EFFECTS OF PLANTING DATE AND VARIETY ON THRIPS POPULATIONS AND INJURY TO COTTON IN THE SOUTHEASTERN UNITED STATES

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Abstract

A planting date study was conducted in Blackville, South Carolina, using a full-season variety in 2015 and an early maturing variety in 2016 to investigate the effect of planting date on the number of thrips found in early season cotton. In 2015, cotton planted on 1 and 8 May sustained significant injury from thrips. In 2016, cotton planted on 25 April sustained significant injury. In both years, cotton planted from mid-May into June sustained less thrips damage than earlier plantings. These results show that planting date is an important factor that influences levels of injury observed across the cotton planting date window. A better understanding of the environmental factors contributing to injury may help reduce economic losses caused by thrips. A 2016 regional variety study conducted in Virginia, North Carolina, South Carolina, Georgia, and Alabama, showed that ST 4946 consistently had the lowest injury ratings, and was significantly less susceptible than six other varieties despite supporting high populations of thrips. This information suggests that selecting a variety with reduced levels of susceptibility to thrips feeding may aid cotton farmers from a risk management perspective, but more data are needed to confirm these results.

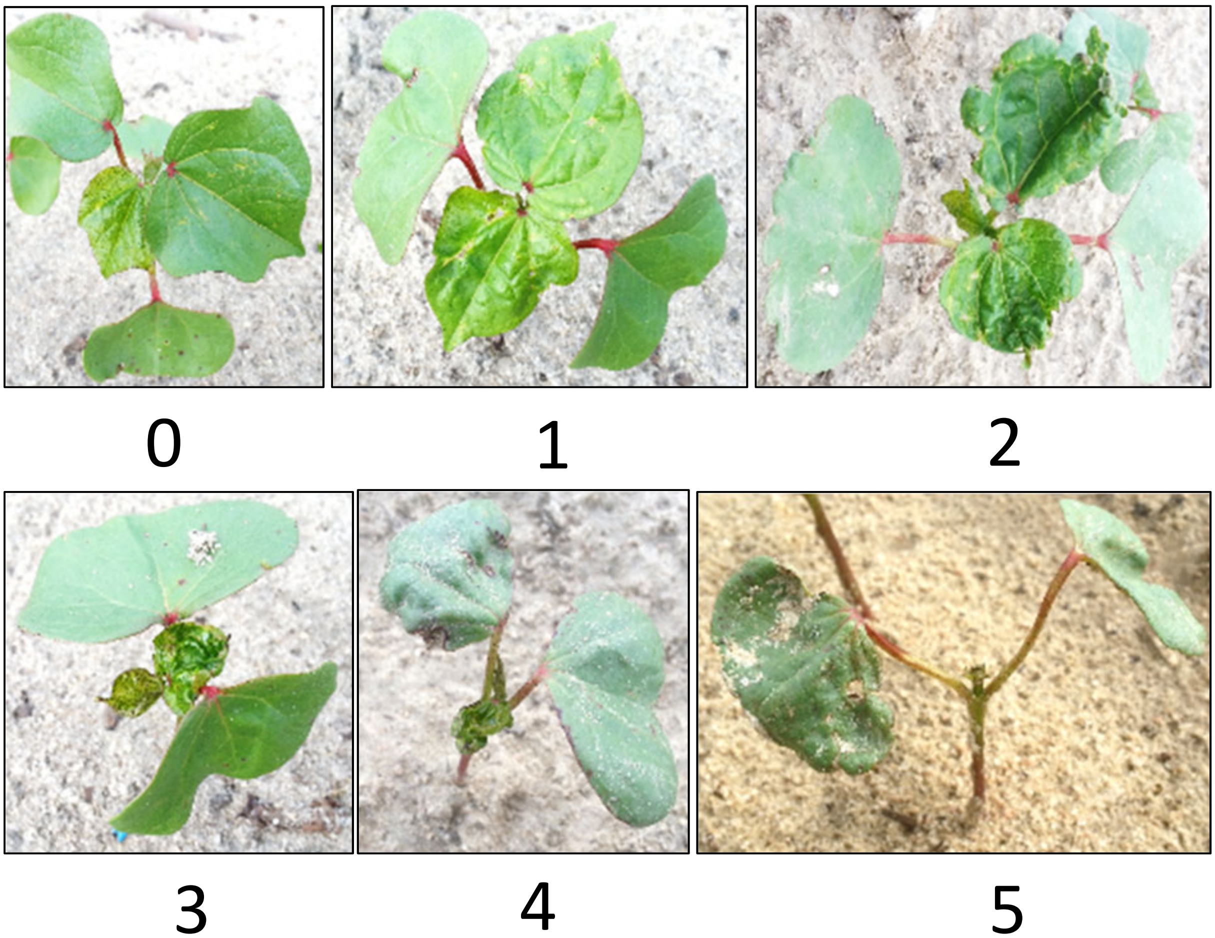
Introduction

Tobacco thrips, *Frankliniella fusca* Hinds, is the most consistent pest of upland cotton, *Gossypium hirstutum* (L.) in the southeastern USA. Yet, despite its predictability, major yield losses often occur in cotton in the United States (Williams 2016). Infestations of thrips can severely lengthen the development of the cotton plant, cause abortion of the terminal, or cause plant death, if the right conditions are met. Abortion of the terminal of a cotton plant results in unwanted vegetative growth (Micinski et al. 1990), which can lead to reduced yields. When left untreated, yield losses of 400 to 600 pounds per acre have been reported (Herbert et al. 2007). In addition, variable levels of neonicotinoid resistance have been reported in tobacco thrips populations across the Southeast (Huseth et al. 2016) and alternate management practices are needed to mitigate yield losses. Cultural control practices such as using resistant cotton varieties and modifying planting dates need to be investigated as tactics to help mitigate thrips damage and reduce selection pressure to neonicotinoid insecticides.

Material and Methods

Planting Date Trial

A split-plot trial with four replicates was planted in Blackville, South Carolina, at Clemson University's Edisto Research and Education Center, with planting date as the main plot and seed treatment as the sub-plot. Plots were 40 feet long with eight 38-inch rows. Ten planting dates were used in 2015 (15 and 24 April; 1, 8, 15, 21, and 29 of May; 5, 12, and 19 June) and in 2016 (18, 25, and 29 April; 5, 12, 17, and 26 May; 3, 10, and 15 June). In 2015, sub-plot treatments were fungicide only and fungicide + imidacloprid (Gaucho). In 2016, sub-plot treatments were fungicide only and fungicide + imidacloprid + thiodicarb (Aeris). Number of adult and immature thrips per plant, plant injury, and plant height were taken weekly. Thrips density was estimated by randomly pulling and submerging



10 plants from each plot in jars (946mL) half filled with isopropyl alcohol, filtering jar contents onto filter paper, and counting thrips under a dissecting microscope (Greene and Capps 2003). Plant injury was estimated by visual observation of thrips damage to true leaves by assigning a value from 0 to 5, with 0 equaling no injury and 5 equaling dead plants or severe terminal growth distortion.

Figure 1. Examples of injury classification (0, no damage; 5, dead plants/terminals) for thrips feeding injury to cotton.

Plant height (cm) was measured from the ground to the terminal of 5 plants per plot weekly. Stand counts were estimated by counting plants per 4 m of row in each plot. Biomass was estimated at 42 days after planting in 2015 and 49 days after planting in 2016 by clipping 5 plants per plot and drying in an oven at 82°C for 48 hours. A mechanical picker was used to estimate seed cotton yield. The data analysis for this paper was generated using SAS software. Copyright © 2012-2016 SAS Institute Inc. SAS and all other SAS Institute Inc. product or service names are registered trademarks or trademarks of SAS Institute Inc., Cary, NC, USA. Data were analyzed with PROC GLIMMIX in SAS Studio 3.5(2012-2016)as a split plot design with a repeated measures statement.

Variety Trial

A randomized complete block design with variety as the fixed effect and four replicates was planted at the Tidewater Agricultural Research and Extension Center in Suffolk, Virginia (planted on 25 May), at the Vernon James Research and Extension Center in Plymouth, North Carolina (planted on 10 May), at the Edisto Research and Education Center in Blackville, South Carolina (planted on 10 May), at the Prattville Agricultural Research Unit in Prattville, Alabama (planted on 25 April), and at the Coastal Plain Experiment Station in Tifton, Georgia (planted on 4 May). The number of adult and immature thrips, plant injury, and plant height were taken weekly as described above. Plant height (cm) was measured from the ground to the terminal of 5 plants per plot weekly. Stand counts were estimated by counting plants present per 4 m of row in each plot. Biomass samples were taken at 7, 14, and 42 days after planting. Cumulative thrips days were calculated (Ruppel 1983). SAS Studio 3.6 (SAS 2012-2016) was used to organize and analyze data. Analysis of variance was conducted using PROC GLIMMIX and means were separated using Tukey's HSD.

Results and Discussion

Planting Date Trial

In 2016, thrips arrived earlier and in larger numbers than the population in 2015 (Figure 2).

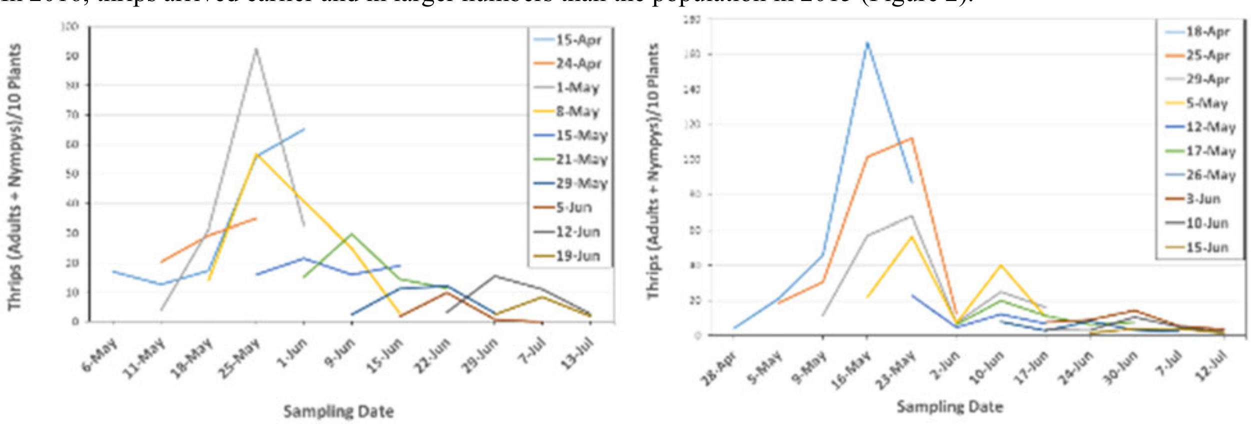


Figure 2. Densities of thrips on seedling cotton from varying planting dates near Blackville, SC, during 2015 (left) and 2016 (right).

In 2015, peak population of thrips occurred on 25 May (between 18 May and 1 June). In 2016, the highest numbers of thrips were recorded 9 days earlier on 16 May (between 9 May and 2 June). In 2016, populations reached nearly 17 thrips per plant. The highest density in 2015 was 9 thrips per plant. Although the numbers of thrips were higher across all dates in 2016, injury ratings were similar for both years (Figure 3.).

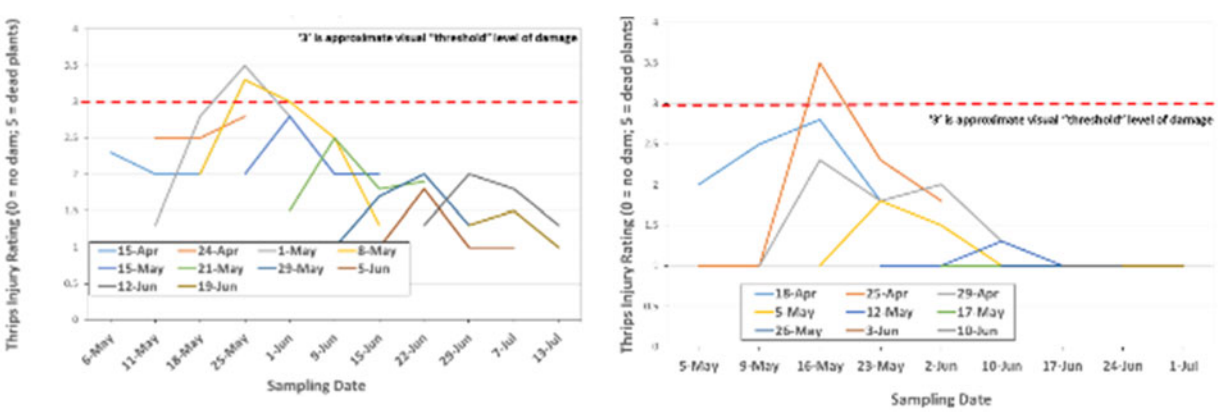


Figure 3. Ratings of feeding injury caused by thrips on seedling cotton from varying planting dates near Blackville, SC, during 2015 (left) and 2016 (right).

Early maturing varieties perform better than late maturing varieties with later planting dates. Late or some mid maturing varieties may not be able to mature all of their fruit before the end of the growing season (Figure 4).

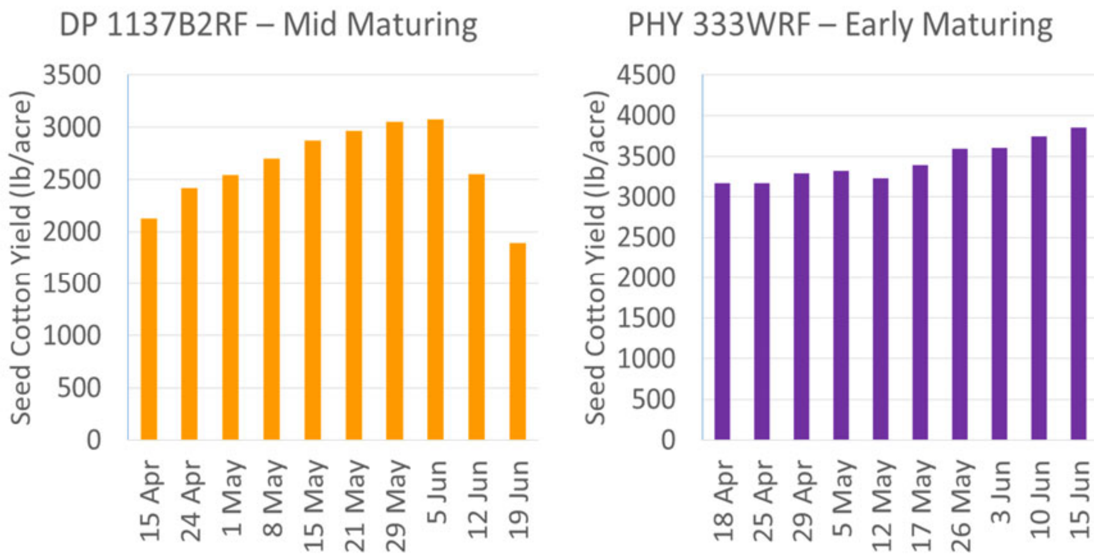


Figure 4. Seed cotton yields by planting date from a mid-to-full season variety (2015, left) compared with an early maturing variety (2016, right).

Variety Trial

In addition to different lengths of maturation, varieties of cotton are known to have different susceptibility to thrips (Johnson et al. 1989), although available data are limited. The populations of thrips in the variety study are measured in thrips days, which takes into account the density of the population and the amount of time the population spends on the plant. The trial in Virginia had the highest population of thrips and the highest damage. Trials in North Carolina and Virginia had high thrips populations, whereas trials in Georgia and South Carolina observed lower thrips populations. In Virginia under high thrips pressure, (140-210 thrips days per plot) no statistical differences in injury among varieties were found. North Carolina, also with high thrips days, (100-180 thrips days per plot) revealed few differences between varieties. Locations with a minimum of 100 thrips days per plot saw few differences in injury rating between varieties. Pooling all location data together revealed the biggest difference in injury ratings. ST 4946 was consistently less injured than six other varieties. (Figure 5). Interestingly, the trial in Alabama had high numbers of thrips (100-180 thrips days per plot) and significant differences among varieties for thrips densities, but not for injury (Figure 6). This information could give clues into a possible driver of varietal susceptibility. Overall, ST 4946 had more thrips days than other varieties, yet had less injury, which indicates that vigorous, healthy plants can support high populations of thrips without significant injury (Figure 6). This study will be repeated in 2017 to further investigate varietal susceptibility to thrips. Information on varietal susceptibility can be used as an integral component of thrips management strategies in cotton. Seedling vigor, a possible contributor to varietal susceptibility of cotton to thrips, will also be investigated.

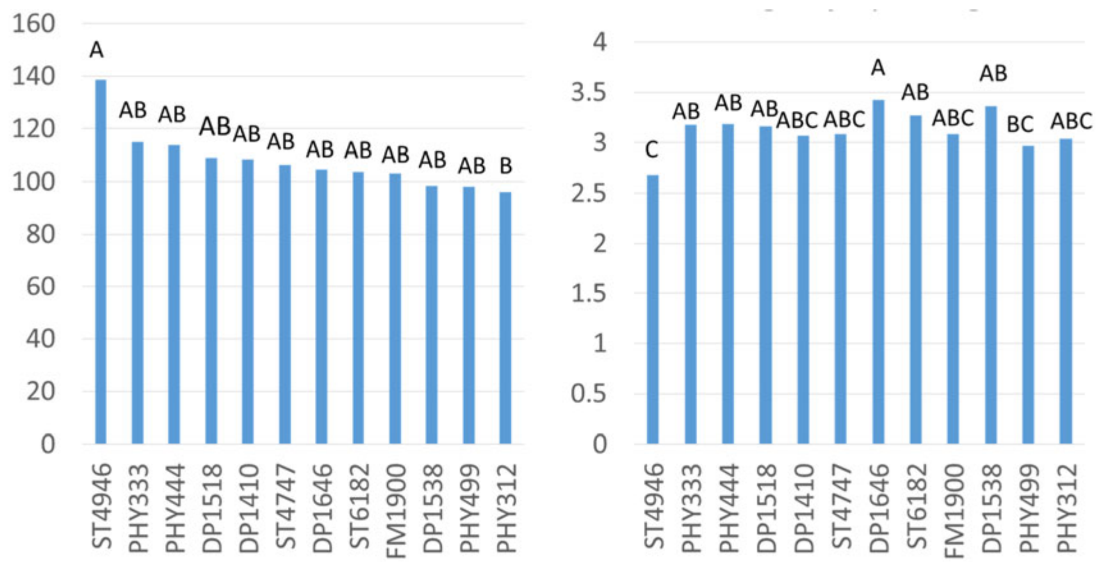


Figure 5. Cumulative thrips days across all locations (left) and average injury rating across all locations (right) organized by variety.

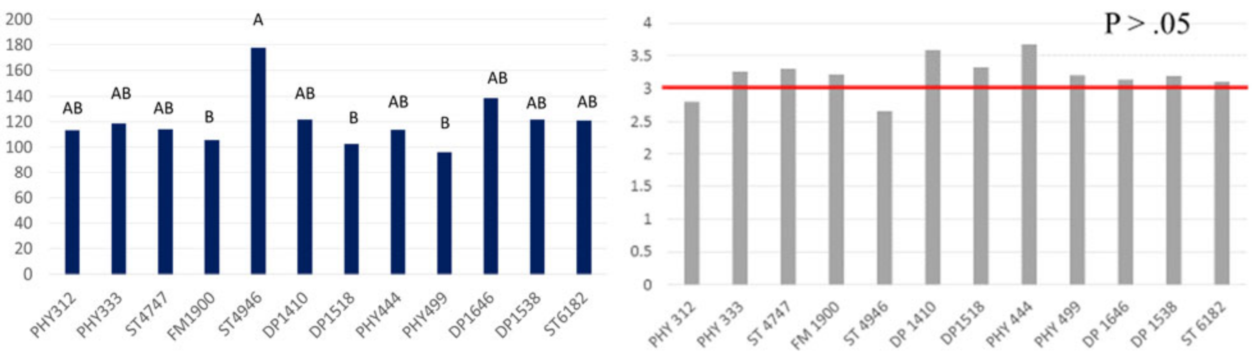


Figure 6. Cumulative thrips days at the Alabama site (left) and average injury rating (right).

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