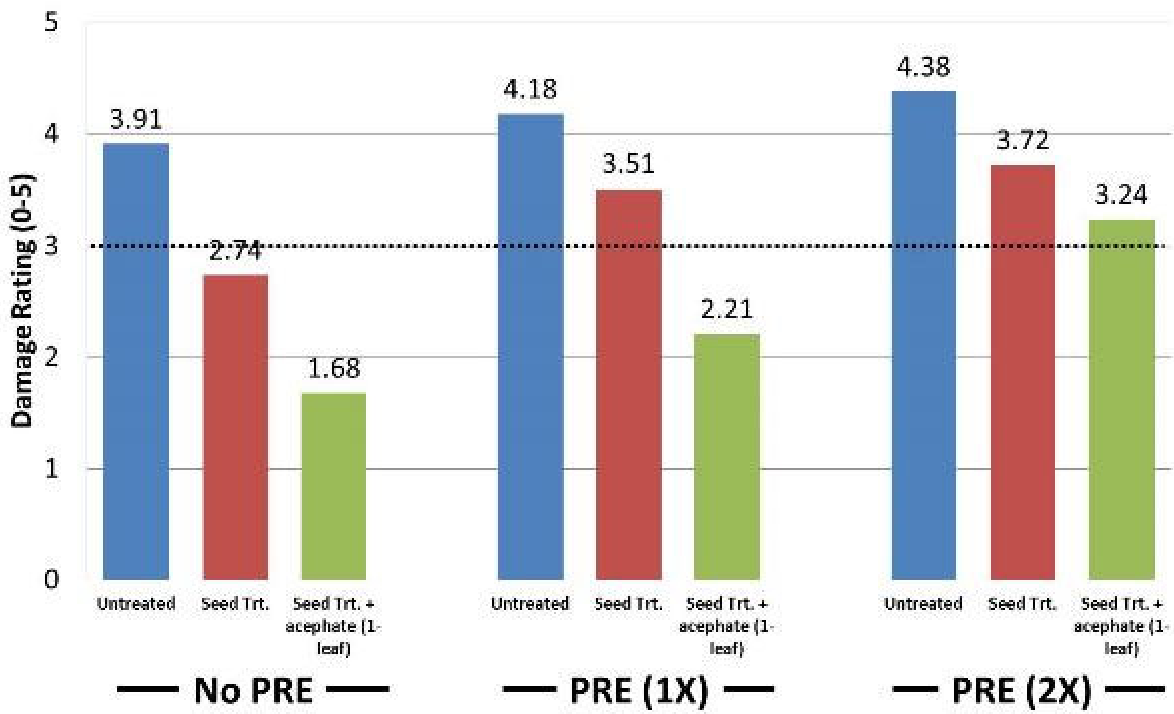

Figure 1. Mean thrips damage ratings from trials with moderate to high thrips infestations; 2013-2014.

Yield trends were inversely related to thrips damage ratings, as thrips damage ratings increased yield was reduced (Figure 2). The general trend is very similar to what was observed in thrips damage ratings. The mean yield response for thrips management treatments tended to increase as the herbicide rate increased (Figure 3). Seed treatments alone increased yield 15, 18, and 24 percent compared with the untreated in the No PRE, PRE(1X), and PRE(2X) treatments respectively. The percent yield increase of the seed treatment+acephate compared with the untreated was 18, 25, and 47 percent in the No PRE, PRE(1X), and PRE(2X) treatments respectively. The difference between yield responses of the seed treatment alone compared with the seed treatment+acephate tended to increase as PRE herbicide rate increased suggesting that yield loss potential was increased as plant stress increased.

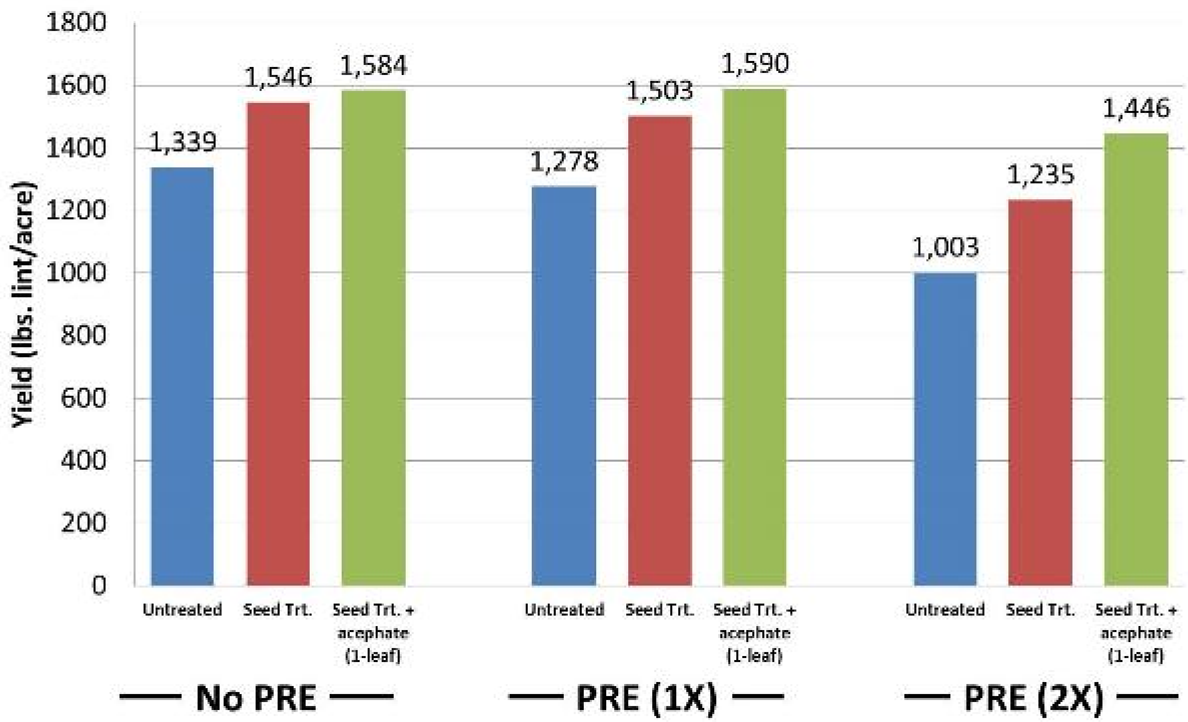

Figure 2. Mean lint yield from trials with moderate to high thrips infestations; 2013-2014.

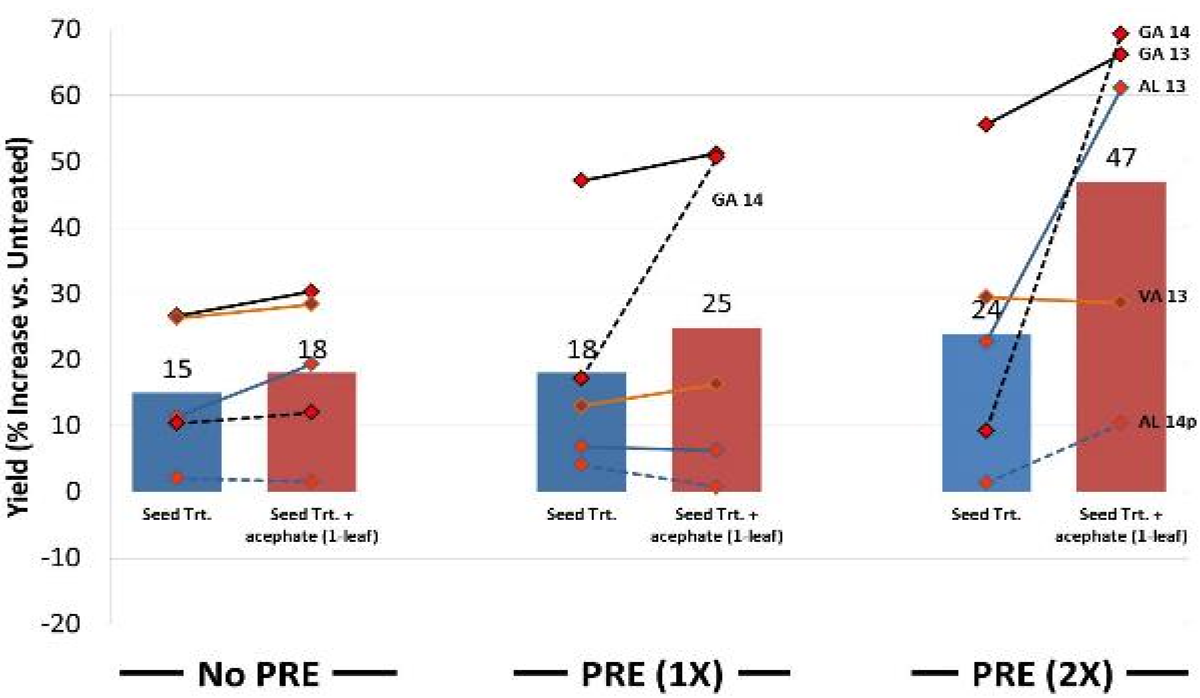

Figure 3. Mean percent lint yield compared with the untreated and from individual trials with moderate to high thrips infestations; 2013-2014.

Yield responses of seed treatment and seed treatment+acephate treatments compared with the untreated within PRE herbicide treatment in individual trials varied by location (connected data points, Figure 3). There were significant interactions at the Alabama (Prattville) and Georgia locations in both years. The slopes of yield response in the seed treatment and seed treatment+acephate treatments within PRE herbicide programs were steeper in the PRE(2X) herbicide system compared with the No PRE and PRE(1X) treatments. Also note that the slope was steep in the PRE(1X) location in the Georgia 2014 location, where stress from the PRE(1X) herbicide treatment was observed.

Summary

Although additional statistical analyses are needed before drawing definitive conclusions from these trials some interesting trends appear obvious. Preventive treatments, in the form of a seed treatment, provided thrips control and increased yield in these studies. There was also evidence that additional thrips management, such as a foliar acephate application, may be needed to supplement thrips control by a seed treatment and further preserve yield in some environments. These data suggest that the impact of thrips on plant injury and yield are increased when seedlings are stressed (i.e. when a PRE(2X) herbicide program was used). Pre-emergent herbicides are and will remain a necessity in southeastern cotton production, and a better understanding of the relationship of thrips management in environments where stress occurs will allow better management decisions to be made. In environments where seedlings are stressed, thrips scouting and management should be a priority.

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