

## **THRIPS MANAGEMENT IN SEEDLING COTTON WITH STARTER FERTILIZER AND A SINGLE FOLIAR APPLICATION**

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### **Abstract**

Thrips are a predictable pest of seedling cotton in the southeastern US. The recent loss of aldicarb from the marketplace created demand for commercial products that provide inexpensive and lasting thrips suppression. Under irrigated and dryland conditions, we conducted two coordinated trials to investigate thrips suppression across the southeastern US. The foliar trial, conducted with fungicide only treated seed, was designed to evaluate the efficacy of foliar applied insecticides for managing thrips on seedling cotton. The starter fertilizer trials, conducted with Cruiser treated seed, were designed to examine how a seed treatment and the addition of starter fertilizer may affect early season cotton growth, and to determine the optimal timing of a single foliar overspray to decrease immature thrips numbers. Response variables included weekly immature thrips counts, aboveground biomass after 42 days, and end of year lint yield. Results in the foliar trial showed that cyazypyr, Radiant SC, and Orthene 97 provided the best suppression of immature thrips. Results from the starter fertilizer trials demonstrated that plots receiving a foliar overspray at 90% first true leaf bud or at two true leaves had fewer immatures than plots not receiving foliar application. Although there were no differences in the number of thrips observed in plots containing starter fertilizer, those plots gained more biomass early in the season under irrigated conditions.

### **Introduction**

Cotton growers in the southeastern United States, who grow roughly 25% of the US crop, have utilized in-furrow insecticides like aldicarb (Temik 15G) with much greater frequency than their counterparts in other parts of the Cotton Belt. In addition to providing excellent thrips control, aldicarb confers nematode suppression and residual protection from spider mites and cotton aphids early in the season. The registrant of aldicarb, Bayer CropScience, recently announced that it will discontinue selling aldicarb by 31 December 2014 (Bayer CropScience 2010). This change in product availability will greatly accelerate the transition to alternative technologies, such as seed treatments, in southeastern cotton production.

Neonicotinoid seed treatments, such as imidacloprid and thiamethoxam, are the most likely replacement technologies for in-furrow insecticides. On the positive side, seed treatments offer unsurpassed convenience and reduced risk to applicators compared with in-furrow insecticides. For example, the use of seed treatments negates the need for insecticide calibration or purchase of insecticide hopper boxes and a mechanical delivery mechanism on the planters. However, previous research in the southeastern US strongly suggests that seed treatments do not provide adequate protection from thrips injury on early-planted cotton in conventional tillage situations. Foliar

insecticide applications are suggested when populations exceed a threshold, but foliar insecticide applications early in the season also increase the risk of secondary pests like spider mites and cotton aphids. Toews et al. (2010) compared thrips populations between conventionally tilled and strip tilled plots planted with thiamethoxam-treated seed and data showed that thrips populations exceeded Extension recommendations for foliar treatment on five out of six sample dates in the conventionally tilled plots. Additionally, a number of researchers report that the incidence of cotton aphid and spider mite outbreaks is higher following the use of neonicotinoid seed treatments.

Objectives of this project were to 1) Evaluate efficacy of foliar insecticides for managing thrips on seedling cotton; 2) examine how a seed treatment and the addition of starter fertilizer may reduce thrips injury on seedling cotton in the southeastern United States; and 3) determine optimal timing of a single acephate overspray to decrease thrips numbers below a common Extension treatment threshold.

### **Methods**

This project was carefully coordinated to improve our ability to mitigate early-season thrips with replicated field sites in five southeastern states. The same core protocols were followed by project investigators in Alabama, Georgia, North Carolina, South Carolina, and Virginia.

#### **Plot Preparation and Management**

Regardless of experiment, all plots were fertilized, planted, and maintained following local Extension recommended practices. Prior to planting, the recommended amount of base fertilizer was incorporated into the entire trial area based on the results of soil testing and a yield goal of approximately 1250 lb (irrigated) or 900 lb (dryland). Individual plots measured 4 to 8 rows (36 to 40 inch row spacing) by 40 to 50 feet long with 10 feet wide alleys between plots. A total of 70 or 90 lb nitrogen was applied to dryland or irrigated plots, respectively. All cotton was planted during the first week of the recommended planting window on conventionally tilled soils. Plots were treated as necessary to prevent confounding insect injury after the plants began flowering.

#### **Objective 1**

Treatments were organized in a randomized complete block design with eight insecticide treatments and four replications (compounds and rates shown in Table 1). Cooperators planted base fungicide only treated PhytoGen 375 WRF during the first week of the Extension recommended planting window. All insecticides were sprayed two times. The first application was applied when the first true leaf bud was evident on 90% of the stand and the second application followed one week later. Cooperators sampled thrips immediately before (up to 24 hours prior) the first insecticide application and then every seven days.

Table 1. Listing of experimental compounds, formulations, and rates for Objective 1

Entry Number	Compound	Formulation	Formulated Product Rate (per acre)
1	Untreated	-	-
2	Orthene 97	SG	3.0 oz or <i>state Recommended</i>
3	Cyazypyr (DPS HGW86)	100 g/L OD	20.6 oz
4	Vydate C-LV	WSL	17 oz
5	Radiant SC	SC	6 oz
6	Karate with Zeon	EC	1.28 oz
7	Dimethoate 4	EC	8 oz
8	Lannate 2.4 LV	WSL	12 oz

#### **Objectives 2 and 3**

Treatments were organized as a three-way factorial arrangement of treatments in a split-plot design with four replications per treatment. Main plot variables included base fertilizer only or base fertilizer plus starter fertilizer; at the subplot level we randomized timing of a single foliar insecticide application (no application, 1<sup>st</sup> true leaf bud, or 7 d later (approximately 2<sup>nd</sup> true leaf). Cruiser 5FS treated PhytoGen 375 WRF seed and base fungicide was used on all seed for this trial. Foliar applications (0.18 lb AI acephate per acre or local Extension recommended rates) were applied using at least 10 gallons of water on sprayers equipped with hollow cone spray tips. The 1<sup>st</sup> true leaf bud

was defined as the visible presence of the first true leaf bud on 90% of the stand. Second true leaf was defined as the second true leaf expanded to the size of a nickel on 50% of the plant stand.

Plots receiving starter fertilizer were treated with 10 gal per acre of 10-34-0 liquid fertilizer applied 2 inches below and 2 inches beside the seed at planting (typically called a 2 x 2 placement). Variable nitrogen rates were used at sidedress to ensure that the total amount of nitrogen received by each plot was consistent across trials. In other words, plots receiving starter fertilizer received less nitrogen at sidedress to compensate for the additional nitrogen those plots received at planting.

Although the complete data set included an assessment of thrips species composition and life stage at selected intervals, only counts of immatures during the interval following the second insecticide application are reported here. Similarly, in the full data set, we examined visual plant damage, plant height, dry biomass at 42 days after planting, and seed cotton yield. For brevity, we report only dry matter and lint yield here. Lint yield was extrapolated to a per acre basis using a gin out efficiency of 38% for purposes of presentation.

## **Results**

### **Objective 1**

Analyses of variance on response variables from the insecticide trial documented differences among treatments. The fewest immatures were observed in plots treated with cyazypyr, Radiant SC, or Orthene 97. Conversely, there were more than seven times more immatures in untreated plots or those treated with Karate Z. Dry biomass at 42 days after planting followed a similar trend; plots treated with cyazypyr and Radiant SC led all other treatments in terms of positive biomass accumulation. The number of immature thrips was inversely correlated with dry biomass ( $P < 0.01$ ). Differences in lint yield were minor, but more lint was harvested from plots treated with Dimethoate 4 or Orthene 97 compared with plots treated with Karate Z (Table 2).

Table 2. \*Mean  $\pm$  SEM number of immatures, biomass accumulation, and lint yield as a function of foliar overspray

<b>Compound</b>	<b>Immatures per 5 plants</b>	<b>Biomass (g per 5 plants)</b>	<b>Lint yield (lb per acre)</b>
Cyazypyr	7.2 d	9.5 a	1030.0 ab
Dimethoate 4	20.5 c	7.9 bc	1067.0 a
Karate Z	86.8 a	6.7 dc	958.0 b
Lannate 2.4 LV	26.5 bc	8.6 ab	1020.0 ab
Orthene 97	7.2 d	9.2 ab	1066.0 a
Radiant SC	4.2 d	10.1 a	1012.0 ab
Untreated	75.6 ab	6.1 d	986.0 ab
Vydate C-LV	21.3 c	9.3 ab	1019.0 ab

\*Means with the same column followed by the same letter are not significantly different (LSMEANS test,  $P < 0.05$ ).

### **Objectives 2 and 3**

Separate dryland vs. irrigated trials were conducted, so these results are reported independently. In the dryland trial, there were no differences in the number of immature thrips attributed to starter fertilizer ( $P = 0.54$ ), but there were strong differences attributed to timing of foliar application (none: 45.9 immatures, 1<sup>st</sup> leaf: 22.6 immatures, 2<sup>nd</sup> leaf: 33.9 immatures) ( $P < 0.01$ ). Neither the addition of starter fertilizer ( $P = 0.28$ ) nor foliar oversprays ( $P = 0.89$ ) made any difference in amount of aboveground biomass accumulated in the dryland trial. Similarly, there were no observed differences in lint yield attributed to the addition of starter fertilizer ( $P = 0.99$ ) or foliar oversprays ( $P = 0.71$ ).

Under irrigated conditions, there were no differences in the number of immature thrips attributed to the addition of starter fertilizer ( $P = 0.52$ ), but differences were attributed to foliar oversprays (none: 44.8 immatures, 1<sup>st</sup> leaf: 32.8 immatures, 2<sup>nd</sup> leaf: 30.3 immatures) ( $P = 0.06$ ). Plants treated with starter fertilizer accumulated more biomass (25.9 g) than plants not receiving starter fertilizer (23.7 g) ( $P = 0.02$ ). Similarly, there were obvious differences in dry weight accumulation among plots receiving no foliar oversprays (22.1 g) compared with 1<sup>st</sup> leaf (26.6 g) or 2<sup>nd</sup> leaf (25.6 g) oversprays ( $P = 0.01$ ). There were no differences in lint yield attributed to starter fertilizer ( $P = 0.83$ ), but differences among oversprays were evident (none 1150 lb, 1<sup>st</sup> leaf 1237 lb, 2<sup>nd</sup> leaf 1130 lb) ( $P < 0.01$ ).

### **Discussion**

In the insecticide trial, results strongly suggest that both cyazypyr and Radiant SC provided similar levels of efficacy as would be expected with Orthene 97. Unfortunately, the rates tested for both of these compounds were likely higher than will be economically feasible. Cyazypyr is not currently labeled for use on seedling cotton. Future work will be conducted with reduced rates of these products. These data show that use of the pyrethroid (Karate Z) provided poor suppression of immature thrips. Assuming this trend holds, growers should avoid the use of pyrethroid insecticides for control of thrips on seedling cotton.

In the starter fertilizer trial, starter fertilizer conferred the benefit of additional biomass under irrigated conditions but not under dryland conditions. Starter fertilizer never reduced the number of immature thrips present. Conversely, the use of a single foliar overspray at either 1<sup>st</sup> leaf or 2<sup>nd</sup> leaf provided superior thrips suppression compared with no foliar sprays under both irrigated and dryland conditions. This trend held through lint production under irrigated conditions but was not as evident in the amount of lint harvested under dryland conditions. Very little rainfall fell during the majority of the 2011 dryland tests. It is possible that treatment effects could be more evident when the cotton is less drought stressed. All tests will be repeated in 2012.

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