

**COTTON RESEARCH ANNUAL REPORT**  
**Alabama Cotton Commission/Cotton Incorporated**

**PROJECT TITLE:** AGRONOMIC AND ECONOMIC IMPACT OF TIMING FOR PLANTING AND DEFOLIATION OF COTTON ON COTTON YIELD, QUALITY AND PROFITABILITY.

**AGREEMENT NUMBER:** 08-278AL

**PRINCIPAL INVESTIGATOR(S):**

Jason Bergtold  
Department of Agricultural Economics  
Kansas State University  
304F Waters Hall  
Manhattan, KS 66506-4011

Dale Monks  
Auburn Extension  
106 Extension Hall  
Auburn University, AL 36849

Kip Balkcom  
USDA-ARS  
411 S. Donahue Dr.  
Auburn, AL 36832  
334-844-4666  
[kip.balkcom@ars.usda.gov](mailto:kip.balkcom@ars.usda.gov)

Randy Raper  
USDA-ARS  
411 S. Donahue Dr.  
Auburn, AL 36832

Francisco Arriaga  
USDA-ARS  
411 S. Donahue Dr.  
Auburn, AL 367832

**PERFORMING INSTITUTION:** USDA-ARS NSDL and Auburn University

**PROJECT OBJECTIVES:**

1. Compare the combined effect of alternative planting and defoliation dates on cotton yield, quality and profitability.
2. Examine alternative methods for determining optimal planting and defoliation dates that maximize net returns from cotton production.
3. Determine management strategies for cotton production that take into account different climatic and market conditions, as well as, risk attitudes by farmers.

**PLAN OF WORK:**

Planting dates and defoliation dates were implemented at the Field Crops Unit of the E.V. Smith Research and Extension Center near Shorter, AL. Treatments were arranged in a strip-plot design with 3 replications as follows:

<u>Planting Dates</u>	<u>2007</u>	<u>2008</u>
1. 4 weeks before "optimal" planting date	4/13/07	4/22/08
2. "optimal" planting date	4/30/07	5/19/08
3. 4 weeks after "optimal" planting date	5/30/07	6/25/08

<u>Defoliation Dates</u>
1. 40% open boll
2. 60% open boll
3. 80% open boll
4. 100% open boll

**REPORT:**

This experiment was initiated in the fall of 2006 at the E.V. Smith Research Center, Field Crops Unit near Shorter, AL on a Compass sandy loam (coarse-loamy, siliceous, subactive, thermic Plinthic Paleudults). The experiment was rotated to a different location each year, but the soil type was the same.

The experimental design contained a strip-plot treatment restriction in a randomized complete block design with three replicates. All plots were 24 ft. wide and 75 ft. long in 2007 and 50 ft. long in 2008. The horizontal plots consisted of three planting dates, and the vertical plots were defoliation times that corresponded to 40%, 60%, 80%, and 100% open boll. A rye cover crop was drilled across the experimental area each fall at 90 lb ac<sup>-1</sup>. An in-row subsoiling operation was performed, prior to each planting date, with a KMC Rip Strip®.

A starter fertilizer application was applied across the experimental area to supply 40 lb N/ac, 11 lb P<sub>2</sub>O<sub>5</sub>/ac, and 40 lb K<sub>2</sub>O/ac. Cotton (DPL 454®) was planted (73,000 plants/ac.) in 36-in. rows with an in-furrow application of Temik® (7 lb/A) and Terraclor® (10 lb/ac). Nitrogen applied as a UAN solution at 70 lb/ac was sidedressed by early square for each corresponding planting date. A POST application of Roundup® (1.5 pts/ac) was applied after each corresponding planting date at the 4-leaf stage that was followed by a layby application of Roundup® (1.5 pt./ac) plus Caparol® (1.5 pt./ac). For each defoliation time, all corresponding cotton was defoliated with Def 6® (8 oz/ac), and Dropp® (3 oz/ac). Four rows of the subsequent plots were harvested with a spindle picker equipped with a bagging attachment approximately 2 weeks following defoliation. A large sub-sample (approximately 50 lbs) was sent to the University of Georgia's Micro-Gin Facility to determine ginning percentages. After the ginning process, another sub-sample of the lint from each plot was sent to the USDA Classing office in Macon, GA to determine cotton quality from all plots with HVI-fiber analysis.

Initial plant populations were recorded approximately 4 weeks after each planting date by counting all the plants from four 5 ft. sections across four harvest rows within each plot. Final plant heights were recorded from 20 plants/plot (5/harvest row) just prior to defoliation.

All response variables were analyzed using the MIXED procedure (Littell et al., 2006) and the LSMEANS PDIF option to distinguish between treatment means (release 9.2; SAS Institute Inc.; Cary, NC). Data were analyzed by year with planting date, defoliation time and their interactions as fixed effects in the model, while replication, replication X planting date, and replication X defoliation time were considered random. Treatment differences were considered significant if  $P \leq 0.05$ .

### **Plant Populations**

In 2007, plant populations were influenced by the planting dates ( $Pr > F = 0.0004$ ). The plant populations were 45,400, 37,900, and 67,000 plants/ac. for planting dates 1, 2, and 3, respectively. These values reflect the climate for the 2007 growing season. Early in the spring, the weather was cool, which certainly would affect cotton germination followed by extremely dry weather. The dry weather forced the cotton for the 2<sup>nd</sup> planting date to be "dusted" in. No rainfall occurred after the 2<sup>nd</sup> planting date and the cotton stayed in the ground until the field was irrigated approximately 3 weeks later. As a result, the lowest plant populations were recorded from the 2<sup>nd</sup> planting date. Excellent planting conditions and subsequent moisture resulted in the highest plant stands recorded for the 3<sup>rd</sup> planting date.

In 2008, the growing season was much cooler initially, which delayed all three planting dates. However, differences among the plant populations were observed and as the planting dates progressed, the subsequent plant populations increased. Plant populations were 42,800, 50,500, and 57,300 for planting dates 1, 2, and 3.

### **Plant Heights**

No differences were observed among plant heights for the three planting dates of the 2007 growing season ( $Pr > F = 0.2430$ ). Plant heights averaged 41, 43, and 40 inches tall for planting dates 1, 2, and 3. However, plant heights measured during the 2008 growing season were affected by planting dates ( $Pr > F = 0.0002$ ). Plant heights in 2008 averaged 43, 55, and 46 inches tall for planting dates 1, 2, and 3. The much taller plants observed for the 2<sup>nd</sup> planting date can be attributed to above average rainfall that stimulated vegetative growth. The wet soil conditions did not allow for timely growth regulator applications.

### **Cotton Yields**

As previously mentioned, extreme cool weather at the beginning of the 2008 growing season pushed all the planting dates back approximately 1 month. This weather combined with cool weather in early fall of 2008 did not allow for cotton harvest of the 3<sup>rd</sup> planting date. In addition, only seed cotton values are available for the 1<sup>st</sup>

and 2<sup>nd</sup> planting dates of the 2008 growing season. However, there was an interaction between planting dates and defoliation dates ( $P > F = 0.0507$ ) for the 2008 seed cotton yields that is illustrated in Fig. 1. Seed cotton yields from planting date 1 were numerically higher than values from planting date 2 with the exception of the 100% defoliation time. Yields from the 100% defoliation of planting date 1 were significantly lower than the 40% and 80% defoliation times of planting date 1. Seed cotton yields from planting date 2 were equivalent across defoliation times, but the 40% and 80% defoliation dates for the 2<sup>nd</sup> planting date were lower than yields from the 80% defoliation of planting date 1.

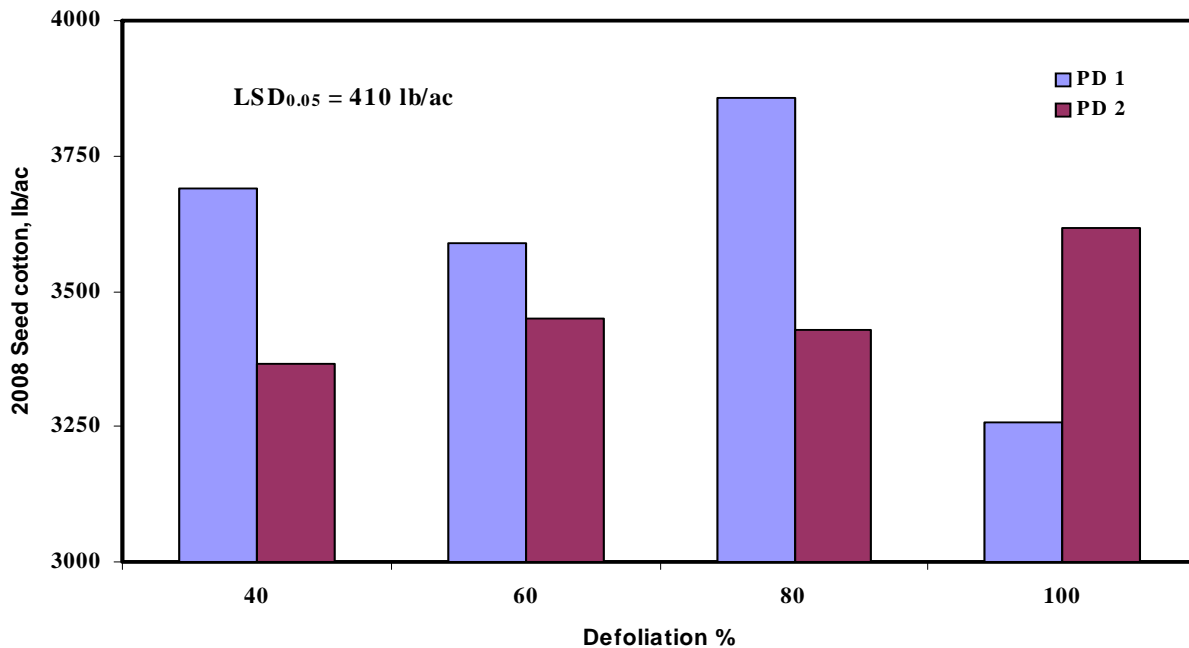


Figure 1. Seed cotton yields measured across two planting dates and four defoliation times during the 2008 growing season at the Field Crops Unit of E.V. Smith Research Center in Shorter, AL.

At this time, a complete data analysis that includes fiber quality is only available for the 2007 growing season. This analysis will focus on lint, length, micronaire, strength, and uniformity with the means across treatments presented in Table 1.

An interaction ( $P > F = 0.0003$ ) was observed between planting dates and defoliation percentages for cotton lint yields (Fig. 2). This interaction can be attributed to 33% lower lint yields measured from the 2<sup>nd</sup> planting date compared to planting date 1 and 3. The lower lint yields for planting date 2 resulted from dry conditions at planting, which suppressed cotton emergence and subsequent growth. In addition, cotton lint yields were more variable across the different defoliation percentages from the 1<sup>st</sup> planting date compared to lint yields across defoliation percentages for the 3<sup>rd</sup> planting date (Fig. 2). These yields indicate that for early planted cotton, there may be a yield advantage to defoliating the cotton slightly later.

### **Fiber quality**

Length, micronaire, and strength were only affected by planting date in 2007, but planting date affected the fiber properties differently (Table 1). The 1<sup>st</sup> planting date produced the longest fibers followed by the 3<sup>rd</sup> and 2<sup>nd</sup> planting dates. This indicates that cotton from the 1<sup>st</sup> planting date was not stressed as much as cotton in the other planting dates. On the other hand, micronaire values for the 1<sup>st</sup> planting date were in the discount range for low micronaire. This would indicate more immature bolls at cotton harvest. This is supported by the lower gin

turnout for this planting date (data not shown). Micronaire values for the 2<sup>nd</sup> planting date were in the premium range, but due to low yields, this seems more due to chance.

Table 1. Cotton lint, and HVI fiber properties (staple, length, micronaire, strength, uniformity) measured across three planting dates and four defoliation times during the 2007 growing season at the Field Crops Unit of E.V. Smith Research Center in Shorter, AL.

	Lint	Staple	Length	Micronaire	Strength	Uniformity
	lb/ac	32nds	inches		kN m/kg	%
PD1	1022	35	1.10	34	281.8	80.8
PD2	670	32	1.01	39	282.6	80.7
PD3	987	33	1.04	48	310.5	82.0
Def-40	715	33	1.05	40	293.7	81.2
Def-60	884	34	1.05	41	293.3	81.6
Def-80	988	33	1.05	41	290.8	81.3
Def-100	984	34	1.05	40	288.7	80.7
PD	0.0021	0.0003	0.0000	0.0000	0.0041	0.0165
Def	0.0386	0.8950	0.9903	0.8192	0.7054	0.1116
PD x Def	0.0003	0.6206	0.9535	0.2262	0.3761	0.0392

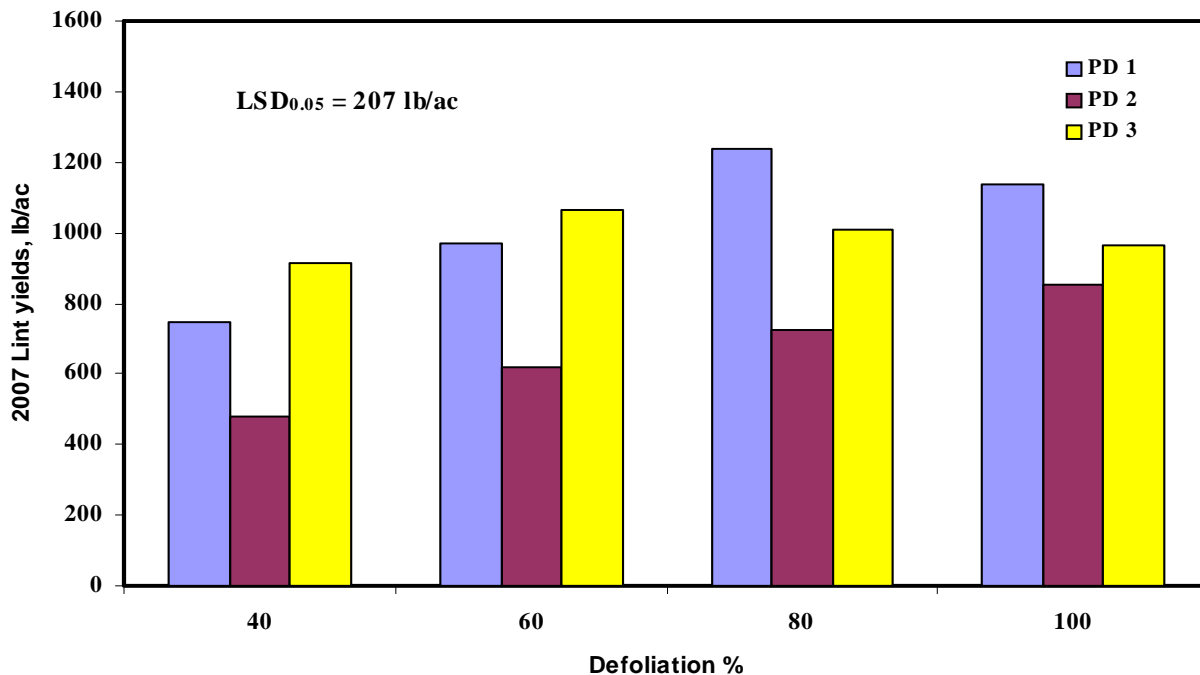


Figure 2. Cotton lint yields measured across three planting dates and four defoliation times during the 2007 growing season at the Field Crops Unit of E.V. Smith Research Center in Shorter, AL.

The highest micronaire values were for the 3<sup>rd</sup> planting date, which were just below the discount range for high micronaire. Fiber strength values were equivalent for the 1<sup>st</sup> and 2<sup>nd</sup> planting dates, but approximately 10% greater for the 3<sup>rd</sup> planting date. Uniformity values for different defoliation percentages within each planting date were not consistent, which resulted in an observed interaction ( $Pr > F = 0.0392$ ) across planting dates and defoliation percentages (Fig. 3). Although uniformity values were not below discount thresholds, the 3<sup>rd</sup> planting date produced higher uniformity values. Uniformity values for the 3<sup>rd</sup> planting date were superior to at least one of the other planting dates across most of the defoliation times.

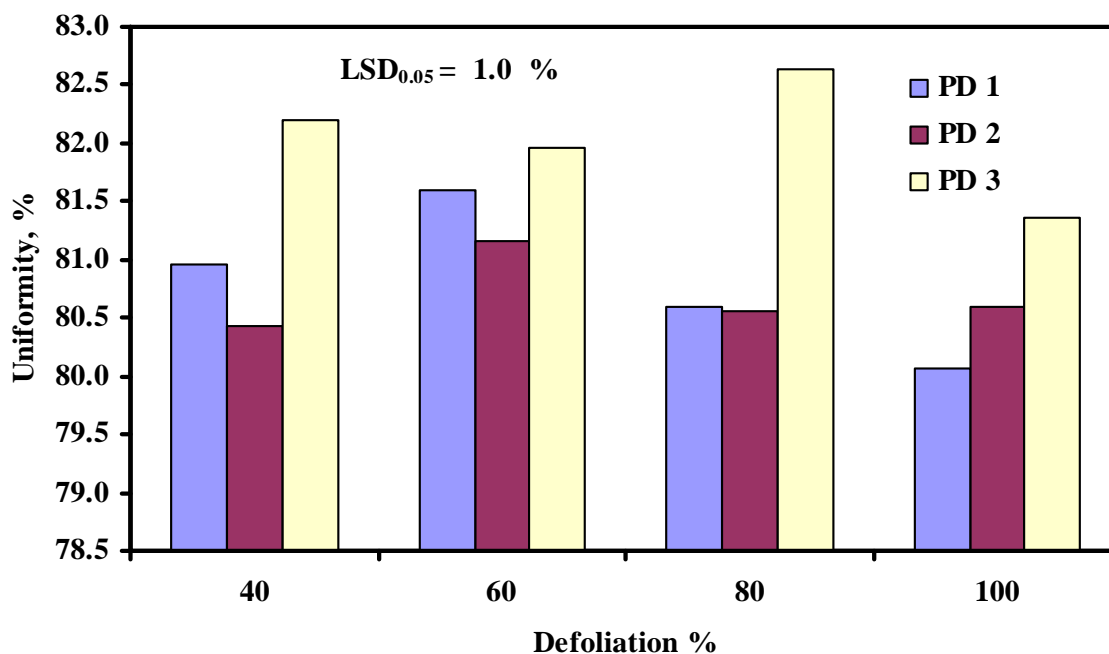


Figure 3. Cotton fiber uniformity values measured across three planting dates and four defoliation times during the 2007 growing season at the Field Crops Unit of E.V. Smith Research Center in Shorter, AL.

### Conclusions

One year of data collection for fiber properties that are influenced by the environment limit the scope of these results. However, combining these results across multiple years should allow trends to become more apparent and enable different management strategies to be tested across various climatic and market conditions.

### References

Littell, R.C., G.A. Milliken, W.W. Stroup, R.D. Wolfinger, and O. Schabenberger. 2006. SAS for Mixed Models. 2<sup>nd</sup> edition ed. SAS Institute Inc., Cary, NC.