

**EVIDENCE OF DEFOLIATION AND HARVEST  
TIMELINESS EFFECTS ON YIELD, GRADE, AND  
PROFIT: THE CASE OF COTTON IN GEORGIA**

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**Abstract**

Cotton was planted on April 27, 1998 at the University of Georgia Ponder Farm in Tift County. Harvest aid applications were initiated when the crop was 5% open bolls and continued each week thereafter for a total of 13 weeks. Net return was calculated for each of the 13 treatments or harvest weeks. The measure of net return used for this study was defined as the "Adjusted Gross Income" which considered differences in yield and quality. Maximum cotton yield of 1,409 pounds per acre was achieved by defoliating the first week of 100% open boll (OB). The highest net return was achieved at 42% open boll. This plot yielded 1,313 pounds per acre (96 pounds per acre less than the maximum) but received no discounts for quality. Delay in defoliation and harvest resulted in a maximum loss of \$167 per acre in net return. On average, delay in defoliation and harvest resulted in losses of \$68 per acre. A trendline representing the average relationship for all the data shows maximum net return by defoliating at 50-60 percent open bolls. Historical data of crop harvest in Georgia indicates that 60% open bolls would occur around mid-September on average. This would be at the very early stage peanut harvest. For this reason, it is likely that most Georgia cotton is defoliated at more than 50-60% open bolls and harvest is delayed even further.

**Introduction**

For many Georgia farmers, peanuts and cotton are typical farming enterprises. Both are economically vital to the farm's profitability. Unfortunately, both crops are similar in their planting and harvest dates and both require approximately 150 days to mature. This often imposes resource constraints on the farm. Cotton harvest is often delayed until peanut harvest is well underway or is completed.

For the 5-year period 1994-98, the Georgia cotton crop averaged being 50% planted on May 8 and 50% harvested on October 12 -- a span of 174 days. Peanut harvest begins around September 1 and is almost complete by the end of October. Cotton harvest begins around mid-September and can extend into early December.

Peak maturity for a cotton boll occurs the day it opens. Once open, a boll will decline in quality and yield loss can also occur. A cotton plant will open bolls for a period of approximately 6 weeks. Therefore, some bolls on the plant will be open and subject to decline in yield and quality while others continue to mature. The objective of crop termination is to apply harvest-aids at such a time that as many bolls as possible can be harvested while not suffering offsetting losses in yield and quality.

**Objectives and Methodology**

The objectives of this research are (1) to quantify the relationship between defoliation and harvest timeliness and cotton yield and grade and (2) to determine the optimum stage of defoliation and harvest that would maximize net returns.

Cotton (Suregrow 501) was planted on April 27, 1998 at the University of Georgia Ponder Farm in Tift County. Crop maturity was determined by the percent open boll method. Harvest aid applications were initiated when the crop was approximately 10% open bolls and continued each week thereafter for a total of 13 weeks. Each plot was replicated 4 times. Harvest-aid was 4oz DEF/Folex plus 1 pound Dropp plus 21 ounces of Prep for each treatment. All other inputs and cultural practices were also the same for each treatment. Each plot was mechanically harvested 2 weeks after harvest-aid application.

Net return was calculated for each of the 13 treatments or harvest weeks. Because all other production practices, inputs, and costs were the same for each treatment, the appropriate comparison can be greatly simplified by considering only those income and cost factors that are different among the treatments. The measure of net return used for this study was defined as the "Adjusted Gross Income" which considered differences in yield and quality. This was calculated as:

$$AGI = Y \times (P + TPD - NGC)$$

where:

AGI = Adjusted Gross Income

Y = the average yield per acre for the treatment

P = the average of the November 1, 1998 and February 1, 1999 Southeast spot market price per pound for Strict Low Middling cotton.

TPD = the average total premiums and discounts or "spot market differences" per pound for color, leaf, staple, micronaire, and strength on November 1, 1998 and February 1, 1999.

NGC = net ginning and warehouse charges per pound after cottonseed.

The average Southeast spot market price for base quality Strict Low Middling (P) was 62 cents per pound. This was adjusted for the premiums and discounts applicable for each treatment (TPD). HVI Leaf Grade was not available for the study. Therefore, Leaf Grade was assumed the same as the Color Grade, i.e. 41 Color with a 4 Leaf or 51 Color with a 5 Leaf, etc. Net ginning charges after cottonseed (NGC) were 6 cents per pound.

### **Results**

Defoliation began on August 11 when the crop had 5% open bolls then harvested 2 weeks later on August 25. Defoliation and harvest continued weekly for a total of 13 weeks. The last treatment was defoliated on November 3 and harvested November 17 (Table 1).

Maximum cotton yield of 1,409 pounds per acre was achieved by defoliating the first week of 100% open boll (OB). This occurred on September 15. This cotton was harvested on September 29. Color grade deteriorated during the harvest period—lowered from Color 41 during the early harvest times to 51 and 61 during the later times. Micronaire tended to increase slightly and fiber strength was lower as defoliation and harvest was delayed. There was no impact on fiber length or staple.

Although the highest lint yield was achieved at the first week of 100% open boll and although higher yields were obtained on some of the later harvested plots than earlier plots, price discounts for reduction in quality resulted in lower net returns. All treatments were in the premium category for fiber strength and staple and all treatments were within the acceptable range on micronaire. Discounts for color grade resulted in lower net returns for the later harvested plots. Losses of up to \$167 per acre were experienced.

Of the 13 treatments, the highest net return was achieved at 42% open boll. This plot was defoliated on August 18 and harvested on September 1 (Figure 1). This plot had a yield of 1,313 pounds per acre (96 pounds per acre less than the maximum) but received no discounts for quality. The Adjusted Gross Income was \$741.85 per acre. The Adjusted Gross Income for the highest yielding plot was \$704.50 per acre.

In Figure 2, net return or Adjusted Gross Income for each of the 13 treatments is shown by Percent Open Boll at the time of defoliation for that treatment. A trend line through the data illustrates the average relationship between net return and defoliation timing.

Each year of this study may show somewhat different results and, likewise, farmers know that plant maturity and weather conditions vary from year to year. This report is for one year data (1998) only and results from 1999 will be added and studied. In 1998, highest net returns were achieved when the crop was defoliated at 50 to 60 percent open boll and harvested in a timely manner afterward. Net return is reduced by defoliating too early as this results in fewer harvestable bolls and lower yield. Net return is also reduced by defoliating and harvesting too late as this results in both lint loss and reduced quality and price.

Of the 13 treatments, note that 8 were defoliated at 100% open bolls. Therefore, by comparing those 8 treatments, the impact of delayed defoliation and harvest can readily be seen (Figure 3). Each one week delay in harvest after 100% open boll resulted in an average loss of \$15.76 per acre in net return. Maximum net return occurred 1 to 2 weeks before 100% open boll and declined each week thereafter. For the 13 treatments, net return declined from approximately \$65 per acre above average 4 weeks prior to 100% open bolls to \$101 below average at 7 weeks after 100% open bolls.

### **Summary and Conclusions**

This study is for one year at the Ponder Farm in Tift County. Results from 1999 will be added and analyzed. The data show that highest yield does not necessarily correspond to the highest level of profit or net returns. Delay in defoliation and harvest resulted in a maximum loss of \$167 per acre in net return. On average, delay in defoliation and harvest resulted in losses of \$68 per acre.

For the 1998 harvest at the Ponder Farm, highest net return was achieved at 42% open boll. A trendline to represent the average relationship for all the data (Figure 2) shows maximum net return by defoliating at 50-60 percent open bolls. Historical data of crop harvest in Georgia indicates that 60% open bolls would occur around mid-September on average. This would be at the very early stage peanut harvest also. For this reason, it is likely that most Georgia cotton is defoliated at more than 50-60% open bolls and harvest is delayed even further.

Cotton farmers face the challenge of allocating limited labor and machinery time. Continuing this research will hopefully help farmers determine the value of harvest timeliness and better allocate resources or even justify adding resources to improve efficiency and timing.

Defoliation and harvest aid is a \$15 to \$20 per acre expense for most Georgia cotton producers. This expense comes at the end of the production year when finances may already be tight. It may often be tempting to forgo this expense. Due to

the long growing season and relatively mild and dry harvest months, some producers may attempt to not defoliate and delay harvest letting the cotton plant take it's natural course. Future study in this research may include the economics of not defoliating.

Table 1. Cotton Yield and Grade By Defoliation and Harvest Date, Ponder Farm, 1998.

Def Date	Hvst Date	% OB	Yield	Grade	Staple	Mic	Strength
Aug 11	Aug 25	5	1154	41	37	4.27	35.28
Aug 18	Sep 1	42	1313	41	38	4.50	34.00
Aug 25	Sep 8	68	1305	41	37	4.39	32.85
Sep 1	Sep 15	73	1339	51	37	4.66	33.05
Sep 8	Sep 22	92	1363	51	37	4.78	32.45
Sep 15	Sep 29	100	1409	52	37	4.71	32.05
Sep 22	Oct 6	100	1361	52	37	4.72	32.05
Sep 29	Oct 13	100	1313	51	37	4.75	30.80
Oct 6	Oct 20	100	1355	51	37	4.74	32.13
Oct 13	Oct 27	100	1224	51	37	4.73	31.03
Oct 20	Nov 3	100	1363	51	36	4.73	31.18
Oct 27	Nov 10	100	1226	61	36	4.69	30.25
Nov 3	Nov 17	100	1286	61	37	4.78	31.40
Avg			1309		37	4.65	32.00

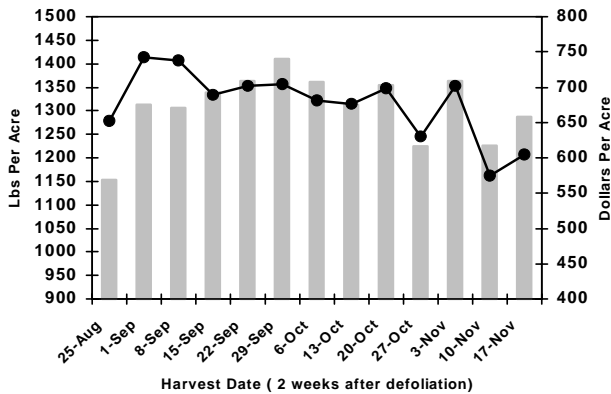


Figure 1. Yield and income by harvest date, Defoliation/Harvest Timing study, Ponder Farm, 1998.

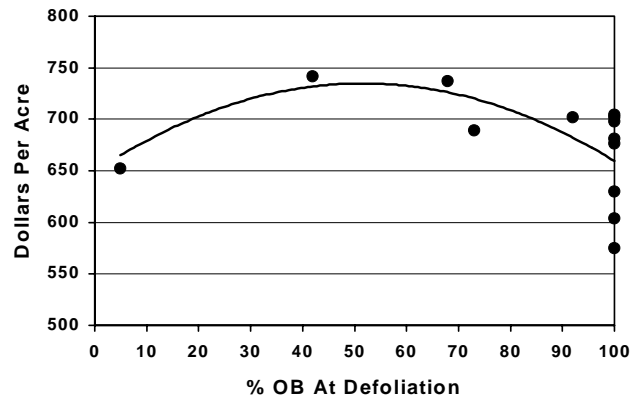


Figure 2. Adjusted gross income by percent open bolls at time of defoliation.

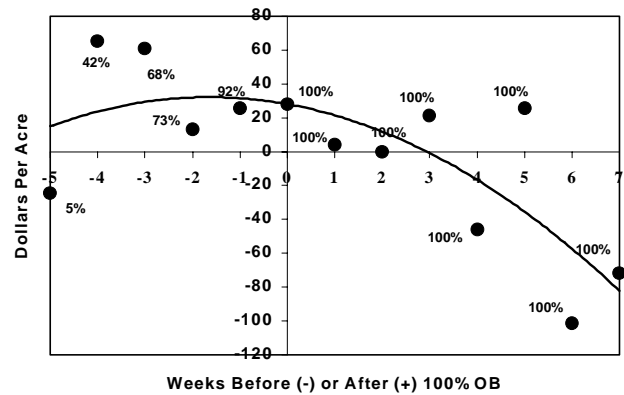


Figure 3. Adjusted gross income per acre amount above or below average by week and % OB.