UTILIZING INSECTICIDE SEED TREATMENTS AND STARTER FERTILIZERS TO REDUCE THRIPS INJURY IN COTTON

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Abstract

Studies were conducted in northeast Louisiana during the 2020 and 2021 growing seasons to evaluate the value of starter fertilizer in conjunction with insecticide seed treatments against thrips infesting cotton seedlings. Ratings include plant stand, thrips counts, thrips damage, leaf area, canopy coverage, plant heights, and yield. There were no significant differences in plant stand between treatments. Significant differences in thrips counts were seen at the 2-leaf ratings between treatments. The inclusion of at-planting insecticides and starter fertilizer reduced thrips numbers compared to the untreated check. There were no significant differences in thrips counts between treatments at the 3 or 5-leaf ratings. There were significant differences in thrips damage between treatments including insecticide seed treatments and the untreated check. There were no significant differences in leaf area, canopy coverage, or plant heights across any sampling date. The addition of a starter fertilizer or insecticide seed treatment did not affect yield in the 2021 growing season.

Introduction

Thrips can be a significant pest of cotton seedlings annually in Louisiana. Several species affect cotton, however, tobacco thrips *Frankliniella fusca* (Hinds) and western flower thrips *Frankliniella occidentalis* (Pergande) are most commonly encountered (Cook et al. 2003). Significant thrips infestations can lead to stunting, delays in maturity, plant death, and yield loss if left untreated. Preventative control options for thrips in Louisiana include insecticide seed treatments and in-furrow applications at planting. Historically, insecticide seed treatments for thrips control have been neonicotinoids. Previously, thiamethoxam provided great control of thrips but resistance has since been documented in mid-south thrips populations (Darnell et al. 2018). Since then, seed treatments containing the active ingredient imidacloprid have been the most effective products for the last decade. In-furrow applications include acephate, imidacloprid, and aldicarb. Due to the ability of thrips to quickly develop resistance to insecticides, the performance of imidacloprid seed treatments has lessened in recent years. Due to this, alternative methods, such as in-furrow sprays, are sometimes warranted to supplement imidacloprid seed treatments for thrips control. For example, acephate has become more widely used either as a seed treatment or an in-furrow spray. As previously stated, aldicarb is a good option in terms of thrips control, however, it is an expensive product. Foliar applications of insecticides are often used by producers; however, this project solely focuses on at-planting applications. In response to growing concerns of resistance to several products for thrips control, alternative methods are needed to negate thrips establishment and damage in cotton crops. Starter fertilizers have historically been utilized in other crops including corn. In this experiment, a starter fertilizer, 10-34-0 (ammonium phosphate) was utilized as an in-furrow spray at planting to determine if the time between cotton emergence and 5-leaf could be shortened leading to reduced thrips injury and establishment.

Materials and Methods

Experiments were conducted at the Macon Ridge Research Station in Winnsboro, Louisiana in 2020 and the Northeast Research Station in St. Joseph, Louisiana in 2021. Treatments were arranged in a randomized complete block design and replicated four times. Phytogen 480 W3FE cottonseed containing only a fungicide seed treatment was used in both trials. Seed was treated with insecticide seed treatments at the Macon Ridge Research Station for both years. In-furrow applications of 10-34-0 starter fertilizer were applied at 5 GPA. Planting dates for each trial were May 1 and May 18 for 2020 and 2021 respectively. Upon seedling emergence, plant stand ratings were collected by counting every plant in the center two treated rows of each plot. Thrips densities were estimated by collecting 5 whole plants from the treated area in each plot at the 2, 3, and 5-leaf stages. Plants were then transported to the lab in jars containing a 50:50 solution of ethyl alcohol and water. The contents of the jar and the plants were washed through a series of screens to separate thrips from foreign debris. Following thrips washes, the foliage was removed from all plants and run through a spectrometer to receive a leaf area index. Thrips damage ratings were measured at the 2, 3, and 5-leaf stages using the 0-5 scale (Kerns et al. 2018) Canopy coverage was rated in the field using the Canopeo application at the 3 and 5-leaf stages. Plant heights were taken at the 2, 3, and 5-leaf stages by measuring 10 cotton plants in the treated area from soil level to the plant terminal. When cotton plots reached full maturity, plots were harvested, and cotton yields were converted to lint based on a 38% gin turnout. Cotton yield data is presented only for the 2021 growing season due to harvest errors in 2020. These data were subjected to ANOVA procedures, and means were separated according to Fisher's Protected LSD.

Results

The addition of starter fertilizers or seed treatments had no significant effect on plant stand across the 2020 and 2021 growing seasons. At the 2-leaf sample, the addition of a starter fertilizer or an insecticide seed treatment led to significantly fewer thrips occurrence when compared to the untreated check (Table 1) The inclusion of multiple insecticide seed treatments with a starter fertilizer led to reduced thrips damage at the 2-leaf growth stage (Table 1). At the 3-leaf rating, there were no differences in thrips numbers or damage ratings across treatments (Table 2). This is likely due to rainfall before the sampling event. At the 5-leaf rating, there were no differences in thrips number across treatments (Table 3). However, significant reductions in thrips damage were observed between treatments that received an insecticide seed treatment at planting and the untreated check and starter only treatments (Table 3). This indicates that insecticide seed treatments are still providing control out to the 5-leaf cotton stage and starter fertilizers alone should not be utilized for thrips damage mitigation. There were no significant differences in leaf area index ratings across the 2, 3, or 5-leaf rating dates. There were no differences in canopy coverage ratings across the 3 or 5-leaf rating dates. Lastly, there were no significant differences observed between treatments with respect to plant heights at the 2, 3, or 5-leaf rating dates. This may indicate that starter fertilizers in cotton do not lead to enhanced growth, therefore, providing little benefit for thrips occurrence and damage mitigation. There were no significant differences in cotton lint yields among treatments in the 2021 growing season (Table 4).

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References

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Table 1. Impact of starter fertilizers and insecticide seed treatments on densities of total thrips and thrips damage at the 2-leaf growth stage.

Treatment	Application Method	Rate	Total Thrips	Damage Rating
Non-Treated	-	-	23.5a	2.3ab
Imidacloprid	Seed Treatment	0.375[1]	11.3b	2.1ab
Imidacloprid + Acephate 97S	Seed Treatment	0.375[1]+6.4[2]	5.8b	2abc
Aeris[3]	Seed Treatment	0.75[3]	5.1b	1.8bc
10-34-0	In-Furrow Spray	5GPA[4]	9.3b	2.5a
10-34-0 + Aeris	In-Furrow Spray + Seed Treatment	5GPA[4]+0.75[2]	3.8b	1.8bc
10-34-0 + Imidacloprid	In-Furrow Spray + Seed Treatment	5GPA[4]+0.375[2]	7.5b	2.1ab
10-34-0 + Acephate + Imidacloprid	In-Furrow Spray + Seed Treatment	5GPA[4]+0.375[1]+6.4[2]	8.4b	1.5c
P>F			<0.01	0.02

Means within a column followed by a common letter are not significantly different (FPLSD P = 0.05).
[1] mg AI / seed.
[2]oz wt. product / cwt.
[3]mg AI / seed. Aeris applied at the listed rate contains 0.375 mg AI imidacloprid (Gaucho) and 0.375 mg AI thiodicarb.
[4]Gallons ammonium phosphate / per acre, in-furrow spray.

Table 2. Impact of starter fertilizers and insecticide seed treatments on densities of total thrips and thrips damage at the 3-leaf growth stage.

Treatment	Application Method	Rate	Total Thrips	Damage Rating
Non-Treated	-	-	9.9	3.1
Imidacloprid	Seed Treatment	0.375[1]	9.4	2.8
Imidacloprid + Acephate 97S	Seed Treatment	0.375[1]+6.4[2]	7	2.6
Aeris[3]	Seed Treatment	0.75[3]	8.9	2.5
10-34-0	In-Furrow Spray	5GPA[4]	13.9	3.1
10-34-0 + Aeris	In-Furrow Spray + Seed Treatment	5GPA[4]+0.75[2]	10	2.5
10-34-0 + Imidacloprid	In-Furrow Spray + Seed Treatment	5GPA[4]+0.375[2]	11.9	2.6
10-34-0 + Acephate + Imidacloprid	In-Furrow Spray + Seed Treatment	5GPA[4]+0.375[1]+6.4[2]	8.5	2.8
P>F			0.91	0.40

Means within a column followed by a common letter are not significantly different (FPLSD P = 0.05).
[1] mg AI / seed.
[2]oz wt. product / cwt.
[3]mg AI / seed. Aeris applied at the listed rate contains 0.375 mg AI imidacloprid (Gaucho) and 0.375 mg AI thiodicarb.
[4]Gallons ammonium phosphate / per acre, in-furrow spray.

Table 3. Impact of starter fertilizers and insecticide seed treatments on densities of total thrips and thrips damage at the 5-leaf growth stage.

Treatment	Application Method	Rate	Total Thrips	Damage Rating
Non-Treated	-	-	16.6	3a
Imidacloprid	Seed Treatment	0.375[1]	21.6	2.5ab
Imidacloprid + Acephate 97S	Seed Treatment	0.375[1]+6.4[2]	14.4	2.4b
Aeris[3]	Seed Treatment	0.75[3]	13.6	2b
10-34-0	In-Furrow Spray	5GPA[4]	18.9	3a
10-34-0 + Aeris	In-Furrow Spray + Seed Treatment	5GPA[4]+0.75[2]	11.2	2.3b
10-34-0 + Imidacloprid	In-Furrow Spray + Seed Treatment	5GPA[4]+0.375[2]	21.6	2b
10-34-0 + Acephate + Imidacloprid	In-Furrow Spray + Seed Treatment	5GPA[4]+0.375[1]+6.4[2]	13.1	2.4b
P>F			0.70	<0.01

Means within a column followed by a common letter are not significantly different (FPLSD P = 0.05).
[1] mg AI / seed.
[2]oz wt. product / cwt.
[3]mg AI / seed. Aeris applied at the listed rate contains 0.375 mg AI imidacloprid (Gaucho) and 0.375 mg AI thiodicarb.
[4]Gallons ammonium phosphate / per acre, in-furrow spray.

Table 4. Impact of starter fertilizers and insecticide seed treatments on cotton yield.

Treatment	Insecticide Class	Rate	Lint Yield (lb. / Acre)
Non-Treated	-	-	912
Imidacloprid	Seed Treatment	0.375[1]	931
Imidacloprid + Acephate 97S	Seed Treatment	0.375[1]+6.4[2]	934
Aeris[3]	Seed Treatment	0.75[3]	905
10-34-0	In-Furrow Spray	5GPA[4]	897
10-34-0 + Aeris	In-Furrow Spray + Seed Treatment	5GPA[4]+0.75[2]	891
10-34-0 + Imidacloprid	In-Furrow Spray + Seed Treatment	5GPA[4]+0.375[2]	888
10-34-0 + Acephate + Imidacloprid	In-Furrow Spray + Seed Treatment	5GPA[4]+0.375[1]+6.4[2]	943
P>F			0.99

Means within a column followed by a common letter are not significantly different (FPLSD P = 0.05).
[1] mg AI / seed.
[2]oz wt. product / cwt.
[3]mg AI / seed. Aeris applied at the listed rate contains 0.375 mg AI imidacloprid (Gaucho) and 0.375 mg AI thiodicarb.
[4]Gallons ammonium phosphate / per acre, in-furrow spray.