PLANTING DATE AFFECTS STINK BUG INJURY, YIELD, AND FIBER QUALITY IN GEORGIA COTTON

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Introduction

Stink bugs are serious economic pests of cotton in Georgia. They feed on cotton bolls and cause abscission of young bolls, or a loss of lint quality when larger bolls are damaged. Feeding injury is characterized by rough warty growths on the inner carpel walls and stained lint. Stink bug feeding is occasionally followed by boll rot because some stink bug species can transmit cotton seed and boll rotting bacteria through their piercing and sucking mouthparts. Of the species of stink bugs that are encountered in cotton fields, southern green stink bug, brown stink bug and green stink bug are most common. Stink bugs have been ranked among the most damaging insect pests in the southeastern states for the last several years. Approximately 1.3 million acres of cotton in Georgia were infested with stink bugs in 2011 and those infestations required insecticide treatment of approximately 1 million acres; at an average of two applications per season. The reduction in broad spectrum insecticide use brought about by boll weevil eradication and widespread adoption of transgenic cotton varieties is believed to have contributed to the emergence of stink bug complex as an economic pest group in cotton.

Polyphagous pests such as stink bugs are often highly mobile and their population dynamics are influenced by continuous availability of suitable plant hosts. Stink bugs overwinter as adults, emerge in early spring and feed on seed bearing weed hosts and subsequently move to crop fields. In cotton, stink bug damage is most critical during third, fourth and fifth week of bloom. Current Extension thresholds recommend insecticide treatment when 10-15% of quarter-sized bolls exhibit stink bug damage. Cultural practices, such as manipulation of planting dates, may allow the crop to escape in time from the most damaging populations. The objective of this project was to study the influence of four different planting dates on stink bug damage in cotton in terms of boll injury, yield, lint quality, and economic value.

Materials and Methods

This experiment was conducted over a 2 yr period in Georgia. In 2011, trials were conducted near Tifton, Midville and Plains. Trials were repeated in 2012 near Tifton and Plains. A second generation cotton cultivar, 'DP 0912 B2RF,' containing Cry1ACc and Cry2Ab proteins for resistance to lepidopteran caterpillars was planted in all plots over four planting dates: 5/10, 5/24, 6/7 and 6/21. Plots at each site were arranged in randomized complete block design with 3-5 replicates. In 2011, plots were 8-rows wide and 15.24m long, except in Midville, where the plots were 30.48 meters long. In 2012, plots at Tifton were 8-rows wide and 12.19m long, while plots in Plains were 4-rows wide and 15.24m. Regardless of planting date or location, all plots were planted using seed from the same bag. The same pneumatic planter and planting depth was utilized for all plots.

Starting in the second week of bloom, plots were sampled weekly for stink bugs using sweep nets, and immature cotton bolls were assessed for stink bug injury. Twenty immature bolls were collected from each plot and internally evaluated for symptoms of stink bug feeding to estimate percent boll injury in each week. Stink bugs captured were identified to species and life stages. For yield and fiber quality assessments, two-rows from each plot were mechanically harvested, weighed, and ginned at the UGA Microgin (Tifton, GA). Representative ginned fiber samples from each plot were sent to the USDA Classing Office located at Macon, GA for official grading. Cotton lint classification followed USDA's official grade standards for American Upland cotton. Lint characteristics such as color, leaf, staple, micronaire, uniformity, strength, color Rd (a measure of fiber brightness) and color +b (a measure of fiber yellowness) were determined using the Uster High Volume Instrument (HVI).

Percentage boll damage data were analyzed using linear regression methods because the data were collected weekly throughout the six weeks of the bloom cycle. Simple linear curve models were fitted using the PROC REG procedure in SAS 9.3 (SAS Institute 2012), with weeks of bloom on the x-axis (independent variable) and mean percentage boll injury on y-axis (dependent variable). Regression model fit was evaluated using pattern of residuals and F tests for lack of fit. Comparisons among individual slopes were made possible by testing slopes of two planting dates at a time. Lint yield, seedcotton yield, gin turnout, and cotton fiber quality parameters were compared using analysis of variable SAS (9.3) among the four planting dates. Data from all trials within a single; year were pooled together for analysis. Economic analyses were based on the average Georgia cash (spot) prices received for base quality (Color 41, Leaf 4, Staple 34) in December 2011 and December 2012 (USDA-AMS) adjusted up or down (a price premium or discount) for the specific quality characteristics of the cotton from each plot. There were few stink bugs captured in the sweep net, so stink bug captures were summed across planting dates and weeks of bloom to illustrate the stink bug species composition.

Results and Discussion

Number of stink bugs captured by the sweep net was generally very low in both years. In 2011, from 287 samples (20 sweeps per sample), only 14 stink bugs were captured. Of these, 42.8% were brown stink bug and 57.1% were green stink bugs; no southern green stink bugs were captured. Much greater stink bug pressure was observed in 2012. From 166 sweep net observations, a total of 39 stink bugs were captured with 92.3% of them being southern green stink bugs and the rest being brown stink bugs. Statistical comparisons were not attempted on stink bugs captures due to low response. Low capture rates were possibly due to the inefficiency of sampling using sweep nets. Other factors such as time of sampling, stage of cotton growth might have also influenced the capture rates. Stink bug sampling using sweep nets gets more difficult later in the bloom cycle as mature bolls tend to break off the plant when sweeping.

The sampling for stink bugs and boll damage commenced around the same period in both years (July 14th in 2011and July 16th in 2012). The mean percent boll damage due to stink bug feeding over a five week period was significantly lower in May planted cotton compared to June planted cotton in 2011 and the results were similar in 2012 (Figure 1). Percent boll injury in June planting dates exceeded the Extension recommended treatment threshold much more frequently than May planting dates. In 2011, the percent boll injury for both the May 10 and May 24 planting dates never exceeded the threshold (10-15%) during weeks 3 to 5. However, both June planting dates exceeded the threshold on three of the possible five dates. Similarly in 2012, the May planted cotton exceeded the Extension recommended threshold only during last two weeks, whereas the June planted cotton exceeded the threshold in 4 out of 5 weeks. Overall mean percentage boll damage was numerically greater in 2012 (17.3 ± 1.5) compared to 2011 (12.6 ± 0.9). The results clearly indicate that the cotton planted later in the season was at a higher risk of being infested with more number of stink bugs. The results also suggest that stink bug infestations are predictable. Early planting could possibly eliminate the need for insecticidal spray later in the season because most of the harvestable bolls will be immune to stink bug injury after the 6^{th} week of bloom.

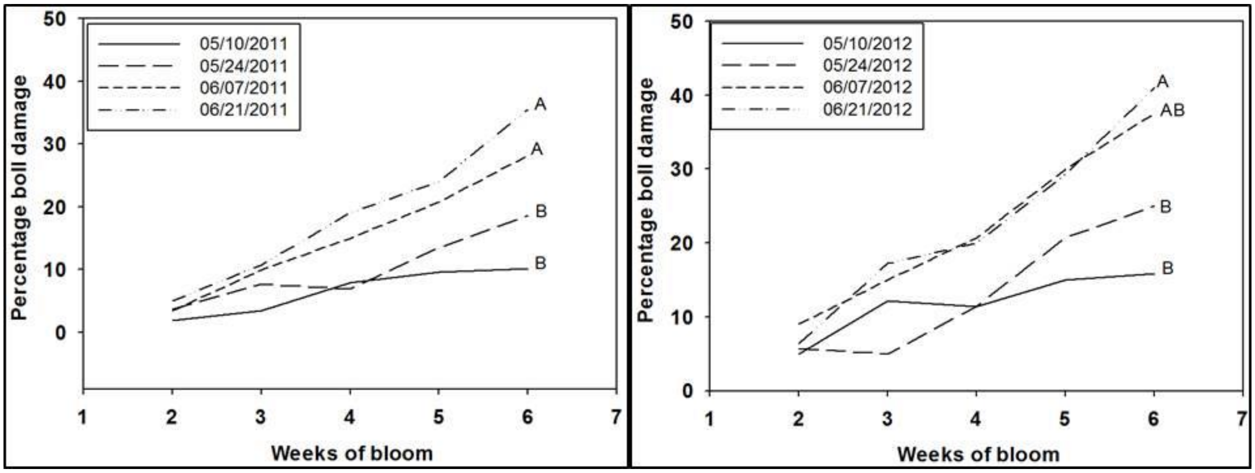

Figure 1. Mean percentage boll damage by week of bloom over four different planting dates in 2011 and 2012. Lines denoted by same letters are not significantly different.

Both planting dates in May had statistically comparable lint yield, which was significantly greater than the yield from both June planting dates in 2011 (Figure 2). The general trend was similar in 2012, except that only 05/10 cotton had statistically greater yields. Other yield parameters such as seedcotton yield and percent gin turnout showed similar trends. Here, yield and fiber quality both decreased in June planted cotton and stink bugs were a likely cause. Early planted cotton showed consistently better (less yellowness) values for HVI color +b in both years. In 2011, both May plantings had significantly better HVI color +b values while in 2012 only the May 10 plantings exhibited significantly better HVI color +b values. HVI color Rd values, which indicate fiber reflectance, indicated slightly better quality in the June planted cotton. Differences in HVI color Rd likely indicated changing environmental conditions, such as rainfall, after the bolls opened. The responses of other quality variables were not consistent between years.

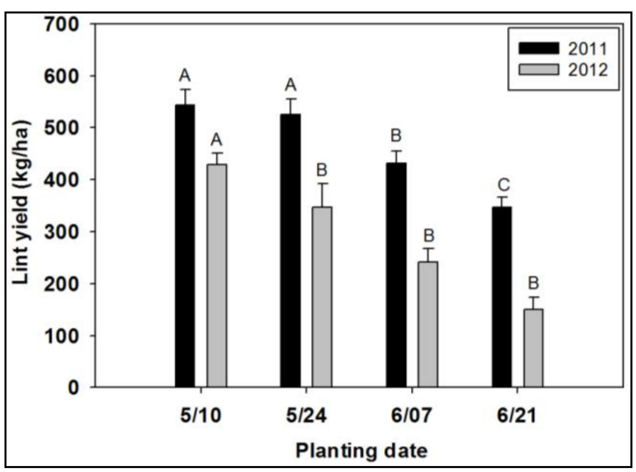

Figure 2. Mean lint yield (kg/ha) ± SEM recorded for four different planting dates in 2011 and 2012. Bars denoted by same letters are not significantly different.

Lint value based on yield, fiber quality, and price (the December 2011 and 2012 average spot price adjusted for quality) differed significantly as a function of planting date (Table 1). Both May planting dates were similar, but greater than the June planting dates in 2011; late June planted cotton exhibited the least lint value. Early May planted cotton had significantly greater lint value in 2012 compared to the remaining planting dates. Lint value was primarily decided by lint yield and the influence of quality parameters was not evident in the results. Previous research has showed that stink bug damage can affect the economic value of lint. Although there were documented statistical differences among planting dates, the remaining quality parameters were not sufficiently different to affect economic returns. Considering that the optimal planting window starts in late April, there may be potential for further improvement in yield and fiber quality by planting earlier than May 10.

Acknowledgments

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Table 1. Mean ± SEM of various parameters evaluated for cotton planted at four different planting dates, 2011 and 2012. Means followed by same letter not significantly different.

		2011		2012	
Parameters	Planting date	Mean	Std. Error	Mean	Std. Error
	5/10	3126.01a	178.19	2494.78a	116.43
	5/24	3026.75a	175.38	1979.18b	253.43
	6/07	2472.80b	141.70	1051.68b	60.52
Seedcotton yield (kg/ha)	6/21	2053.87c	124.89	1208.07b	150.49
	5/10	0.39a	0.00	0.38a	0.00
	5/24	0.38a	0.00	0.38a	0.00
	6/07	0.39a	0.00	0.36b	0.00
Gin Turnout ratio	6/21	0.37b	0.01	0.35c	0.01
	5/10	3420.76a	176.26	2276.72a	115.46
	5/24	3264.73a	175.15	1880.76b	259.55
	6/07	2749.79b	161.87	935.99b	34.93
Lint value ($/ha)	6/21	2232.18c	134.71	1089.17b	143.85
	5/10	7.54a	0.35	8.07a	0.16
	5/24	7.54a	0.35	8.81b	0.24
	6/07	8.17b	0.34	8.71b	2.42
HVI color +b	6/21	8.82c	0.35	8.84b	0.11
	5/10	72.54a	0.86	74.09a	0.38
	5/24	73.65b	0.68	76.10b	0.67
	6/07	74.75c	0.62	75.37ab	0.26
HVI color Rd	6/21	76.41d	0.52	75.53ab	0.62