NITROGEN MANAGEMENT FOR COTTON FOLLOWING COTTON ON COASTAL PLAIN SOILS

Glen Harris and Shelby Baker
Extension Agronomist and Research Scientist
University of Georgia
Tifton, GA

Abstract

With the recent expansion of cotton acreage in Georgia, the practice of planting cotton following cotton instead of following peanuts, corn or soybeans has increased significantly. The objective of this research was to determine the optimum N rate for cotton following cotton on Coastal Plain soils. A field study was conducted from 1993 through 1996 at the University of Georgia Coastal Plain Experiment station in Tifton, GA. Cotton plots were established on a Tifton loamy sand soil following peanuts and fertilized with 0, 20, 40, 60, 80, 100 and 160 lb N/a on the same plots each year of the study. In 1993 following peanut, there was no yield response above the 20 lb N/a rate, indicating the current recommendation of 30 to 40 lb N/a is adequate. In 1994, the first year following cotton, 80 lb N/a was the optimum rate. Growing conditions and yields were excellent, thereby justifying a higher N rate than the currently recommended 60 lb N/a. In both 1995 and 1996, the third and fourth years of continuous cotton, the optimum N rate was 100 lb N/a. Therefore, N rates above the 60 lb/a base rate may be justified for cotton following cotton on Coastal Plain soils, especially at yield levels above the statewide average as produced in this study. There was no yield advantage for N rates above 100 lb N/a in any year of the study. In 1996, cotton yield actually decreased at a rate above 100 lb N/a, indicating possible detrimental effects of excessive N fertilization on this soil.

Introduction

Cotton acreage in Georgia has increased significantly in recent years while peanut, corn and soybean acres have declined. For example, in 1993, of the approximately 2.5 million total acres planted to these four crops, cotton accounted for 25 %, peanut 27 %, corn 25 % and soybean 23 %. In 1996, approximately 2.9 million total acres of these four crops were planted in Georgia with cotton accounting for 48 %, peanut 18 %, corn 20 % and soybean 14 %. Most (over 90 %) of this row crop acreage is planted in the southern part of the state on Coastal Plain soils. Therefore, the practice of planting cotton following cotton instead of following peanuts, corn or soybeans on Coastal Plain soils has also increased significantly in recent years.

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The current base nitrogen (N) rate for cotton recommended by the University of Georgia Cooperative Extension Service is 60 lb N/a. For Coastal Plain soils such as the Tifton, Greenville or Dothan series that have subsoil clay within plow depth, 60 lb N/a is considered adequate for cotton even when following cotton. For cotton following peanuts, heavily fertilized corn, or soybeans on these soils, the recommended N rate is 30 to 40 lb/a total. However, with more cotton following cotton, irrigation, higher-yielding varieties and better insect control situations currently found in Georgia, these N fertilizer recommendations need to be reevaluated.

The objective of this study was to determine the optimum fertilizer N rate for cotton following cotton on a Coastal Plain soil.

Materials and Methods

This research was conducted from 1993 through 1996 at the University of Georgia Coastal Plain Experiment Station located in Tifton, GA. Cotton plots (24 ft. wide x 40 ft. long) were established following peanut on a Tifton loamy sand soil and fertilized with 0, 20, 40, 60, 80, 100, and 160 lb N/a. The same plots were maintained and fertilized with the same N rates each year of the study. The cotton variety used was Stoneville/GA King. Nitrogen fertilizer was applied in the form of ammonium nitrate and split applied (half the rate at planting and half sidedressed at first square). Preplant fertilizer (500 lb/a of 0-10-20) was broadcast and incorporated on all plots each year to satisfy P and K requirements. Cotton was planted late April each year and harvested in early October. Herbicide and insecticide applications were made following recommended guidelines. Irrigation was used when needed. The center 2 rows of the 8 row plots were mechanically harvested and representative seed cotton samples were ginned to determine lint yields. The experimental design was a randomized complete block with four replications. Analysis of variance and a multiple range test for separation of means were conducted to determine significant effects of N rate on cotton lint yield.

Results and Discussion

A significant cotton lint yield response to fertilizer N rates was measured in all four years of the study (Table 1). In 1993, following peanut, a significant yield increase was measured at the 20 lb N/a rate (vs. 0) but no additional yield increase was measured for rates above 20 lb N/a. This indicates that the current recommendation of 30 to 40 lb N/a for cotton following peanuts is still adequate. In 1994, the first year for cotton following cotton, a significant yield increase was measured as N rates increased up to 80 lb N/a. This indicates that the current recommendation of 60 lb N/a for cotton following cotton on typical Coastal Plain soils may be low. However, the 1994 was marked by record rainfall and a record statewide yield average of 850 lb/a.

Also, averaged across N rates, yields at the experimental site in 1994 were well above the statewide average. Therefore, under more normal growing conditions at yield levels closer to the statewide average, 60 lb N/a for cotton following cotton may still be considered adequate. In 1995, the third year of "continuous cotton", a significant yield increase was measured with increasing N rates up to the 100 lb N/a rate. This indicates that for cotton following more than one year of cotton, rates of up 100 lb N/a may be justified. The 1995 growing season was considered dryer than normal with the statewide yield averaging 633 lb/a lint. However again, growing conditions at the experimental site were good and overall yields were well above the statewide average. In 1996, the fourth consecutive cotton crop responded to increasing N rates with increased yield up to the 100 lb N/a rate. Yield then dropped back down at the 160 lb N/a rate. This indicates again, that for cotton following more than one year of cotton, N rates of up to 100 lb/a may be justified on typical Coastal Plain soils. Also there is no additional yield response to rates higher than 100 lb/a, in fact these rates may even be detrimental. The 1996 growing season was considered "normal" with the statewide yield average approximately 730 lb/a lint.

Conclusions

Previous crop is a significant factor to be considered when determining N rates for cotton on Coastal Plain soils. The recommendation of 30 to 40 lb N/a for cotton following peanuts was verified in this study. For first year cotton following cotton, the optimum N rate was 80 lb/a. However, under more normal growing conditions and yield levels, 60 lb N/a may still be enough on these soils. The optimum N rate for the third and fourth years of continuous cotton was 100 lb N/a. Yields even dropped back down for the N rate above 100 lb/a during the fourth year. This indicates a possible buildup of residual soil N and detrimental effects due to history of excessive N applications on this soil. With more cotton following cotton, growers should be prepared to adjust N rates according to previous crop history as well as soil type, growing conditions and yield goals.

Table 1. Cotton lint yield response to N fertilizer rates applied four consecutive years.

	Year			
N Rate	1993	1994	1995	1996
lb/a	----------lint yield (lb/a)----------			
0	996a	686a	1083a	832a
20	1133b	1010b	1330b	1070b
40	1157b	1192c	1440c	1233c
60	1117b	1287d	1433c	1257c
80	1136b	1423e	1497c	1367d
100	1178b	1490e	1679d	1456e
160	1157b	1495e	1718d	1387d
Average	1125	1226	1454	1228
Significance	*	**	**	**
CV (%)	6.3	5.6	5.2	3.0

* and ** indicate significance at the 0.05 and 0.001 probability levels, respectively.
Values followed by the same letter are not different at the 0.05 level of probability.