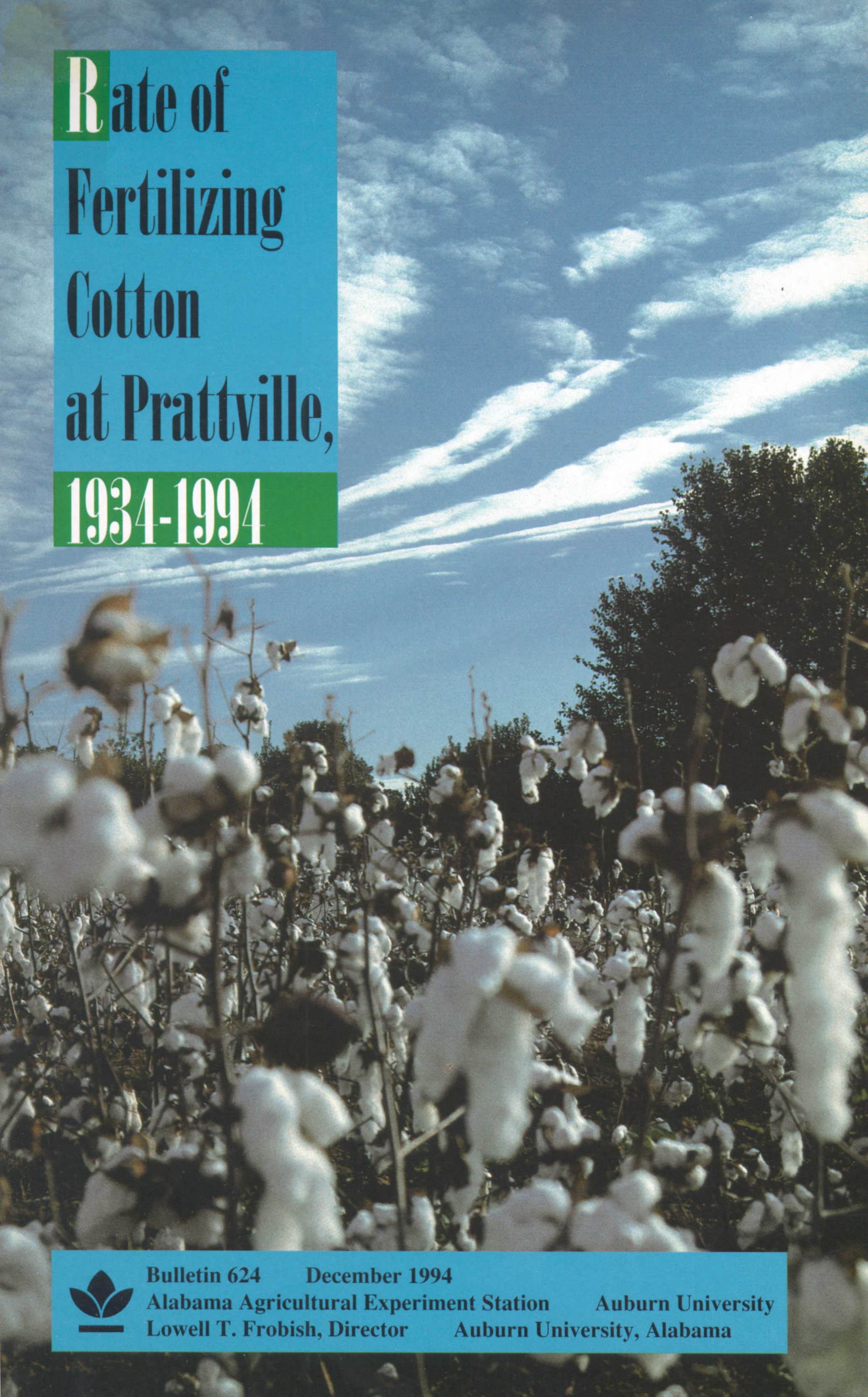

Rate of Fertilizing Cotton at Prattville, 1934-1994

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Rate of Fertilizing Cotton at Prattville, 1934-1994

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INTRODUCTION

IN 1934, A SIMPLE, COTTON TEST was established on the new Prattville Experiment Field (c. 1928). The test consisted of six, nonreplicated treatments comparing a 0-6-0 grade fertilizer, three rates of a 10-6-5 grade fertilizer, and two untreated controls. In 1962, seven nitrogen rate variables were added and the number of plots was expanded to 12. Although this test was originally designed to gather information and demonstrate cotton response to rates of fertilizers available to farmers in the area, no one intended for it to become one of the three oldest, continuous, cotton tests in the world and one of the oldest, continuous field crop tests in North America *(5)*. The only cotton experiments older than the "Rate of Fertilizing Cotton" test at Prattville are Alabama's "Old Rotation" (c. 1896) and "Cullars Rotation" (c. 1911) at Auburn, Alabama.

The "Rate of Fertilizing Cotton" test has always served as more of a test/demonstration than as a scientific experiment since treatments are not replicated. It is located in a prominent, highly visible location next to the experiment field office. Farmers and other visitors can readily identify the rates-of-N treatments which range from severely N deficient plants to dark green, succulent cotton where 300 pounds N per acre per year have been applied.

This test provides interesting insights into trends in long-term cotton yields in central Alabama and cotton's response to increasing and changing rates of nitrogen (N), phosphorus (P), and potassium (K). It is of particular interest as fertilization relates to sustainable production using only commercial fertilizer materials. Ironically, no formal research publications have been found which report or summarize cotton yields on this test. J. T. Cope, Jr., who served as project leader from 1951 until

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his retirement 1984, noted that the test was maintained primarily because of its simplicity and visibility. No data were reported in Experiment Station publications during this time although complete yield and soil test records were maintained (J.T. Cope, Jr., personal communication).

Therefore, the objective of this bulletin is to summarize 60 years of continuous cotton production on the "Rate of Fertilizing Cotton" test at Prattville and to document cotton response to rates of N, P and K.

METHODS

Soil at the site is a Lucedale sandy clay loam (fine-loamy, siliceous, thermic Rhodic Paleudult) which is a desirable, productive soil for cotton in Central and South Alabama. The plow-layer (0-8 inches) has a cation exchange capacity of 5.1 cmol/kg.

This test has always been planted using conventional tillage practices for cotton production which usually include (1) moldboard plowing in the late fall, (2) disking in the spring, (3) lime, fertilizer, and preplant incorporated fertilizer applications, and (4) final seedbed preparation.

Fertilizer was broadcast on a total plot area. Cultivation, weed and insect control, and other cultural practices were standard recommendations and practices.

Varieties planted on the "Rate of Fertilizing Cotton" test were selected based on cotton variety tests on the experiment field (Table 1). A variety released by USDA and the Alabama Agricultural Experiment Station, 'Auburn 56', remained on the test for 15 years—longer than any other variety.

Each plot is 21 feet wide and 86.5 feet long (1/24 acre). This allows six, 42-inch rows per plot. From 1977 through 1979, all plots were planted in a 2x1 skip-row pattern by planting the two center rows and the two outside rows in each plot. Since 1980, only the N-rate variable plots (6-12) have been planted in a skip-row pattern. This was done in order to gather information on N rates for skip-row cotton which had become the planting pattern used by most area farmers. Seed cotton yields were estimated by harvesting the two center rows in each plot and calculating yield based on total land area.

Table 1. Cotton Varieties Planted, 1934-1994

Year(s)	Variety
1934	Cook 307
1935	Cook 1022
1936-38	Cook 1006
1939-40	Cook 144-16
1941-43	Cook 144
1944-49	Stoneville 061
1950-52	Coker 100
1953-67	Auburn 56
1968	McNair 1032
1969	McNair 1032B
1970	Coker 201
1971-73	Deltapine (DPL) 16
1974-75	Stoneville 213
1976-77	DPL 25
1978-79	Stoneville 213
1980-83	DPL 61
1984-94	DPL 90

Several adjustments have been made in nutrients applied since the "Rate of Fertilizing Cotton" test began in 1934 (Table 2). Plot 1 has never received any fertilizer nutrients and plot 2 has not received any P fertilizer since 1936. Plot 6 has received P and K since 1962 but has never received any N fertilizer. Plot 4, the "no K" treatment, has not received any K fertilizer since 1971. Plots 3 and 5 are moderate and high rates of P and K. All P and K and half of the N are applied just prior to final seedbed preparation and planting. The complement of N is applied as a sidedressing at early squaring.

TABLE 2. ANNUAL RATES OF N-P_2O_5-K_2O APPLIED TO PLOTS, 1934-1994.

	Years					
Plot	1934-35	1936-59	1960-61	1962-70	1971-76	1977-94
			pounds N-P_2O_5-K_2O per acre			
1	0-0-0	0-0-0	0-0-0	0-0-0	0-0-0	0-0-0
2	0-36-0	36-0-0	48-0-0	120-0-60	120-0-60	90-0-60
3	30-18-12	18-30-12	24-24-24	120-30-60	120-30-60	90-30-60
4	60-36-24	36-60-24	48-48-48	120-60-48	120-60-0	90-60-0
5	90-54-36	54-90-36	72-72-72	120-72-72	120-60-30	90-60-30
6	0-0-0	0-0-0	0-0-0	0-60-60	0-60-60	0-60-60
7	—	—	—	30-60-60	30-60-60	30-60-60
8	—	—	—	60-60-60	60-60-60	60-60-60
9	—	—	—	90-60-60	90-60-60	90-60-60
10	—	—	—	120-60-60	120-60-60	120-60-60
11	—	—	—	150-60-60	150-60-60	150-60-60
12	—	—	—	300-60-60	300-60-60	300-60-60

Source of N during the early years of the test was nitrate of soda. However, since 1962, ammonium nitrate has been used. Superphosphate (0-20-0) or concentrated superphosphate (0-46-0) has been used as the source of P, and muriate of potash (0-0-60) has been the primary source of K.

A major addition to the test occurred in 1962 when annual rates of N from 0 (plot 6) to 300 pounds N per acre (plot 12) were added. All N-rates (plots 6-12), have received 60 pounds P_2O_5 and 60 pounds K_2O annually since 1962.

Soil test records date back to 1958. Mehlich-1 (dilute, double acid) extractable P and K have been determined on plow-layer soil samples taken in the fall (11 times since 1958). Lime was generally applied and incorporated into the top 6-8 inches of each plot whenever the soil pH dropped below 5.8. However, the records indicate that plot 12, 300 pounds N per acre per year, often had plow-layer pH values below 5.8 which may have resulted in reduced yields before lime was applied.

RESULTS AND DISCUSSION

Yield Trends

The most striking observations in cotton yields from year to year since 1934 are wide, weather-dependent fluctuations (Figure 1). As would be expected, trends since 1934 have tended toward higher average yields with unfavorable weather or insect damage (as in 1993) reducing yields below those of the 1930's. Although this test was begun to look at the influence of N, P, and K fertilizers on cotton yields, trends indicate that any treatment effect can be overwhelmed by environmental conditions. High or low yield extremes rarely remain high or low for two consecutive years. Record yields during the 60 years of this test are in Table 3.

In order to minimize the fluctuation in seed cotton yields from year to year so treatment effects can be compared, data can be presented as averages over a period of time or as a relative yield comparing each treatment with a standard treatment *(3)*. Relative yields are used later in this bulletin.

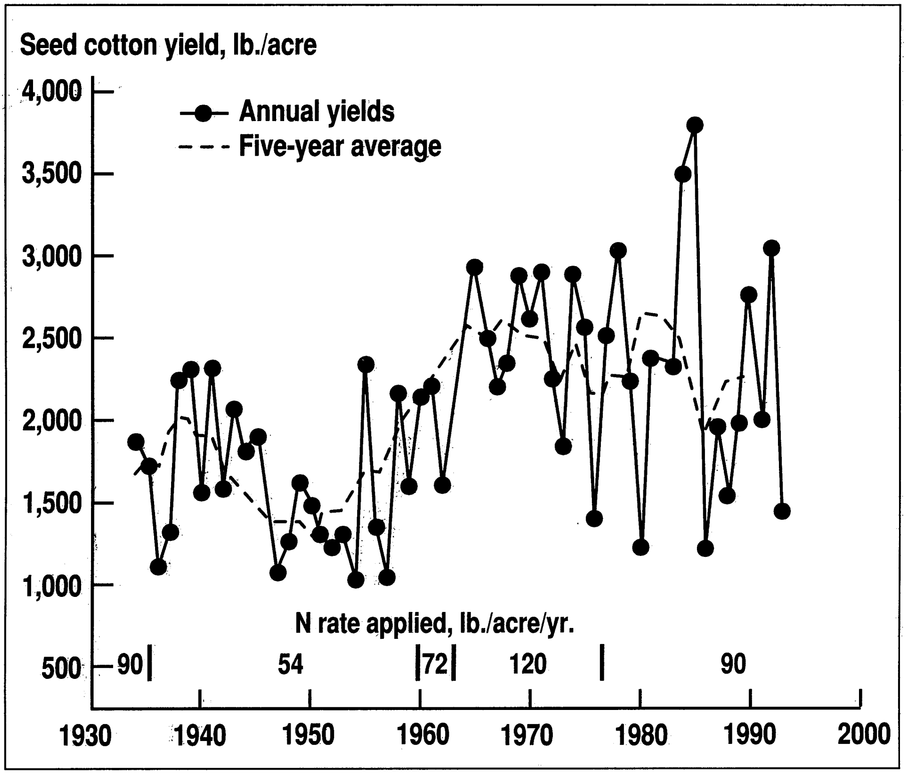

Figure 1. Trends in seed cotton yield on plot no. 5 since 1934.

TABLE 3. RECORD HIGH AND LOW YIELDS DURING THE 60-YEAR HISTORY OF THE "RATES OF FERTILIZING COTTON" TEST AT PRATTVILLE.

Record	Plot	Year	Seed cotton yield
			Lb./acre
Highest plot yield	11	1985	4,310
Highest yielding year	average	1985	3,240
Lowest yielding year	average	1946	94
Highest control yield	1	1934	1,244
Lowest control yield	1	1946	25
Highest yield for recommended N rate	9	1985	4,260
Lowest yield for recommended N rate	9	1986	980

NITROGEN RATES VERSUS YIELDS

Five-year running averages indicate that rates of 60 to 150 pounds N per acre produced maximum yields (Figure 2). However, when average yields were low such as the years around 1978 and again around 1989, 30 pounds N per acre were adequate.

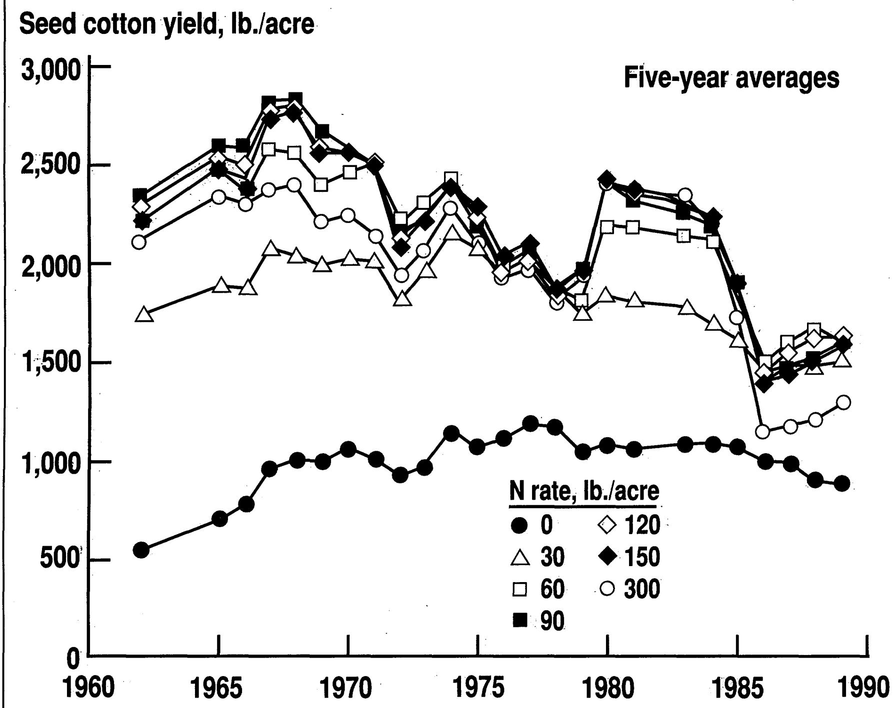

Figure 2. Effect of N rate on seed cotton yield since 1962 (plots 6-12). Each data point represents a 5-year running average.

These data support the standard N recommendations made by the Auburn University Soil Testing Laboratory which suggests 90 pounds N per acre with a 30 pound adjustment up or down based on yield potential and field history *(2)*. These standard recommendations were developed from numerous, replicated N-rate studies on cotton throughout Alabama. The 300 pounds N per acre rate usually resulted in excessive growth and increased difficulty controlling insects. This sometimes occurred on the 120 and 150 pounds N per acre rates, especially when rainfall was higher than normal.

Rates of Phosphorus and Potassium versus Yield

The first 28 years of the study compared increasing rates of a complete fertilizer (N, P, and K all increased simultaneously). Most cotton growers during this era fertilized in this manner. There was no soil testing program in Alabama until 1954. As expected, the highest yields were produced by the highest rate of fertilizer applied which was plot 5. During the 28-year period, this plot received as much as 90 pounds of N, 90 pounds of P_2O_5, and 72 pounds of K_2O annually (Table 2). The effects of N, P, and K cannot be separated because of the confounded variables. However, in 1962, three annual rates of P_2O_5 (0, 30 and 60 pounds per acre) were established

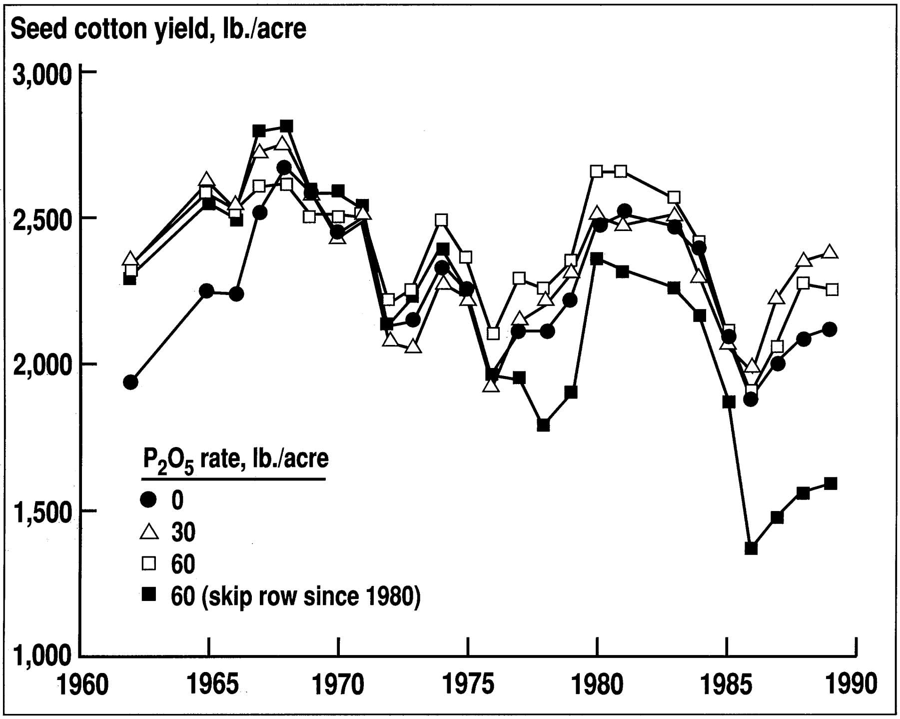

Figure 3. Effect of phosphorus rate (plots 2, 3, 5, and 9 or 10) on seed cotton yield since 1962. Each data point represents a 5-year running average yield.

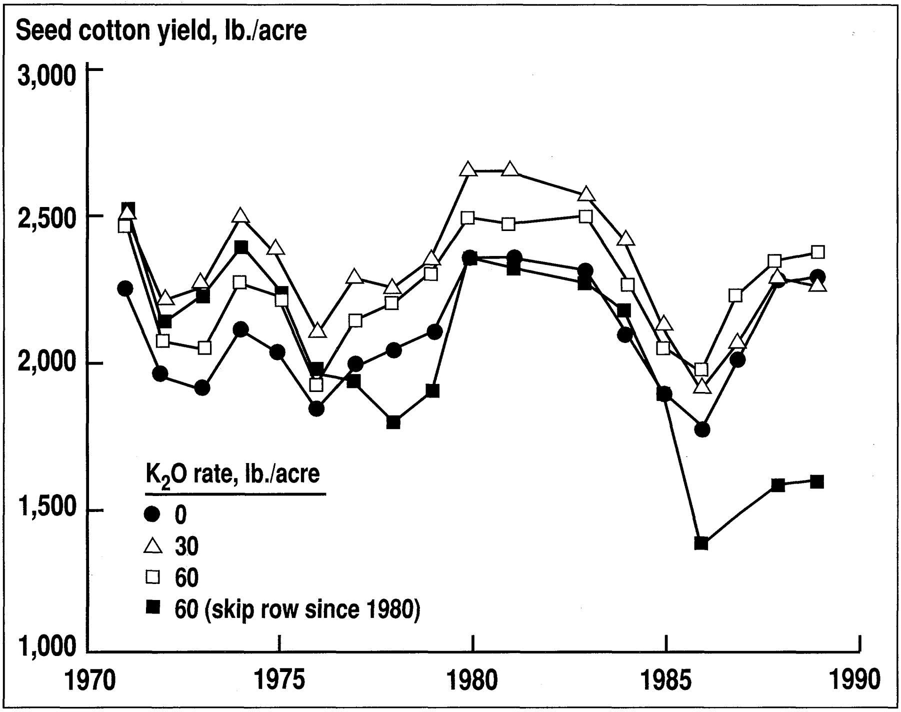

Figure 4. Effect of potassium rate (plots 3, 4, 5, and 9 or 10) on seed cotton yield since 1971. Each data point represents a 5-year running average yield.

in plots with equal rates of N and K (plots 2, 3, and 10). In 1971, three annual rates of K_2O (0, 30 and 60 pounds per acre) were established in plots with equal rates of N and P (plots 4, 5, and 9 or 10). Since that time, we have been able to observe the effect of annual applications of these nutrients alone on yields (Figures 3, 4). However, by this time, previous P and K applications on these plots had increased residual soil P and K to the point that cotton yields were not increased by increasing rates of these nutrients. An apparent decrease in yield since 1980 where 60 pounds P_2O_5 and 60 pounds K_2O per acre were applied is probably due to the skip-row planting pattern used only on plots 6-12.

Soil-test P versus Relative Yield

The soil testing program in Alabama created a need for as much soil test calibration information as possible. Therefore, by 1962, project leaders began altering the treatments to evaluate the effect of P and K separately and to gather data in support of soil test calibration research. Mehlich-1 extractable P since 1958 from the P variable plots indicates no correlation with relative seed cotton yield (Figure 5). Relative yield was calculated by dividing the yield on plots 1, 2, 3, and 4 by the yield of plot 9 or 10, a standard rate of N. Relative yields on the control (plot 1) are included

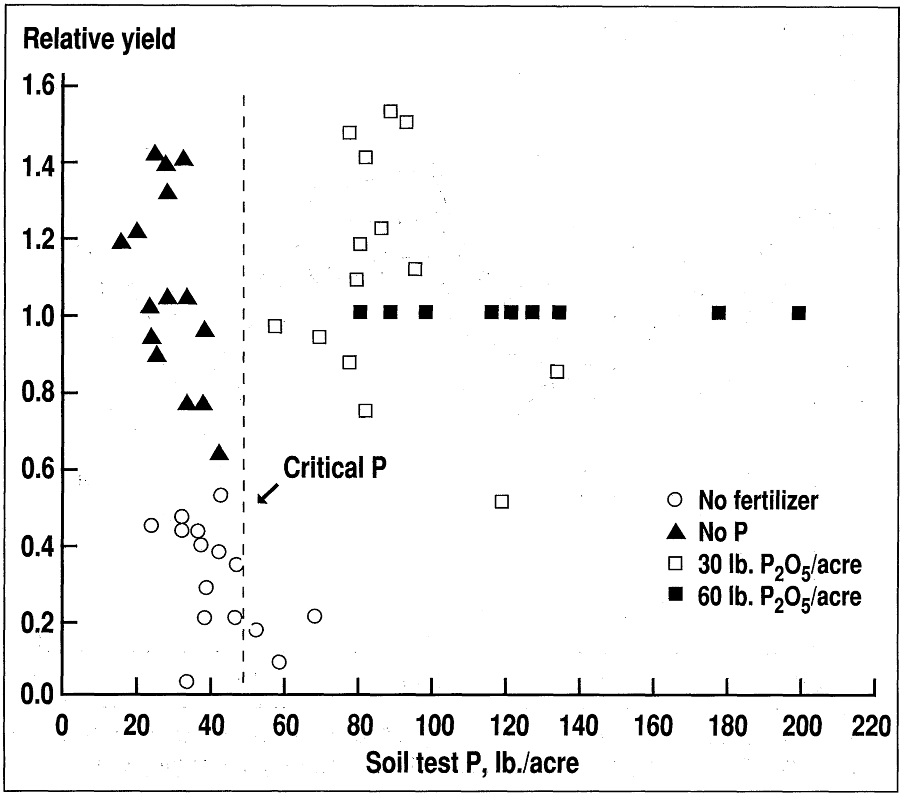

Figure 5. There was no relationship between soil test (extractable) P and relative seed cotton yield even though soil test P on the no P plots (plot 2) was considerably lower than the critical P level used by the Auburn University Soil Testing Laboratory of 50 pounds extractable P per acre. Relative yields are yields on plots 1, 2, 3, or 5 compared to yields on plots 9 or 10 at the same N and K rate.Soil samples were taken following harvest in the same year.

in Figure 5 for comparison only. Since the control plot does not receive any N, P, or K fertilizer, low yields are expected. Current soil test calibration for this soil would suggest applying P fertilizer if extractable P is less than 50 pounds per acre *(2)*. However, Figure 5 suggests that, in fact, a critical soil test P value may be considerably lower than 50. Evans *(4)* has suggested a critical value of 30 pounds per acre extractable P.

Although yields do not indicate a response to soil-applied P fertilizer, the soil test records clearly show a differentiation of soil-test P by long- term treatment (Figure 6). Continuous application of 60 lb P_2O_5 and K_2O increased extractable P and K to very high levels.

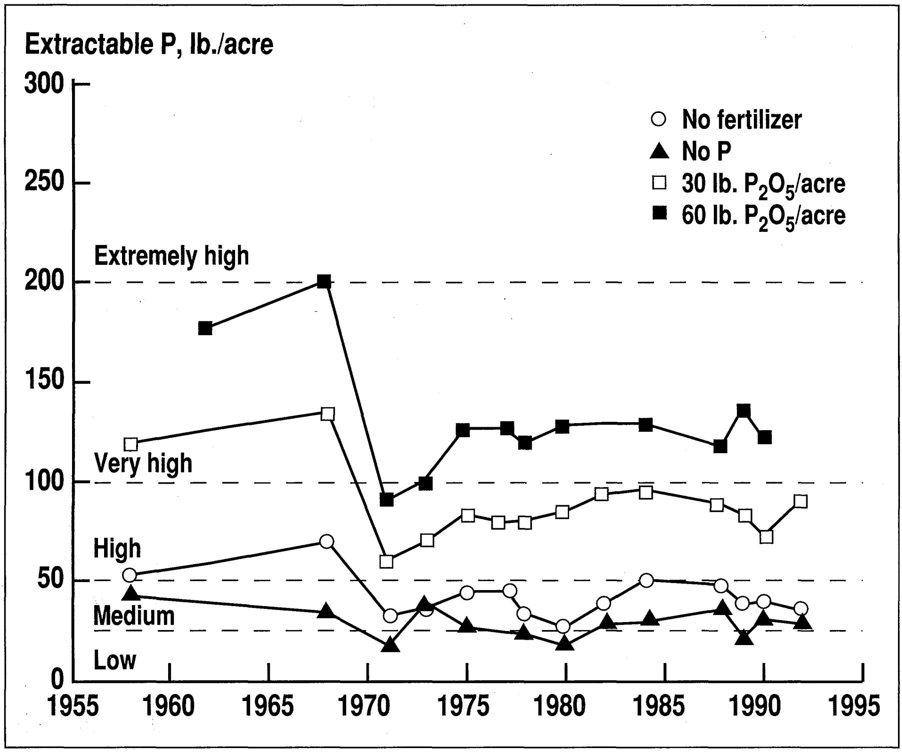

Figure 6. Effect of applied P on soil test (extractable) P compared to existing soil test calibration used in Alabama (2).The sudden decline in extractable P after 1968 cannot be explained but may be related to laboratory methodology which is not documented in the records of this test.

Soil test K versus Relative Yield

Surprisingly, soil test K was only weakly correlated with relative yield (Figure 7). However, the only relative yields below 1.0 are on the plots receiving no K since 1971 or only 30 pounds K_2O per acre per year. Existing soil test calibration for cotton on Lucedale and similar soils with a cation exchange capacity between 4.6 and 9.0 cmol/kg by the Auburn University Soil Testing Laboratory uses 180 pounds extractable K per acre as the critical K value *(2)*. Values above 180 are rated "high" and no additional K fertilizer is recommended. Although no yield increases were found in this test when soil test K was above 180 pounds per acre, soil test K values below this often resulted in yields lower than the plot receiving a complete fertilizer (plot 9 or 10).

As with soil-test P, treatment effects of soil-test K is obvious, increasing with increasing rate of applied K (Figure 8).

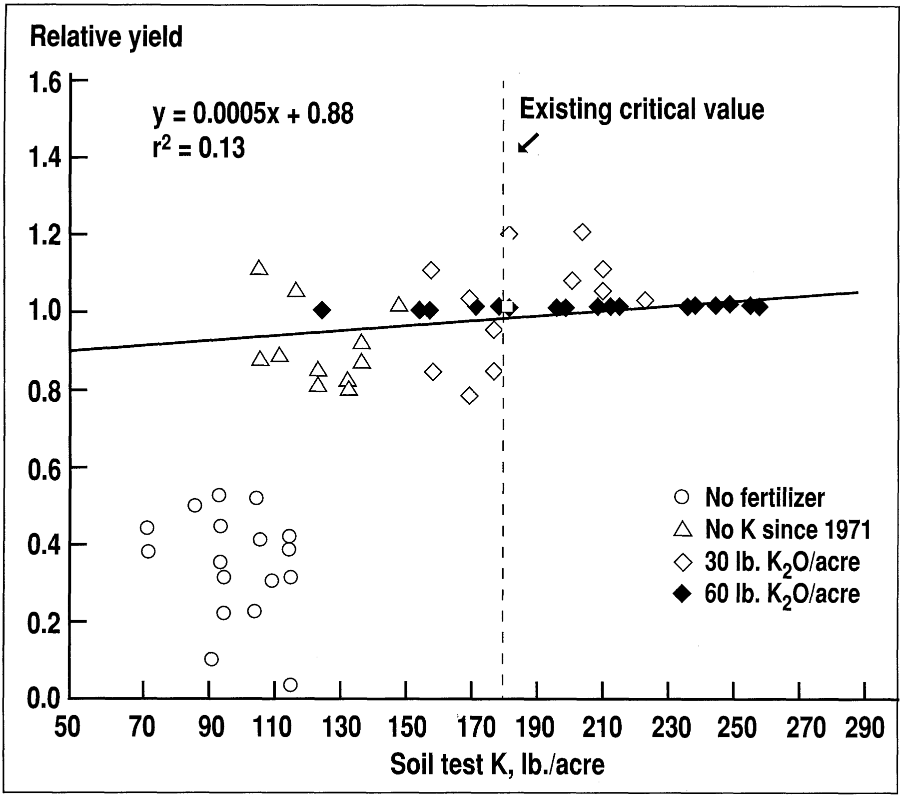

Figure 7. There was only a weak correlation between soil test (extractable) K and relative seed cotton yield on plots 1, 4, and 5 compared to plots 9 or 10 at the same N and P rate. The Auburn University Soil Testing Laboratory uses 180 pounds extractable K per acre as a critical K value for this soil.Soil samples were taken following harvest in the same year.

Soil pH

Soil acidity as measured by soil pH was not a variable in this test. However, soon after the N-rate plots began in 1962, records indicate a problem maintaining a desirable pH on the high N-rate plots, especially where 300 pounds N per acre per year was applied (Figure 9). Ground, dolomitic agricultural lime was applied based on soil and buffer pH *(1)* in an attempt to maintain plow-layer pH in a range of 5.8 to 6.5. Figure 9 indicates that high N rates often resulted in rapid soil acidification and frequent pH values lower than desired in spite of regular liming. In some years, soil acidity may have actually reduced yields at the high N rate when lime was not applied. The standard N recommendation of 90 pounds per acre required 5.0 tons of lime per acre during the 32-year period compared to 15 tons per acre where 300 pounds N per acre per year was applied (Table 4). Interestingly, over the period from 1962 to 1994,

Table 4. Total Lime Applied from 1962 to 1994 on the 12 Plots of the "Rate of Fertilizing Cotton" Test at Prattville.

Plot	Treatment	Total no. of applications	Total lime applied	Total N applied	Lime: N ratio
			Tons/A	*Lb./A*	
1	No fertilizer	1	1.0	0	—
2	No P	5	5.5	3,420	3.2
3	30 lb P_2O_5/acre	5	5.5	3,420	3.2
4	No K	4	5.0	3,420	2.9
5	30 lb K_2O/acre since 1971	4	4.5	3,420	2.6
6	No N	0	0	0	—
7	30 lb N/acre	1	1.0	990	2.8
8	60 lb N/acre	3	3.0	1980	3.4
9	90 lb N/acre	4	5.0	2,970	3.2
10	120 lb N/acre	6	6.5	3,960	3.2
11	150 lb N/acre	8	8.0	4,960	3.2
12	300 lb N/acre	9	15.0	9,900	3.0
					MEAN= 3.1

Table 5. Comparison of Selected Average Seed Cotton Yields from Plots Planted to Solid-Row Cotton and Skip-Row Cotton[1].

Solid planted	Yield	Skip-row planted	Yield
	Lb./acre		*Lb./acre*
Plot 3, 1974-76 (120N)[2]	2,130	Plot 3, 1977-79 (90N)	2,350
Plot 3, 1983-88 (90N)	2,300		
Plot 5, 1974-76 (120N)	2,300	Plot 5, 1977-79 (90N)	2,340
Plot 5, 1983-88 (90N)	2,400	Plot 9, 1983-88 (90N)	2,090
Plots 8,9,10, 1974-76[3]	2,360	Plots 8,9,10, 1977-79[3]	2,320
		Plots 8,9,10, 1983-88[3]	2,180

[1]All plots were in solid cotton before 1977 and skip-row during 1977-1979. Since 1980, plots 1-5 have been in solid cotton and plot 6-12 in skip-row cotton.

[2]Values in parentheses are the annual N rate applied during this period.

[3]Nitrogen rate averaged 90 pounds N/acre during this period.

the test received agricultural lime at the rate of 3.1 pounds lime per pound of N applied as ammonium nitrate. This is within the theoretical equivalent acidity range for ammonium nitrate (6). A value of 3 pounds agricultural lime per pound of N as ammonium nitrate is often recommended as a guide to neutralize the acidifying effects of ammonium nitrate.

Solid versus skip-row planting

The non-replicated treatments, changing varieties, and the complicating N, P, and K variables make statistical analysis of the method of planting cotton (solid versus skip-row) impossible. However, comparing the yield records before skip-row and

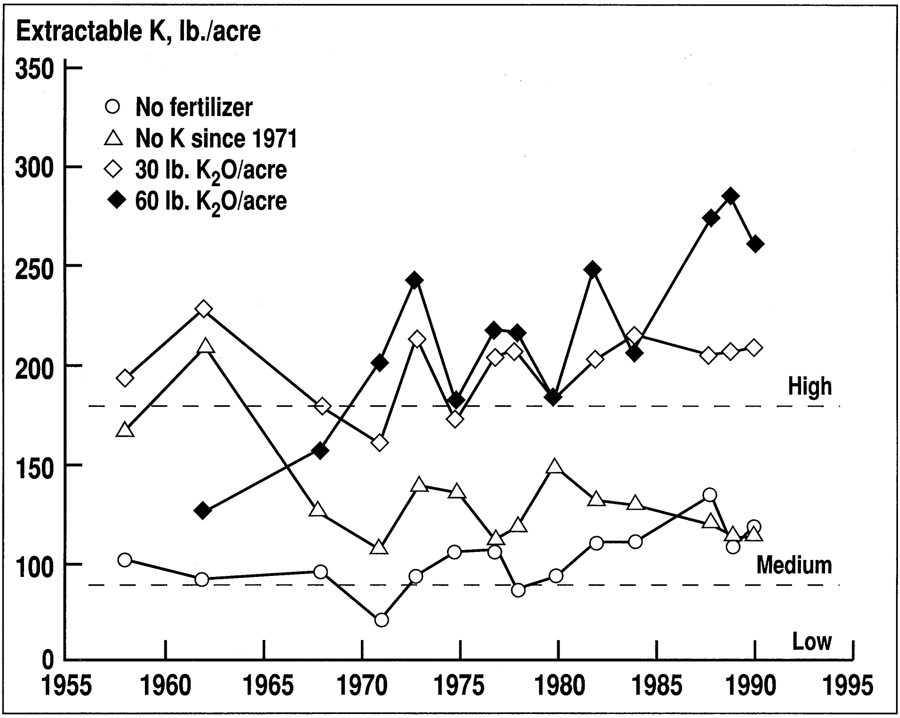

Figure 8. Effect of applied K on soil test (extractable) K compared with existing soil test calibration for soils with a C.E.C. of 4.6 to 9.0 cmol/kg.

after skip row on the same plots and comparing similar plots planted to skip row after 1980 (plots 6-12) with those in solid cotton (plots 1-5), suggests that there is no yield advantage to planting skip-row cotton in this area (Table 5). All yields were calculated on a total area basis, not just planted area. While skip-row planting was popular during the late 1970's and 1980's, many area growers have returned to solid planted cotton. This test served to demonstrate to area growers that method of planting cotton does not affect the recommended N rate.

CONCLUSIONS

Records from the 60-year history of the "Rate of Fertilizing Cotton" test at Prattville have complemented and verified recommended fertilization practices of the Alabama Agricultural Experiment Station and Cooperative Extension Service. Weather and factors other than those studied can overwhelm treatment effects in this test and result in wide fluctuations in annual seed cotton yields. Extremes rarely follow patterns of two consecutive high-yielding years or two consecutive low-yielding years. Nitrogen rates had the most dramatic effects on long-term yields. Nitrogen

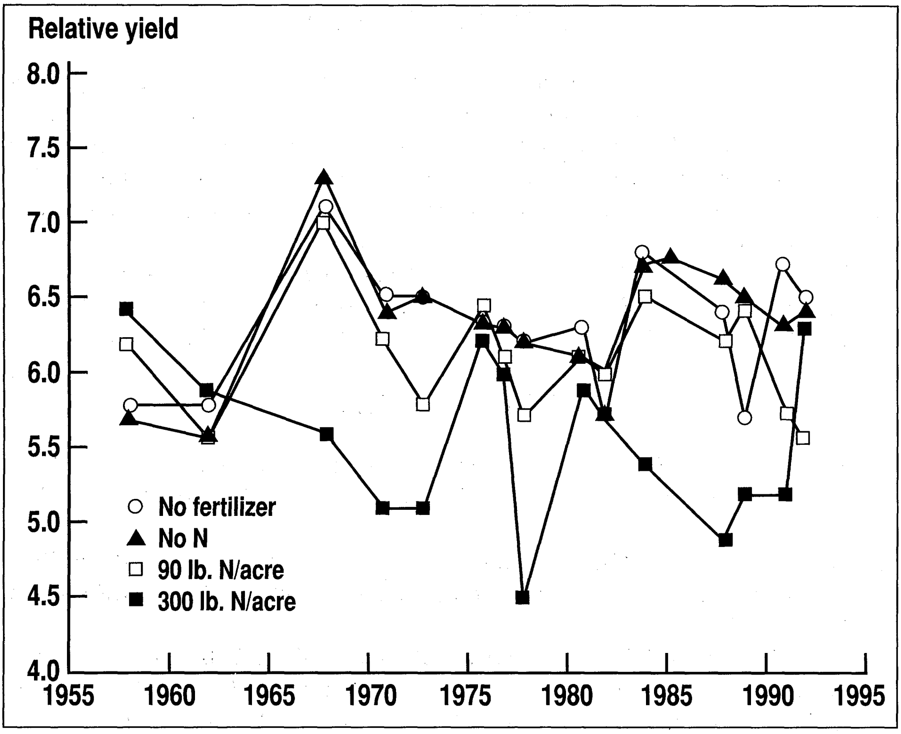

Figure 9. Soil pH tended to drop rapidly and more often in plots receiving high rates of fertilizer N.

rates of 60 to 150 pounds per acre produced maximum yields. There were no long-term yield differences within these rates. Soils required liming at an average rate of 3.1 pounds lime for every pound N applied as ammonium nitrate.

Surprisingly, neither P rates nor soil test P levels influenced long-term yield trends. Mehlich-1 extractable P on the plot receiving no P fertilization since 1936 is below the 50 pounds-per-acre critical value as used by the Auburn University Soil Testing Laboratory. However, long-term seed cotton yields were just as high on this plot as on plots receiving as much as 60 pounds P_2O_5 per acre annually. Yields were weakly correlated with Mehlich-1 extractable K on the plots receiving K variable rates since 1971.

Although the test was not designed for statistical analyses of treatment effects, observations over the years suggest that there is little yield advantage to planting skip-row cotton over a solid-row pattern.

The "Rate of Fertilizing Cotton" test has provided an interesting demonstration in fertilization management for local cotton growers. However, because it was not designed for statistical analysis, scientifically-based conclusions are difficult to make from the confounding variables. This test will not be continued beyond 1994.

ACKNOWLEDGEMENTS

The fact that the "Rate of Fertilizing Cotton" test has been continued for over 60 years is a tribute to the dedication of the superintendents at the Prattville Experiment Field. They realized the need to share their research with local growers through a visible, non-replicated demonstration as well as collect scientific yield data. The following superintendents and project leaders have been responsible for this test:

Superintendents		Project Leaders	
F.E. Bertram	1928-1967	J.T. Williamson	1934-1952
Fred Glaze	1968-1981	J.T. Cope, Jr.	1952 - 1984
Don Moore	1982-present	C.C. Mitchell	1984 - 1994

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APPENDIX

Appendix Table 1. Seed Cotton Yields by Year on Plots of the "Rates of Fertilizing Cotton" Test at Prattville Experiment Field, 1934-1961, in Pounds Per Acre

Plot	1934	1935	1936	1937	1938	1939	1940	1941	1942	1943	1944
1	1,244	1,056	666	666	662	720	540	252	209	472	583
2	1,860	1,508	859	1,111	1,498	1,526	1,195	1,357	1,040	1,436	1,354
3	1,394	1,279	810	975	1,166	1,235	1,138	,303	828	1,145	1,285
4	1,860	1,567	1,057	1,212	1,868	1,912	1,559	1,768	1,235	1,634	1,652
5	1,882	1,747	1,132	1,345	2,268	2,318	1,576	2,329	1,595	2,081	1,818
6	886	868	422	555	716	583	439	425	212	432	587

Plot	1945	1946	1947	1948	1949	1950	1951	1952	1953	1954	1955
1	428	25	216	302	216	313	742	461	367	515	374
2	1,292	115	778	911	1,091	990	1,354	1,116	976	936	1,318
3	1,123	104	569	792	828	900	1,289	965	940	925	1,192
4	1,699	184	918	1,177	1,328	1,411	1,462	1,156	1,148	1,123	1,991
5	1,922	122	1,094	1,282	1,627	1,512	1,314	1,238	1,321	1,040	2,351
6	396	14	148	223	126	256	432	310	169	360	295

Plot	1956	1957	1958	1959	1960	1961 (revised)
1	310	331	396	230	533	245
2	792	871	1,368	918	1,670	1,397
3	929	763	1,123	785	1,397	1,170
4	1,325	972	1,746	1,231	1,951	1,840
5	1,368	1,066	2,171	1,620	2,156	2,221
6	252	209	306	187	446	259

Appendix Table 2. Seed Cotton Yields by Years on Plots of the "Rates of Fertilizing Cotton" Test at the Prattville Experiment Field, 1962-1993 (In Pounds Per Acre)

Plot	1962	1963	1964	1965	1966	1967	1968	1969	1970 (revised)
1	162	missing	missing	292	374	328	641	662	857
2	1,174	data	data	2,743	2,203	1,350	2,221	2,682	2,722
3	1,539			2,963	2,491	2,228	2,477	2,938	2,556
4	1,620			3,020	2,563	2,174	2,390	2,758	2,275
5	1,616			2,945	2,502	2,221	2,369	2,884	2,639
6	369			508	392	511	943	1,130	886
7	1,516			1,724	1,638	1,883	1,922	2,279	1,670
8	1,562			2,408	1,958	2,174	2,563	2,628	2,261
9	1,534			2,851	2,250	2,196	2,887	2,797	2,891
10	1,570			3,028	2,124	1,958	2,830	2,815	2,790
11	1,602			3,026	2,153	1,793	2,578	2,887	2,768
12	1,512			2,765	2,300	1,591	2,437	2,617	2,596

Plot	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981
1	1,530	800	762	993	583	935	978	1,214	1,071	554	942
2	3,625	2,120	1,636	2,568	2,619	1,611	2,324	2,581	2,158	1,065	2,453
3	3,409	2,370	1,640	2,273	2,755	1,352	2,208	2,755	2,079	1,245	2,432
4	3,028	2,300	1,557	2,396	2,014	1,489	2,093	2,535	2,057	1,050	2,165
5	2,905	2,280	1,866	2,885	2,597	1,417	2,525	3,051	2,230	1,252	2,381
6	1,343	730	902	1,504	554	957	964	1,746	1,158	795	1,271
7	2,610	1,740	1,697	2,417	1,611	1,746	2,432	2,717	2,014	1,203	1,966
8	3,316	2,100	1,758	2,950	2,417	1,806	2,626	2,391	2,022	1,068	1,957
9	3,467	2,080	1,712	2,777	2,511	1,806	2,366	2,414	2,000	1,049	1,904
10	3,546	2,040	1,730	2,777	2,525	1,662	2,474	2,520	2,086	1,078	1,971
11	3,722	1,970	1,658	2,741	2,374	1,755	2,582	2,603	2,129	1,160	2,067

Appendix Table 2, Continued. Seed Cotton Yields by Years on Plots of the "Rates of Fertilizing Cotton" Test at the Prattville Experiment Field, 1962-1993 (In Pounds Per Acre)

Plot	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994
1	no yield	496	626	638	406	232	415	307	738	448	70	522	840
2		2,360	3,057	3,407	1,245	2,315	1,684	1,776	2,456	1,859	2,717	1,846	3,520
3		2.496	3,280	3,049	1,178	2,547	1,468	2,074	2,630	2,423	3,144	1,620	3,640
4		2,417	2,806	3,282	1,145	1,883	1,435	1,767	2,614	2,398	3,109	1,533	3,480
5		2,345	3,518	3,796	1,245	1,950	1,568	2,000	2,779	2,008	3,057	1,463	3,860
6		897	1,156	1,328	697	1,325	940	1,045	1,007	631	865	854	1,070
7		1,611	1,986	2,433	1,029	1,770	1,289	1,610	1,742	1,123	1,673	1,423	2,020
8		1,559	2,451	3,955	1,001	1,737	1,438	1,604	1,676	1,504	2,114	1,284	2,780
9		1,655	2,921	4,259	913	1,593	1,189	1,460	1,770	1,433	1,998	1,330	2,580
10		1,482	3,122	4,259	979	1,676	1,195	1,610	1,726	1,554	2,050	1,284	2,380
11		1,439	3,151	4,314	1,134	1,471	1,162	1,455	1,742	1,361	1,922	1,475	2,980
12		1,583	3,180	4,135	1,173	1,632	929	819	1,184	1,333	1,800	1,376	2,710

Appendix Table 3. Analyses of the Youngest, Mature, Cotton Leaf Blades Taken at Early Bloom on 16 July 1991.

Plot	N	P	K	Mg	Ca	Mn	Zn	B
	Pct.	*Pct.*	*Pct.*	*Pct.*	*Pct.*	*mg/kg*	*mg/kg*	*mg/kg*
1	3.40	0.64	0.88	0.43	2.03	10	328	39
2	4.64	0.50	1.12	0.44	1.89	72	28	43
3	5.26	0.52	1.09	0.40	1.97	90	28	46
4	5.00	0.53	1.06	0.56	2.48	90	26	36
5	4.87	0.50	1.07	0.39	1.96	69	25	55
6	4.06	0.36	1.26	0.36	2.53	153	29	42
7	4.33	0.53	1.08	0.30	1.93	84	29	36
8	4.74	0.50	1.15	0.39	2.37	97	27	48
9	5.21	0.49	1.29	0.43	2.34	83	30	50
10	5.22	0.54	1.30	0.47	2.42	78	27	53
11	5.17	0.57	1.25	0.47	2.12	61	60	49
12	5.30	0.47	1.25	0.52	2.15	150	25	52
Sufficiency range*	3.50-4.50	0.30-0.50	1.50-3.00	0.30-0.90	2.00-3.00	25-350	20-200	20-60

*Plank, C.O. 1988. Plant analysis handbook for Georgia. Georgia Coop. Extension Service. Athens, GA.

Alabama's Agricultural Experiment Station System
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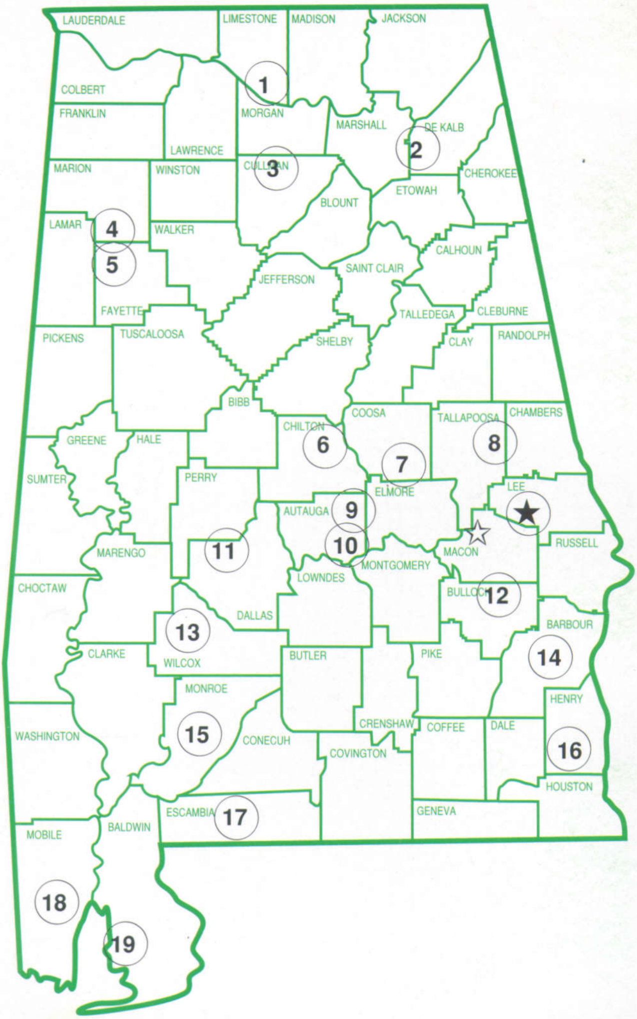
With an agricultural research unit in every major soil area, Auburn University serves the needs of field crop, livestock, forestry, and horticultural producers in each region in Alabama. Every citizen of the state has a stake in this research program, since any advantage from new and more economical ways of producing and handling farm products directly benefits the consuming public.



Research Unit Identification

★ Main Agricultural Experiment Station, Auburn.

☆ E. V. Smith Research Center, Shorter.

1. Tennessee Valley Substation, Belle Mina.
2. Sand Mountain Substation, Crossville.
3. North Alabama Horticulture Substation, Cullman.
4. Upper Coastal Plain Substation, Winfield.
5. Forestry Unit, Fayette County.
6. Chilton Area Horticulture Substation, Clanton.
7. Forestry Unit, Coosa County.
8. Piedmont Substation, Camp Hill.
9. Foresty Unit, Autauga County.
10. Prattville Experiment Field, Prattville.
11. Black Belt Substation, Marion Junction.
12. The Turnipseed-Ikenberry Place, Union Springs.
13. Lower Coastal Plain Substation, Camden.
14. Forestry Unit, Barbour County.
15. Monroeville Experiment Field, Monroeville.
16. Wiregrass Substation, Headland.
17. Brewton Experiment Field, Brewton.
18. Ornamental Horticulture Substation, Spring Hill.
19. Gulf Coast Substation, Fairhope.