# NITROGEN FERTILIZATION

## Nitrogen Fertilization

More than any other nutrient, N can increase or decrease yields of cotton. Apply too little N, and yields drop sharply. On the other hand, apply too much N or apply at the wrong time, and plants will be rank, slow to fruit, more attractive to insect pests, late to mature, more difficult to cover with crop protection chemicals, quick to develop boll rot, more troublesome and expensive to defoliate and control regrowth, and more likely to have grade reductions from bark.

### N Rate

The recommended rate of N ranges from 50 to 70 pounds N per acre. The best rate for a particular field depends on soil texture, the previous crop, expected rainfall patterns or irrigation, and grower experience in that field. Without knowledge of the field and the specific management practices used, it is difficult to give specific recommendations, but some guidelines are available. Uptake studies across the cotton belt suggest that cotton needs 60 pounds N per acre to produce one bale of lint. Numerous N rate studies in North Carolina and Georgia show that unfertilized plots can supply 40 to 70 pounds of available N from organic matter, subsoil storage, and rainfall. Soil N supplies are generally higher on the more productive loamy soils. A good crop of soybeans or peanuts will supply an additional 20 to 30 pounds N per acre. Thus, the recommended rates are consistent with a range of total available N from 110 to 170 pounds per acre following peanuts or soybeans, or from 90 to 140 pounds per acre following other crops. In general, soils with more than 16 inches to the subsoil will require the highest rates of N, while loams and finer textured soils will require the lowest rates of N. Following soybeans or peanuts, use a total N rate of 40 to 50 pounds per acre.

### Deficiency

Nitrogen deficiency symptoms first appear on the lower leaves. They become a pale yellowish green, fading with age first to hues of yellow, then variously tinted shades of red, and finally brown as they dry up and are prematurely shed. Deficient plants are stunted and generally unthrifty in appearance, and fruit set is poor.

If a deficiency develops, nitrogen can be applied to the soil until the second or third week of bloom. Beyond that point, soil applications become questionable. Foliar applications can increase yields at this stage of crop growth when plants are deficient. (See Foliar Fertilization.)

If nitrogen is leached out of the rooting zone, it should be replaced. Adjustments for replenishment are suggested in Table 1.

**Table 1. Adjustments for Leaching Loss of Nitrogen**

| Inches of Excess Water* | Fraction of Total Nitrogen Used to Be Replaced** |
|---|---|
| 1 | 1/5 |
| 2 | 1/3 |
| 3 or more | 1/2 to 3/4 |

* Inches of water that entered the soil in the 4- to 5-day period in excess
** Extra nitrogen needed through third week of fruiting

## Timing

Timing is important for cotton. Unlike crops such as corn and tobacco, only a small portion of the N is taken up before fruiting or flowering. About 45 days after emergence, nutrient uptake increases rapidly until it reaches a prolonged peak about two weeks after first bloom, when the processes of flower production, boll filling, and boll maturation create a heavy demand for nutrients. All too frequently, all the N is applied early in the season, or even before planting. While this may be the most convenient means of application, it makes little sense in an area subject to unpredictable leaching rains. The applied N remains exposed to leaching rains for more than 60 days before demand begins to peak. Leaching losses during this period will need to be accounted for and replaced to attain optimum yield. Heavy applications early in the season can lead to excessive vegetative growth and delayed fruiting.

Cotton needs about 20 to 25 pounds N per acre to get the plant through sidedress time. If following peanuts or soybeans, no initial N may be required. The ideal time to sidedress would be just prior to first bloom, but uncertainty with rainfall dictates that N should be applied between first square and first bloom. On sandy soils subject to rapid leaching, the sidedress N can be split, with half applied about four weeks after emergence and the remainder in three to four weeks.

## Sources

Of the many N sources available for cotton fertilization, no one source has proven to be superior to others. Nitrogen solutions, ammonium nitrate, ammonium sulfate urea and anhydrous are most frequently used because of their high analysis. Sodium nitrate and calcium nitrate can be used, but have no proven benefit over ammonium-type fertilizers and are more expensive per pound of N applied. Conversion of ammonium forms to nitrate occurs very rapidly under warm, moist conditions. The choice should be based on price, convenience, and availability of equipment. Liquid N solutions are very convenient and exhibit little volatile loss when dribbled beside the row, even without cultivation. Anhydrous is a very economical source of N, but requires specialized handling equipment There is a temptation with anhydrous to apply all the necessary N prior to planting. The best results are still obtained when sidedress applications are knifed-in after squaring begins. Care should be taken to avoid root pruning. Urea is also a suitable N source, but surface-applied sidedress application should be lightly incorporated on light, sandy soils.

Nitrification inhibitors are recommended in some parts of the country to slow the change of ammonium N to nitrate. These materials are most effective in cold, wet soils. The ammonium form is less subject to leaching because it is bound by soil clays and nitrate is not. Because cotton is generally planted in warm soils, these compounds seldom show beneficial results in on-farm tests. The best way to reduce leaching losses is to sidedress the major portion of the nitrogen once squaring has begun.

## Nitrogen, Pix and Irrigation

The potential to reduce vegetative growth with Pix has led some growers to increase N rates with the hope of increasing yields. On-farm tests in North Carolina consistently show that cotton yield response to nitrogen is not affected by Pix applications. Additional nitrogen is not justified just because Pix will be applied. Furthermore, where excessive rates of N are used, and soil moisture is good, Pix will not adequately control rank growth at labelled rates.

Under irrigated conditions, yield potential on some soils can sometimes approach three bales. Higher N rates (90 to 120 pounds N per acre) may be justified in these situations. When high N rates are planned for irrigated cotton, split N applications to provide the bulk of the N as flowering begins. Plan on using Pix to help control vegetative growth, but be aware that primary control depends on maintaining high square retention and a heavy fruit load.

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**Source:** *Cotton Fertilization*, Steven C. Hodges, Soil Science Extension Specialist,
North Carolina Cooperative Extension Service, 1995.

# Nitrogen Management for Cotton Following Cotton on Coastal Plain Soils

Due to recent market situations, the practice of planting cotton following cotton instead of following peanuts, corn or soybeans is increasing in Georgia and other parts of the Southeast. 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 ( 8 rows by 40 ft) were established on a Tifton loamy sand soil following peanuts and fertilized with 0, 20, 40 , 60, 80, 120 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 was Stoneville/GA King and the study was irrigated. Ammonium nitrate was used as the N source and was split applied, half at planting and half at first square. The center 2 rows were mechanically harvested and a subsample was ginned for turnout. The experimental design was a randomized complete block with four replications.

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.

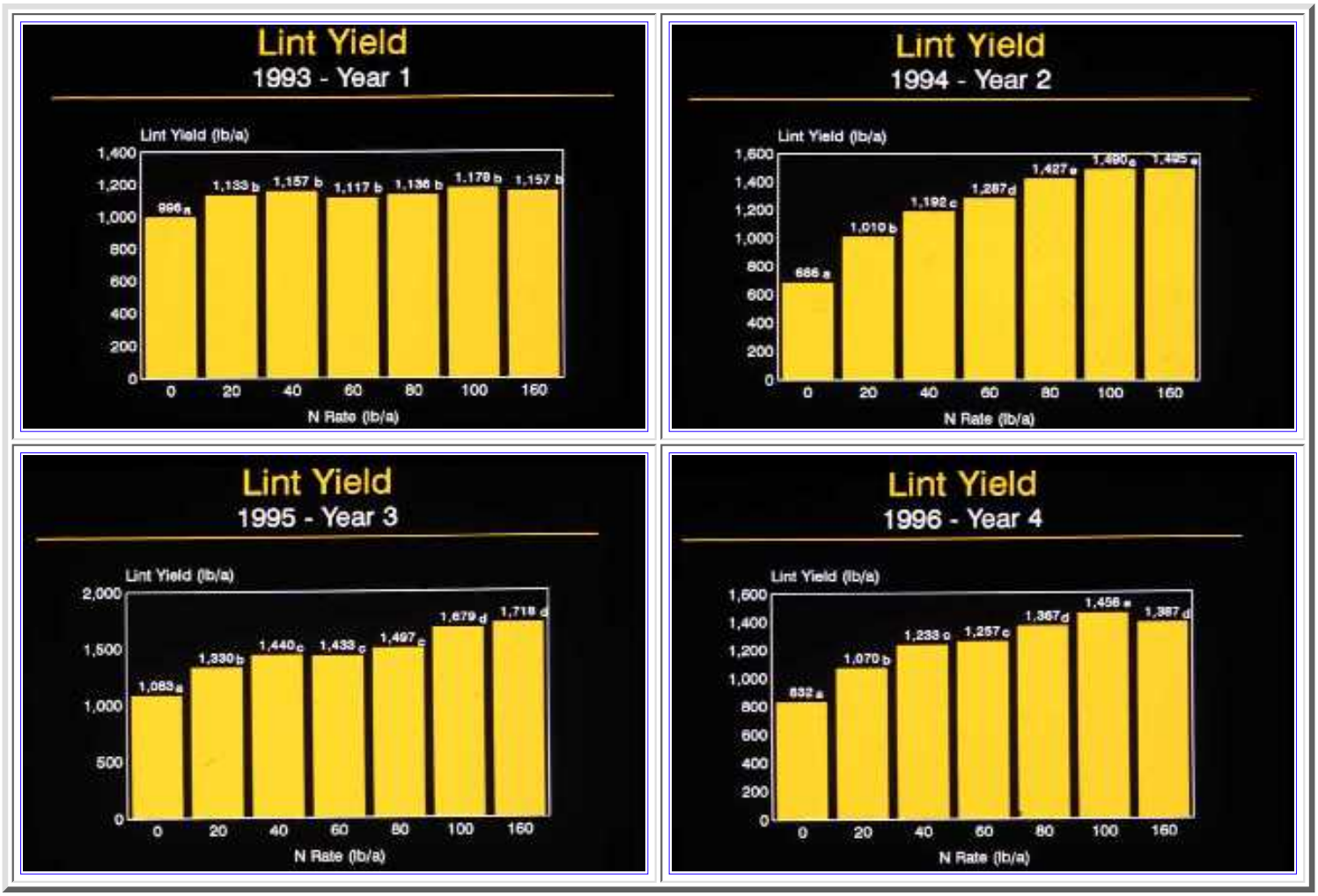
**Cotton lint yield response to N fertilizer rates applied four consecutive years.**

| | 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.

# Lint Yields 1993 - 1996

**Click on any bar graph to view enlarged or to print:**

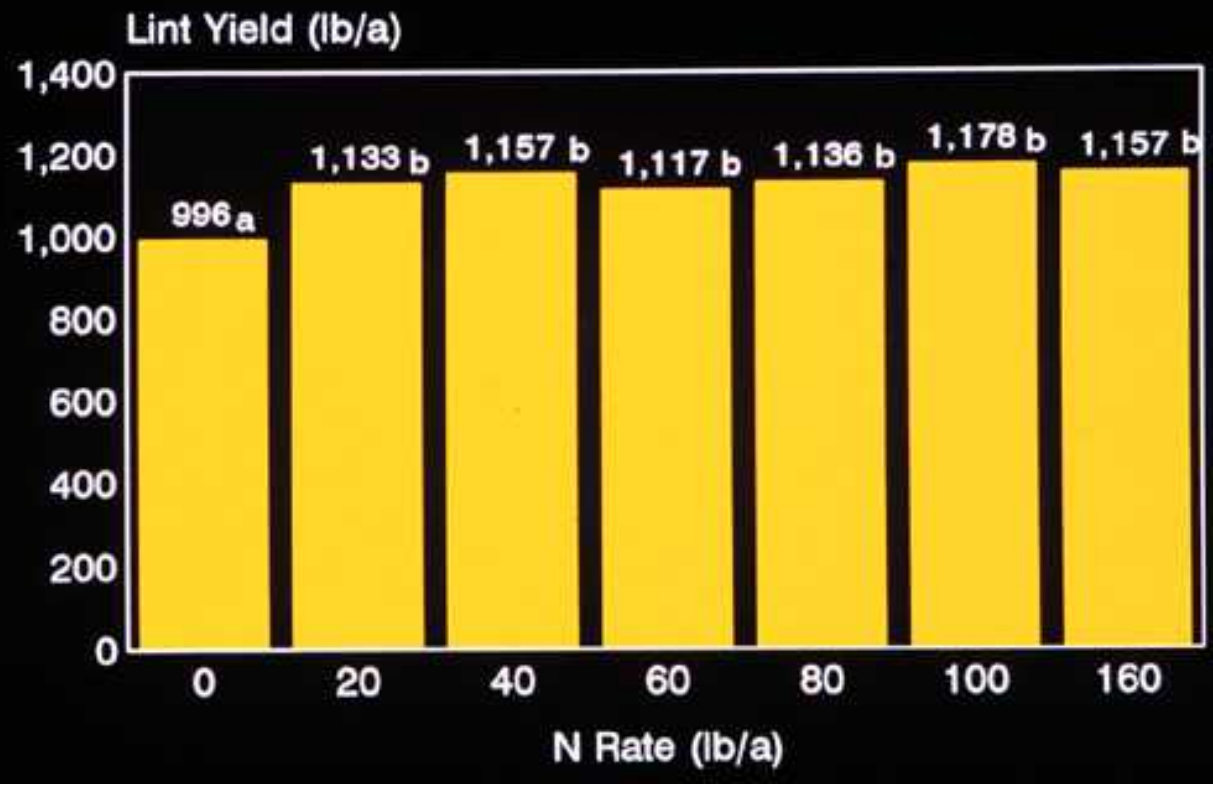



**Source:** Glen Harris and Shelby Baker, Extension Agronomist and Research Scientist
University of Georgia, Tifton, GA

[Return to Cotton Fertility: Week 1]

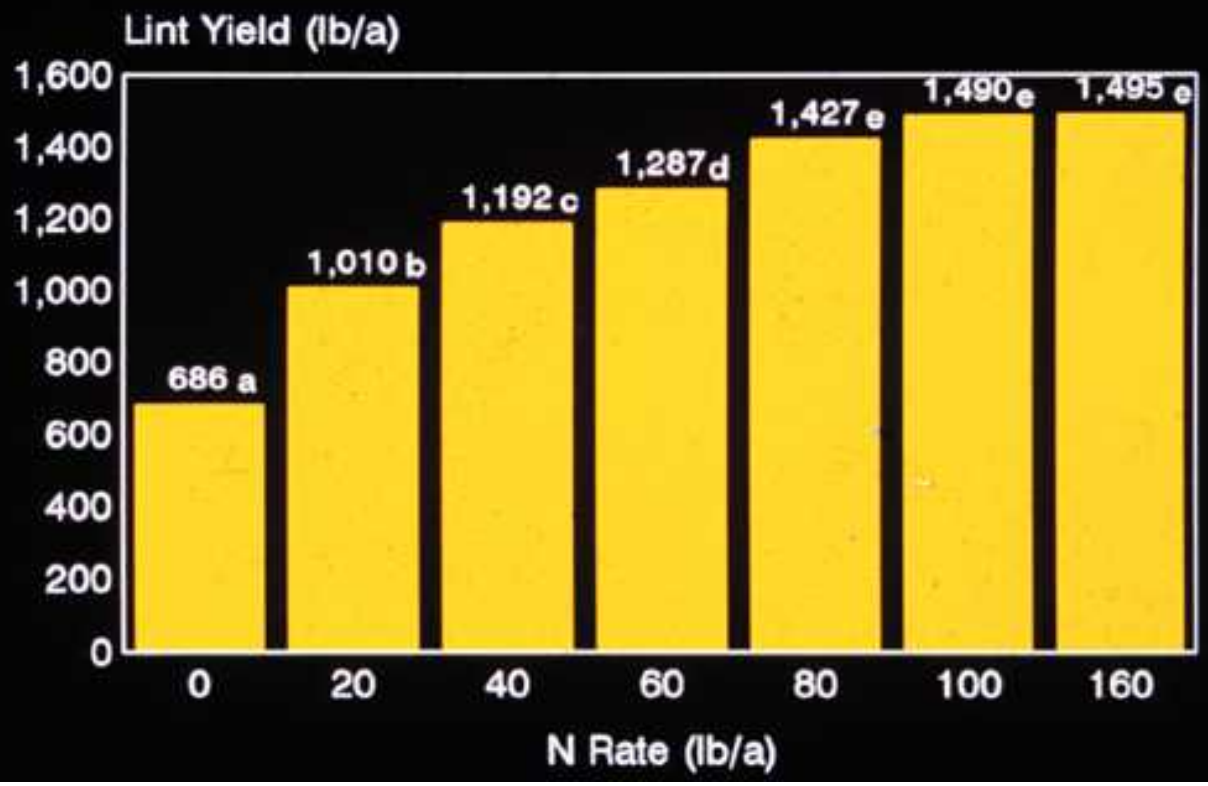
# Lint Yield

## 1993 - Year 1

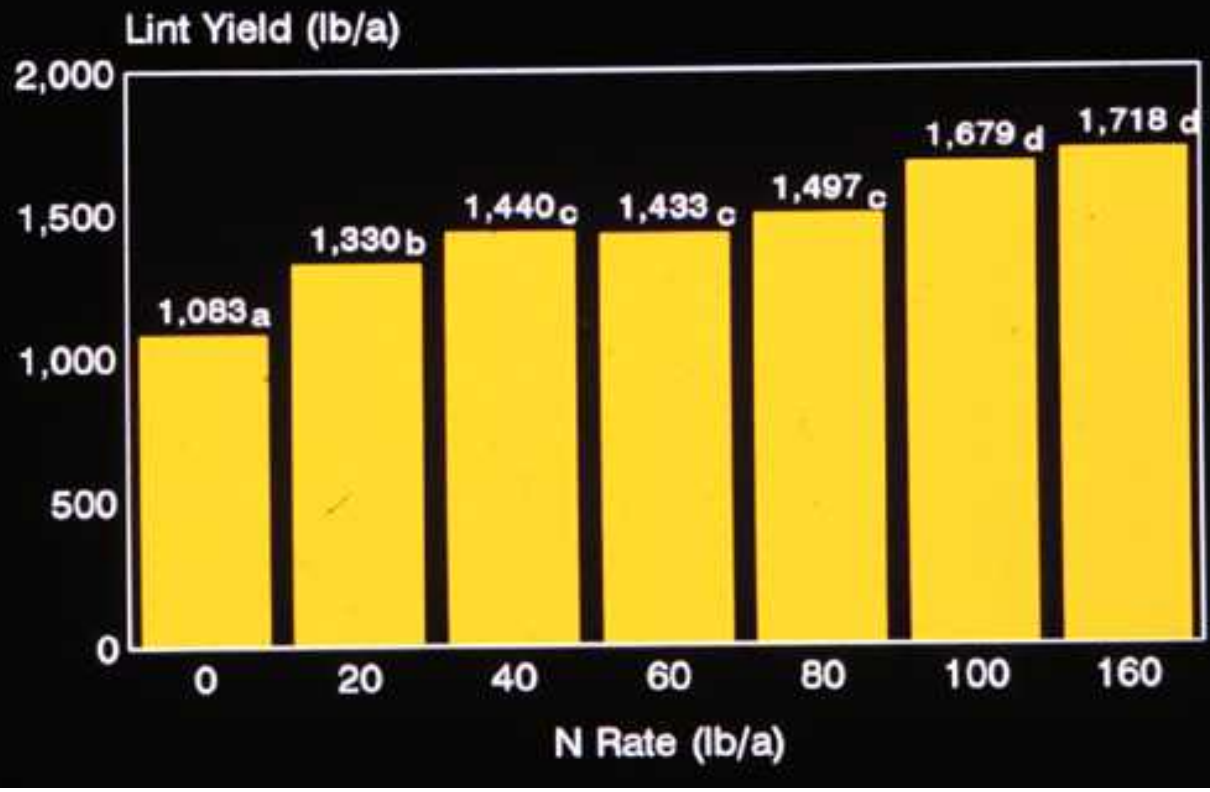


# Lint Yield

## 1994 - Year 2

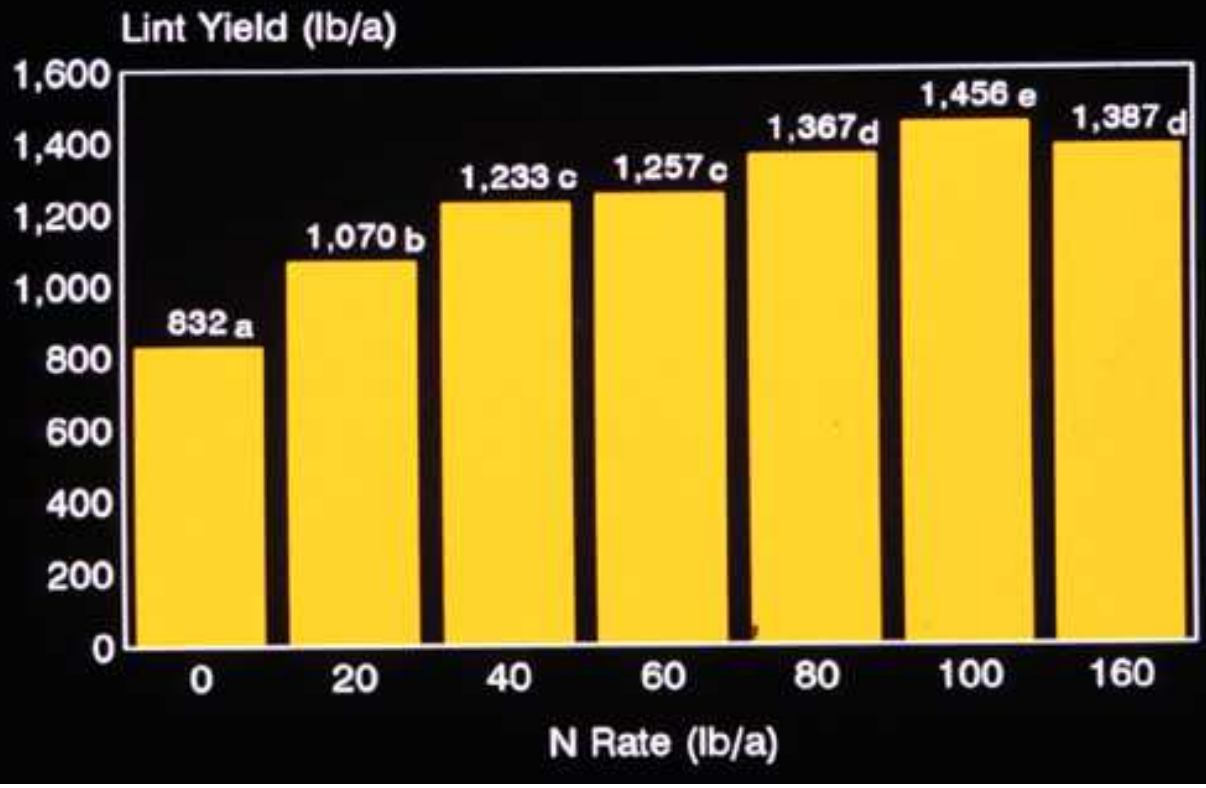


# Lint Yield
## 1995 - Year 3



# Lint Yield

## 1996 - Year 4



CLEMSON EXTENSION

# COTTON FERTILITY
## Internet Inservice Training

# *WEEK 1:*
# *Nitrogen Fertilization*

## At the end of this week, you should know:

1. **The forms and amounts of nitrogen required for optimum cotton production.**
2. **Optimum timing for nitrogen applications.**
3. **Effects of Pix applications on nitrogen response.**
4. **Effects of previous crops on nitrogen requirements.**
5. **The benefits of broiler litter for cotton.**
6. **Guidelines for applying broiler litter to avoid cotton growth problems.**
7. **How to use the petiole nitrate monitoring program.**
8. **Effects of foliar boron applications along with foliar nitrogen applications.**


## Nitrogen Fertilization: General Information

## Use of Poultry Litter

## Petiole Nitrate Monitoring

## Foliar Boron

Return to Cotton Fertility Training Schedule

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**Attendance:** 

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