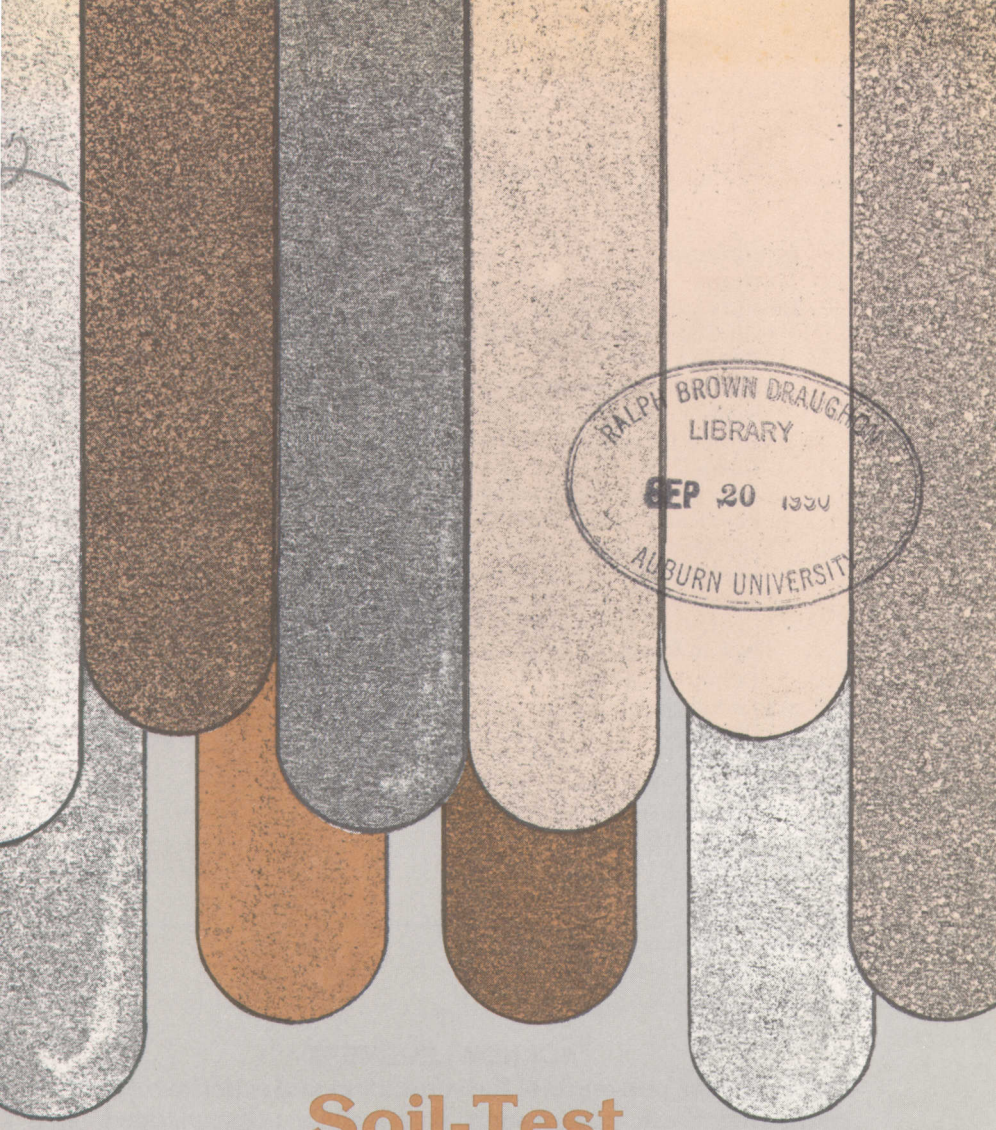



# Soil-Test Evaluation Experiments at 10 Alabama Locations 1977-1982

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## ACKNOWLEDGMENT

Cooperation of personnel of the substations and experiment fields in conducting these experiments is gratefully acknowledged. This publication is dedicated to the memory of Roy G. Rogers, who as a graduate student managed these experiments from 1977 through 1980.

# SOIL-TEST EVALUATION EXPERIMENTS AT 10 ALABAMA LOCATIONS 1977-1982

J.T. COPE[1]

## INTRODUCTION

PRIOR TO 1970, the Auburn University Soil Testing Laboratory recommended moderate amounts of phosphorus (P) and potassium (K) for all crops at *High* soil-test levels. This recommendation of 20 to 40 pounds per acre of $P_2O_5$ and $K_2O$ was considered a maintenance application to maintain the desirable *High* level in the soil. However, considerable research on experiment stations and on farmers' fields showed that when soil test levels were *High*, crops seldom showed any response to direct applications of P or K. Once soils had been built up to *High* levels, they changed slowly after applications were discontinued. Therefore, in 1970, the *Very High* level was established and P and K recommendations were discontinued at this level.

After additional research on residual effects of P and K, fertilizer recommendations were revised again in 1976 and the recommendation of P and K at *High* levels was also discontinued for most agronomic crops. Soil-test summaries showed that more than 40 percent of all samples received in Auburn's soil testing laboratory for agronomic crops were *High* in P and about the same percentage were *High* in K. This policy was adopted to encourage farmers to benefit from the buildup of P and K resulting from many years of continuous application of high rates of fertilizer.

Following this change in policy, research efforts were increased to obtain additional information on residual effects of applied fertilizers to determine if the policy of not recommending P and K at *High* levels should be continued or if maintenance recommendations should be resumed.

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## METHODS

In 1977, soil-test evaluation experiments were started on eight Experiment Station field units to determine if current recommendations based on soil tests were dependable. Two other locations were added in 1978. Experiments were located on sites which were considered the most likely of those available to show response to P or K at each station. Due to the age of the research units, most of which were established in 1928, sites were either *High* or *Medium* in both P and K due to past fertilization, table 1. Soil samples were used to determine original soil test levels and to select suitable sites.

Two-year rotations with both crops grown each year were used. Crops were corn-soybeans at eight locations, cotton-soybeans at two locations, and corn-peanuts at the Wiregrass Substation. Plots were 6 rows, 46 feet long with three replications of both crops. Objectives of the experiments were to:

1. Evaluate P and K recommendations based on soil tests.
2. Compare annual applications of P and K with biennial applications.
3. Compare row-placed with broadcast fertilizers for corn and cotton.
4. Determine effects of rates applied on soil-test levels of P and K.

Recommended varieties, spacing, cultural practices, and rates of nitrogen, boron, zinc, sulfur, and lime were used at each location. Soil samples were taken from all plots in the fall every other year to determine effects of the different fertilizer rates on soil-test levels. Average annual rates of $P_2O_5$ and $K_2O$ used were 0, 20, 40, and 60 pounds per acre in most cases.

Experiments were continued on the same plots from 1977 or 1978 through 1981 or 1982. Yields and soil-test data are presented and discussed by location. Serious drought was encountered during some years at most locations. Data from years when average yields at a location were less than 40 bushels of corn or 15 bushels of soybeans are not included in most cases. Such experiments are usually too variable to be reliable indicators of response to fertilizers.

Yield data were analyzed by analysis of variance. Yields are presented by years and average of all years shown for all eight treatments. Coefficients of variation (CV) shown for each experiment are an indication of the uncontrolled variables or error in each experiment. Values of less than 10 percent CV usually indicate good data while CVs of more than 20 percent make accurate evaluation of the yield data difficult in most cases. The letters NS indicate that

TABLE 1. LOCATION, CROP ROTATION, ORIGINAL SOIL-TEST VALUES, SOIL GROUPS, AND SOIL CLASSIFICATION OF SOILS USED IN SOIL TEST EVALUATION EXPERIMENTS, 1977-82

| Location | Crop rotation | Original soil-test values | | | | Soil group[1] | Soil series |
|---|---|---|---|---|---|---|---|
| | | pH | P | K | CEC | | |
| | | | | | meq/100g | | |
| Gulf Coast Substation | Corn-soybean | 6.1 | H | M | 5 | 2 | Malbis fsl |
| Monroeville Experiment Field | Corn-soybean | 5.7 | H | H | 8 | 2 | Lucedale fsl |
| Brewton Experiment Field | Corn-soybean | 5.6 | H | M | 3 | 1 | Benndale fsl |
| Lower Coastal Plain Substation | Corn-soybean | 5.8 | L | M | 6 | 2 | Cahaba fsl |
| Sand Mountain Substation | Corn-soybean | 5.8 | M | M | 6 | 2 | Hartsells fsl |
| Upper Coastal Plain Substation | Corn-soybean | 6.4 | M | H | 8 | 2 | Savannah scl |
| Wiregrass Substation | Corn-soybean | 6.4 | H | H | 4 | 1 | Dothan fsl |
| Prattville Experiment Field | Cotton-soybean | 5.9 | H | H | 8 | 2 | Lucedale scl |
| Tennessee Valley Substation | Cotton-soybean | 6.0 | M | M | 12 | 3 | Decatur sil |
| Black Belt Substation | Corn-soybean | 5.5 | L | H | 25 | 4 | Vaiden c |

[1]Based on CEC
Group 1: CEC $\leq$ 5
Group 2: CEC = 5-10
Group 3: CEC $\geq$ 10
Group 4: acid and calcareous soils of the Black Belt, CEC > 15.

differences between treatments in a column were not statistically different at the 10 percent level. Where significant differences were found, they are indicated by different letters (a, b, c) for treatments that were different. Where no letters are shown, yields were not different from any others in the column. The LSD (least significant difference) indicates the number of bushels or pounds per acre required for a difference between two yield values in a column to be significant at the 10 percent probability level.

Original soil-test levels of P and K and results of subsequent samplings of the six replications of the no-P and no-K plots are reported in the tables. Data from the most recent sampling show soil-test levels after about 5 years of average annual applications of 40 and 60 pounds per acre of both $P_2O_5$ and $K_2O$. Soil-test data show both the pounds per acre of P and K extracted by the Mehlich I extractant and the fertility index as used by the Auburn University Soil Testing Laboratory. These index values are percent sufficiency and are adjusted for soil type. Fertility ratings indicated are those used for corn, soybeans, or peanuts. *(3)*

The locations, crop rotations, original soil-test values, pH, cation

TABLE 2. FERTILIZER TREATMENTS USED IN SOIL-TEST EVALUATION EXPERIMENTS EXPRESSED IN POUNDS PER ACRE OF N, $P_2O_5$, AND $K_2O$

| Treatment no. | Variable | Corn[1] | Soybeans or peanuts | Cotton | Soybeans |
|---|---|---|---|---|---|
| 1 | Standard | 40- 40- 40 | 0- 0- 0 | 80- 80- 80 | 0- 0- 0 |
| 2[2] | Drilled | 40- 40- 40 | 0- 0- 0 | 80- 40- 40 | 0-40-40 |
| 3 | P and K to soybeans | 40- 0- 0 | 0-40-40 | 80- 0- 0 | 0-80-80 |
| 4 | No P | 40- 0- 40 | 0- 0- 0 | 80- 0- 80 | 0- 0- 0 |
| 5 | No K | 40- 40- 0 | 0- 0- 0 | 80- 80- 0 | 0- 0- 0 |
| 6 | P and K both crops | 40- 40- 40 | 0 40-40 | 80- 40- 40 | 0-40-40 |
| 7[3] | Double PK | 40- 80- 80 | 0- 0- 0 | 80- 40- 40 | 0- 0- 0 |
| 8[3] | Triple PK | 40-120-120 | 0- 0- 0 | 80-120-120 | 0- 0- 0 |

[1]Plots received 80 pounds nitrogen per acre sidedressed when in corn.
[2]Treatment 2 was drilled in the corn-soybean or peanut rotation. In the cotton-soybean rotation, treatment 2 was drilled and received one-half of the N (40 pounds nitrogen per acre) sidedressed.
[3]Treatment 7 was the ½ PK rate and treatment 8 was the 1½ PK rate in the cotton-soybean rotation.

exchange capacities (CEC), soil group, and soil series are listed in table 1. Treatments used for the two rotations are presented in table 2. Rates of N, $P_2O_5$, and $K_2O$ shown were broadcast prior to planting except for treatment No. 2, where fertilizer was applied and mixed with soil in the row or placed beside the row at planting.

## RESULTS AND DISCUSSION

Yield and soil test data are presented and discussed for each location, beginning with the corn-soybean rotations. Since yield responses to P or K were seldom found, discussions of yield differences are brief. More emphasis is placed on the soil-test values and on fertilizer recommendations.

### Gulf Coast Substation, Malbis Fine Sandy Loam, Tables 3 and 4

Average corn yields for 5 years, 1978 through 1982, were 118 bushels per acre. No response to P was found in any year although soil test P was originally H110 in 1978 and decreased slightly to M90 by 1982. Yield responses to 40 pounds per acre $K_2O$ were found on corn in 1978, 1981, and 1982, and in the 5-year average as was expected at the soil test K level of M80, which remained constant for 5 years on the untreated plots. The yield increase from 40 pounds per acre of $K_2O$ was about 12 bushels per acre with no further increase from the higher rates. Soil test P and K were increased slightly by the 40 and 60 pounds per acre rates of both nutrients. Placing fertilizer in the drill for corn increased yield in 3 of the 5 years and was the highest yielding treatment in the 5-year average.

TABLE 3. RESPONSE TO P AND K BY CORN AND SOYBEANS AT THE GULF COAST SUBSTATION, 1977-82

| Treatment | Corn yield/acre | | | | | | | Soybean yield/acre | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1977 | 1978 | 1979 | 1980 | 1981 | 1982 | 5-yr. av. | 1977 | 1978 | 1979 | 1980 | 1981 | 1982 | 5-yr. av. |
| | | *Bu.* | *Bu.* | *Bu.* | *Bu.* | *Bu.* | *Bu.* | *Bu.* | *Bu.* | *Bu.* | *Bu.* | *Bu.* | *Bu.* | *Bu.* |
| 1 Standard[1] | | 110 | 175 | 81 | 120 | 90 | 115 | 50 | 44b | 27 | | 32 | 39 | 38 |
| 2 Drilled | D | 129a[2] | 167 | 83 | 125a | 118a | 125a | 52 | 48a | 30 | D | 29 | 41 | 40a |
| 3 PK soybean | R | 105b | 166 | 81 | 116b | 107 | 115 | 52 | 47 | 30 | R | 31 | 37b | 39 |
| 4 No P | O | 121 | 169 | 82 | 121 | 108 | 120 | 51 | 46 | 30 | O | 28 | 38 | 39 |
| 5 No K | U | 108b | 171 | 81 | 113b | 84b | 111b | 52 | 41b | 28 | U | 29 | 39 | 38b |
| 6 PK both crops | G | 105b | 162b | 84 | 118 | 105 | 115 | 53 | 46 | 28 | G | 32 | 42a | 40a |
| 7 Double PK | H | 106b | 179a | 87 | 114b | 123a | 122 | 52 | 48a | 30 | H | 31 | 39 | 40a |
| 8 Triple PK | T | 124 | 170 | 86 | 123 | 115a | 123a | 53 | 47 | 30 | T | 29 | 41 | 40a |
| CV (%) | | 12 | 7 | 13 | 5 | 18 | 11 | 9 | 6 | 9 | | 9 | 6 | 8 |
| LSD 10% | | 19 | 17 | NS | 8 | 28 | 8 | NS | 4 | NS | | NS | 3 | 2 |

[1]The standard treatment was 40-40-40 plus 80N broadcast for corn with no fertilizer for soybeans.
[2]Values in a column followed by different letters are statistically different at the 10 percent level.

TABLE 4. SOIL-TEST P AND K AT THE GULF COAST SUBSTATION, 1978-82

| Treatment | Applied annually | Soil test | | | | | |
|---|---|---|---|---|---|---|---|
| | | Jan. 1978 | | Nov. 1979 | | Nov. 1982 | |
| | | *Lb./acre* | *Index* | *Lb./acre* | *Index* | *Lb./acre* | *Index* |
| | | | | **Phosphorus** | | | |
| 4 | No P | 57 | H110 | 48 | M100 | 43 | M 90 |
| 6 | 40 $P_2O_5$ | - | - | - | - | 52 | H110 |
| 8 | 60 $P_2O_5$ | - | - | - | - | 67 | H130 |
| | | | | **Potassium** | | | |
| 5 | No K | 112 | M 80 | 97 | M 80 | 114 | M 80 |
| 6 | 40 $K_2O$ | - | - | - | - | 130 | H 90 |
| 8 | 60 $K_2O$ | - | - | - | - | 138 | H 90 |

Soybean yields averaged 39 bushels per acre for the 5 years. They averaged less than 15 bushels per acre in 1980 due to dry weather. No response to P was found in any year. Response to K was produced only in 1978 when top yields were 48 bushels. Average yield of all treatments for the 5 years was from 38 to 40 bushels, with an average increase of 2 bushels per acre from 40 pounds per acre $K_2O$ applied to corn and no further increase from the double and triple rates.

Fertilizer recommendations for this soil would have been 80 pounds per acre of $P_2O_5$ and $K_2O$ for each 2-year rotation at medium-medium P and K. The data show that this would have been adequate to produce top yields and to maintain or increase the level of both nutrients to *High* during the 6 years.

### Monroeville Experiment Field, Lucedale Fine Sandy Loam, Tables 5 and 6

Corn yields on this red, fine sandy loam soil averaged 78 bushels per acre in 5 of the 6 years; soybeans averaged 33 bushels for the 6 years. The soil was H130 in P and H90 in K in April 1977. Soil-test P dropped to M90 by November 1981, and response to P was found in 1982 for the first time. The soil-test K level remained constant at H90 without addition of K for 5 years and was increased to H100 and H110 by 40 and 60 pounds per acre, respectively. Neither crop showed a yield response to K in any year or in the average. The data show that the soil test recommendation of "no P or K" would have been adequate for the first 5 years. Since the P level had dropped to M90 by 1982, the recommendation would have been that 80 pounds per acre of $P_2O_5$ be applied to corn ahead of soybeans, which would not be fertilized. This produced a response of about 12 bushels per acre on corn in 1982 and would begin to rebuild the P level to *High*. Since the K level remained constant without fertilizer addition for 5

TABLE 5. RESPONSE TO P AND K BY CORN AND SOYBEANS ON THE MONROEVILLE EXPERIMENT FIELD, 1977-82

| Treatment | Corn yield/acre | | | | | | | Soybean yield/acre | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1977 | 1978 | 1979 | 1980 | 1981 | 1982 | 5-yr. av. | 1977 | 1978 | 1979 | 1980 | 1981 | 1982 | 6-yr. av. |
| | *Bu.* | *Bu.* | *Bu.* | *Bu.* | *Bu.* | *Bu.* | *Bu.* | *Bu.* | *Bu.* | *Bu.* | *Bu.* | *Bu.* | *Bu.* | *Bu.* |
| 1 Standard[1] | 62 | 65 | | 74 | 91 | 96a[2] | 78 | 43 | 29 | 36 | 29 | 35 | 21 | 32 |
| 2 Drilled | 66 | 66 | D | 72 | 91 | 88 | 77 | 44 | 29 | 39 | 28 | 40a | 20 | 33 |
| 3 PK soybean | 67 | 68 | R | 70 | 94 | 93a | 78 | 45a | 28 | 37 | 29 | 37 | 20 | 33 |
| 4 No P | 67 | 69 | O | 74 | 93 | 77b | 77 | 42 | 27 | 39 | 31 | 37 | 20 | 33 |
| 5 No K | 60 | 66 | U | 67 | 96 | 89 | 76 | 44 | 27 | 39 | 31 | 36 | 19 | 33 |
| 6 PK both crops | 67 | 72 | G | 71 | 97 | 93a | 80 | 44 | 29 | 40 | 32 | 37 | 19 | 34 |
| 7 Double PK | 62 | 70 | H | 78 | 104 | 81 | 79 | 40b | 26 | 37 | 33 | 34b | 18 | 31 |
| 8 Triple PK | 70 | 67 | T | 69 | 100 | 89 | 79 | 46a | 25 | 38 | 29 | 37 | 19 | 32 |
| CV (%) | 11 | 8 | | 13 | 15 | 12 | 13 | 7 | 22 | 8 | 11 | 8 | 13 | 11 |
| LSD | NS | NS | | NS | NS | 15 | NS | 4 | NS8 | NS | NS | 4 | NS | NS |

[1]The standard treatment was 40-40-40 plus 80N broadcast for corn with no fertilizer for soybeans.
[2]Values in a column followed by different letters are statistically different at the 5 percent level.

TABLE 6. SOIL-TEST P AND K AT THE MONROEVILLE EXPERIMENT FIELD, 1977-81

| Treatment | Applied annually | Soil test | | | | | |
|---|---|---|---|---|---|---|---|
| | | Apr. 1977 | | Nov. 1979 | | Nov. 1981 | |
| | | *Lb./acre* | *Index* | *Lb./acre* | *Index* | *Lb./acre* | *Index* |
| | | | | **Phosphorus** | | | |
| 4 | No P | 66 | H130 | 55 | H120 | 42 | M 90 |
| 6 | 40 $P_2O_5$ | - | - | - | - | 67 | H140 |
| 8 | 60 $P_2O_5$ | - | - | - | - | 78 | H160 |
| | | | | **Potassium** | | | |
| 5 | No K | 149 | H 90 | 148 | H 90 | 146 | H 90 |
| 6 | 40 $K_2O$ | - | - | - | - | 162 | H100 |
| 8 | 60 $K_2O$ | - | - | - | - | 192 | H110 |

years, it shows this soil has the capacity to supply considerable K for growing crops. It would be expected to need K at some point; thus, when not fertilized with $K_2O$, it should be sampled annually to prevent loss in yield in case the level drops into the *Medium* range.

## Brewton Experiment Field, Benndale Fine Sandy Loam, Tables 7 and 8

This experiment was on a deep, sandy soil with little clay in the surface 18 inches. The original site was H140 in P and M80 in K and was expected to respond to K on both corn and soybeans. Corn yields averaged less than 40 bushels per acre due to drought in 3 of 6 years from 1977 through 1982. Responses of about 15 bushels per acre to both P and K were found on corn in the 1978-79 averages. Soybeans did not respond to P or K in the first 3 years. The experiment was moved in 1980 to a nearby rented area on the same soil type. The new site was M80 in P and M70 in K and was anticipated to produce more response to both nutrients.

Yields of both crops were unsatisfactory because of a drought in 1980. In 1981, corn yields averaged 62 bushels. The no-K treatment produced only 51 bushels, indicating a response to K although it was not statistically significant because of variability in the experiment, as indicated by a CV of 22 percent. Soybeans did not respond to P or K at either site, although yields averaged 37 bushels in the 5 years reported.

Soil test levels showed little change in P or K at either site after 2 or 3 years. The data on this sandy soil indicate that recommendations based on soil tests would have been adequate for these crops and would have maintained or increased fertility at both sites.

TABLE 7. RESPONSE TO P AND K BY CORN AND SOYBEANS AT THE BREWTON EXPERIMENT FIELD, 1977-82

| Treatment | Corn yield/acre | | | | | | | Soybean yield/acre | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1977 | 1978 | 1979 | 2-yr. av. | 1980[1] | 1981 | 1982 | 1977 | 1978 | 1979 | 1980[1] | 1981 | 1982 | 5-yr. av. |
| | *Bu.* | *Bu.* | *Bu.* | *Bu.* | *Bu.* | *Bu.* | *Bu.* | *Bu.* | *Bu.* | *Bu.* | *Bu.* | *Bu.* | *Bu.* | *Bu.* |
| 1 Standard[2] | | 102 | 83 | 93 | | 65 | | 52 | 40 | 41 | | 28 | 31 | 38 |
| 2 Drilled | D | 119 | 86 | 102a[3] | D | 73 | D | 51 | 37 | 43 | D | 29 | 28 | 37 |
| 3 PK soybean | R | 123 | 81 | 102a | R | 55 | R | 52 | 40 | 41 | R | 21 | 30 | 37 |
| 4 No P | O | 104 | 69 | 87b | O | 70 | O | 48 | 39 | 37 | O | 27 | 30 | 36 |
| 5 No K | U | 103 | 71 | 87b | U | 51 | U | 47 | 39 | 36 | U | 28 | 32 | 36 |
| 6 PK both crops | G | 119 | 80 | 100 | G | 61 | G | 47 | 41 | 41 | G | 29 | 33 | 38 |
| 7 Double PK | H | 114 | 81 | 97 | H | 64 | H | 50 | 38 | 43 | H | 29 | 28 | 38 |
| 8 Triple PK | T | 118 | 84 | 101 | T | 70 | T | 47 | 39 | 36 | T | 31 | 33 | 37 |
| CV (%) | | 14 | 17 | 15 | | 22 | | 7 | 8 | 16 | | 20 | 30 | 13 |
| LSD 10% | | NS | NS | 14 | | NS | | NS | NS | NS | | NS | NS | NS |

[1]Site was changed in 1980.
[2]The standard treatment was 40-40-40 plus 80 N broadcast for corn with no fertilizer for soybeans.
[3]Values in a column followed by different letters are statistically different at the 10 percent level.

TABLE 8. SOIL-TEST P AND K AT THE BREWTON EXPERIMENT FIELD, 1977-81

| Treatment | Applied annually | Soil test | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | May 1977 | | Dec. 1978 | | Nov. 1979 | | Dec. 1980[1] | | Nov. 1981 | |
| | | *Lb./acre* | *Index* | *Lb./acre* | *Index* | *Lb./acre* | *Index* | *Lb./acre* | *Index* | *Lb./acre* | *Index* |
| | | | | | | **Phosphorus** | | | | | |
| 4 | No P | 68 | H140 | 60 | H120 | 62 | H120 | 34 | M 80 | 40 | M 90 |
| 6 | 40 $P_2O_5$ | - | - | - | - | 74 | H150 | - | - | 50 | H110 |
| 8 | 60 $P_2O_5$ | - | - | - | - | 83 | H170 | - | - | 71 | H140 |
| | | | | | | **Potassium** | | | | | |
| 5 | No K | 78 | M 80 | 85 | H 90 | 70 | M 80 | 43 | M 70 | 39 | L 60 |
| 6 | 40 $K_2O$ | - | - | - | - | 86 | H 90 | - | - | 76 | M 80 |
| 8 | 60 $K_2O$ | - | - | - | - | 89 | H 90 | - | - | 84 | H 90 |

[1]Site was changed in 1980.

TABLE 9. RESPONSE TO P AND K BY CORN AND SOYBEANS AT THE LOWER COASTAL PLAIN SUBSTATION, 1978-82

| Treatment | Corn yield/acre | | | | | | Soybean yield/acre | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1978 | 1979 | 1980 | 1981 | 1982 | 3-yr. av. | 1978 | 1979 | 1980 | 1981 | 1982 | 2-yr. av. |
| | *Bu.* | *Bu.* | *Bu.* | *Bu.* | *Bu.* | *Bu.* | *Bu.* | *Bu.* | *Bu.* | *Bu.* | *Bu.* | *Bu.* |
| 1 Standard[1] | | 102 | | 79 | 66 | 82 | | 45 | | 16 | | 30 |
| 2 Drilled | D | 94 | D | 80 | 70 | 81 | D | 41 | D | 17 | D | 29 |
| 3 PK soybean | R | 108 | R | 86 | 77a[2] | 90a | R | 42 | R | 16 | R | 29 |
| 4 No P | O | 99 | O | 77 | 59b | 78b | O | 42 | O | 16 | O | 29 |
| 5 No K | U | 104 | U | 89 | 67 | 87 | U | 43 | U | 15 | U | 29 |
| 6 PK both crops | G | 99 | G | 77 | 67 | 81 | G | 43 | G | 18 | G | 30 |
| 7 Double PK | H | 103 | H | 93 | 64b | 87 | H | 45 | H | 18 | H | 31 |
| 8 Triple PK | T | 98 | T | 90 | 75a | 89 | T | 42 | T | 17 | T | 30 |
| CV (%) | | 11 | | 17 | 11 | 13 | | 5 | | 15 | | 8 |
| LSD 10% | | NS | | NS | 11 | 9 | | NS | | NS | | NS |

[1]The standard treatment was 40-40-40 plus 80 N broadcast for corn with no fertilizer for soybeans.
[2]Values in a column followed by different letters are statistically different at the 10 percent level.

## Lower Coastal Plain Substation, Cahaba Fine Sandy Loam, Tables 9 and 10

This experiment was started in 1978 at Camden, and usable yields were produced only 3 years on corn and 2 years on soybeans through 1982. The P level in the soil was L70, and a response to P of 5 to 10 bushels per acre of corn was found in the 3-year average. Corn showed no response to K at M80 and soybeans did not respond to P or K. The P soil-test level dropped from L70 to L60 while the K level remained constant on the no-$K_2O$ plots at M80 throughout the 5 years.

The data show that recommendations based on soil tests would have been more than adequate for yields of both crops. Rates of P applied did not increase the original level in this soil. Levels of K were increased to H90 and H100 by the 40 and 60 pounds per acre $K_2O$ rates, respectively.

TABLE 10. SOIL-TEST P AND K AT THE LOWER COASTAL PLAIN SUBSTATION, 1977-82

| Treatment | Applied annually | Soil test | | | | | |
|---|---|---|---|---|---|---|---|
| | | May 1977 | | Nov. 1979 | | Feb. 1982 | |
| | | *Lb./acre* | *Index* | *Lb./acre* | *Index* | *Lb./acre* | *Index* |
| | | | | **Phosphorus** | | | |
| 4 | No P | 22 | L 70 | 14 | L 60 | 16 | L 60 |
| 6 | 40 $P_2O_5$ | - | - | - | - | 18 | L 60 |
| 8 | 60 $P_2O_5$ | - | - | - | - | 24 | L 70 |
| | | | | **Potassium** | | | |
| 5 | No K | 120 | M 80 | 110 | M 80 | 117 | M 80 |
| 6 | 40 $K_2O$ | - | - | - | - | 150 | H 90 |
| 8 | 60 $K_2O$ | - | - | - | - | 176 | H100 |

## Sand Mountain Substation, Hartsells Fine Sandy Loam, Tables 11 and 12

This gray sandy loam soil is normally one of the most productive and most responsive to fertilizer of all soils in the State. Corn yields since 1977 in this experiment have been disappointing, averaging only 72 bushels per acre. Soybean yields averaged 40 bushels per acre. This soil was *Medium* in both P and K when sampled after the first crop in 1977. Both P and K remained about the same where none was applied through 1981. They were increased to *High* by average annual applications of 40 pounds per acre of $P_2O_5$ and $K_2O$.

Yields of corn and soybeans showed no consistent differences among treatments. The 4-year averages showed no differences due to fertilizer treatment on either crop. The lack of response to P and K at these *Medium* levels was unexpected, since this soil has been found to respond to both nutrients in other long-term experiments.

TABLE 11. RESPONSE TO P AND K BY CORN AND SOYBEANS AT THE SAND MOUNTAIN SUBSTATION, 1977-82

| Treatment | Corn yield/acre | | | | | | Soybean yield/acre | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1977 | 1978 | 1979 | 1980 | 1981 | 4-yr. av. | 1977 | 1978 | 1979 | 1980 | 1981 | 4-yr. av. |
| | *Bu.* | *Bu.* | *Bu.* | *Bu.* | *Bu.* | *Bu.* | *Bu.* | *Bu.* | *Bu.* | *Bu.* | *Bu.* | *Bu.* |
| 1 Standard[1] | | 74[2] | 86 | 46 | 73 | 70 | 33 | 36 | 49 | | 40 | 40 |
| 2 Drilled | D | 76 | 88 | 47 | 75 | 71 | 33 | 35 | 48b | D | 38 | 39 |
| 3 PK soybean | R | 88 | 88 | 52 | 66 | 73 | 36 | 34 | 51 | R | 45 | 41 |
| 4 No P | O | 84 | 87 | 50 | 71 | 73 | 36 | 37 | 49 | O | 40 | 40 |
| 5 No K | U | 92 | 82 | 56 | 67 | 74 | 34 | 40 | 48 | U | 40 | 40 |
| 6 PK both crops | G | 73 | 93 | 45 | 71 | 70 | 34 | 35 | 51a | G | 44 | 41 |
| 7 Double PK | H | 76 | 93 | 48 | 77 | 73 | 34 | 36 | 50 | H | 42 | 40 |
| 8 Triple PK | T | 69 | 92 | 45 | 74 | 70 | 34 | 35 | 49 | T | 42 | 40 |
| CV (%) | | 10 | 9 | 17 | 11 | 11 | 13 | 16 | 4 | | 12 | 11 |
| LSD 10% | | NS | NS | NS | NS | NS | NS | NS | 3 | | NS | NS |

[1]The standard treatment was 40-40-40 plus 80 N broadcast for corn with no fertilizer for soybeans.
[2]Values in a column followed by different letters are statistically different at the 10 percent level.

TABLE 12. SOIL-TEST P AND K AT THE SAND MOUNTAIN SUBSTATION, 1977-81

| Treatment | Applied annually | Soil test | | | | | |
|---|---|---|---|---|---|---|---|
| | | Aug. 1977 | | Nov. 1979 | | Nov. 1981 | |
| | | *Lb./acre* | *Index* | *Lb./acre* | *Index* | *Lb./acre* | *Index* |
| | | | | **Phosphorus** | | | |
| 4 | No P | 41 | M 90 | 36 | M 90 | 37 | M 90 |
| 6 | 40 $P_2O_5$ | - | - | - | - | 64 | H130 |
| 8 | 60 $P_2O_5$ | - | - | - | - | 75 | H150 |
| | | | | **Potassium** | | | |
| 5 | No K | 106 | M 80 | 105 | M 80 | 115 | M 80 |
| 6 | 40 $K_2O$ | - | - | - | - | 162 | H100 |
| 8 | 60 $K_2O$ | - | - | - | - | 196 | H110 |

The data show that application of 80 pounds per acre of $P_2O_5$ and $K_2O$ every 2 years, which is the rate recommended based on medium-medium soil tests, was adequate for both crops and increased levels of both nutrients in the soil.

### Upper Coastal Plain Substation, Savannah Sandy Clay Loam, Tables 13 and 14

Yields of both corn and soybeans were poor in 3 of the 5 years due to dry weather during the growing season. No response to P or K was found on either crop in any year, so the experiment was discontinued after the 1981 crop. Although yields in this experiment were low, the data indicate that application of P or K to this soil at high and medium soil test levels would not have increased yield. Recommendations based on soil tests would have been that none be applied until 1980 when 80 pounds $P_2O_5$ per acre would have been recommended for the 2-year rotation. This would have increased the soil P level, but probably would not have increased yields. Although soil-test K dropped from *High* to *Medium* by 1981, no response to K was indicated.

TABLE 13. RESPONSE TO P AND K BY CORN AND SOYBEANS AT THE UPPER COASTAL PLAIN SUBSTATION, 1977-81

| Treatment | Corn yield/acre | | | | | | Soybean yield/acre | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1977 | 1978 | 1979 | 1980 | 1981 | 2-yr. av. | 1977 | 1978 | 1979 | 1980 | 1981 | 2-yr. av. |
| | *Bu.* | *Bu.* | *Bu.* | *Bu.* | *Bu.* | *Bu.* | *Bu.* | *Bu.* | *Bu.* | *Bu.* | *Bu.* | *Bu.* |
| 1 Standard[1] | | | 90 | | 67 | 78 | | | 38 | | 24 | 31 |
| 2 Drilled | D | D | 89 | D | 60 | 75 | D | D | 36 | D | 24 | 30 |
| 3 PK soybean | R | R | 88 | R | 54 | 71 | R | R | 40 | R | 26 | 33 |
| 4 No P | O | O | 100 | O | 47 | 73 | O | O | 39 | O | 22 | 31 |
| 5 No K | U | U | 80 | U | 40 | 60 | U | U | 42 | U | 22 | 32 |
| 6 PK both crops | G | G | 71 | G | 37 | 54 | G | G | 43 | G | 25 | 34 |
| 7 Double PK | H | H | 77 | H | 43 | 60 | H | H | 44 | H | 26 | 35 |
| 8 Triple PK | T | T | 70 | T | 42 | 56 | T | T | 40 | T | 24 | 32 |
| CV (%) | | | 21 | | 41 | 28 | | | 11 | | 19 | 14 |
| LSD 10% | | | NS | | NS | NS | | | NS | | NS | NS |

[1]The standard treatment was 40-40-40 plus 80 N broadcast for corn with no fertilizer for soybeans.

TABLE 14. SOIL-TEST P AND K AT THE UPPER COASTAL PLAIN SUBSTATION, 1977-81

| Treatment | Applied annually | Soil test | | | | | |
|---|---|---|---|---|---|---|---|
| | | Mar. 1977 | | Nov. 1979 | | Nov. 1981 | |
| | | *Lb./acre* | *Index* | *Lb./acre* | *Index* | *Lb./acre* | *Index* |
| | | | | **Phosphorus** | | | |
| 4 | No P | 32 | M 80 | 28 | M 80 | 30 | M 80 |
| 6 | 40 $P_2O_5$ | - | - | - | - | 45 | M100 |
| 8 | 60 $P_2O_5$ | - | - | - | - | 75 | H150 |
| | | | | **Potassium** | | | |
| 5 | No K | 155 | H100 | 132 | H 90 | 120 | M 80 |
| 6 | 40 $K_2O$ | - | - | - | - | 164 | H100 |
| 8 | 60 $K_2O$ | - | - | - | - | 186 | H110 |

### Black Belt Substation, Vaiden Clay, Tables 15 and 16

The experiment at this location was on an area that had been in pasture for many years without fertilization. The soil is an acid clay with cation exchange capacity of 35 meq/100 g and original pH of 5.5. The soil-test P was *Low* and K was *High*, as is typical for such soils that have not been fertilized or cropped. The test area was limed to raise the pH to about 6.6 before applying the fertilizer the first year.

In 1978, corn yield was limited by drought but soybeans averaged 36 bushels per acre with no response to P or K. In 1979, corn averaged 142 bushels and soybeans 43 bushels per acre with no response to P or K fertilizer. After a corn failure in 1980, good corn yields were produced again in 1981, but without a response to P or K. Soybeans averaged 50 bushels per acre in 1981, and the plots that had received no P in 4 years made 48 bushels. Average yields for the entire period showed no differences among treatments.

The Black Belt soils are quite different from other soils in Alabama. The dilute, double-acid extractant used in testing other soils in Alabama is not satisfactory for testing these soils. Therefore, the clay soils of the Black Belt are extracted with the procedure used in the Mississippi soil testing program. It was developed and calibrated for the Black Belt and Delta soils of Mississippi and is suitable for soils with high cation exchange capacities. The lack of response to P at the *Low* level found in this test indicates that the calibration and recommendations for P need further study. The recommendations for a corn-soybean rotation on this soil would have been 120-160-0 of N-$P_2O_5$-$K_2O$ applied to corn and no fertilizer to the soybeans. The yield data do not show a response to P. The recommendation of "no K" was supported by the yield of both crops.

Soil samples taken in November 1981 showed that both P and K on all plots were about the same as in 1977. Plots receiving 40 and 60 pounds $P_2O_5$ annually were increased slightly. The K level increased on all plots, even where none was applied. Soil-test K is much less stable than is P, and variation from one year to another or between seasons in a year are not unusual, particularly when the level is *High* or *Very High*. This emphasizes the need for keeping soil test records of individual fields, so the magnitude of fluctuation can be evaluated for individual soils. Sandy soils, where the K levels are lower, generally show less fluctuation than clayey soils.

TABLE 15. RESPONSE TO P AND K BY CORN AND SOYBEANS AT THE BLACK BELT SUBSTATION, 1978-81

| Treatment | Corn yield/acre | | | | | Soybean yield/acre | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | 1978 | 1979 | 1980 | 1981 | 2-yr. av. | 1978 | 1979 | 1980 | 1981 | 4-yr. av. |
| | *Bu.* | *Bu.* | *Bu.* | *Bu.* | *Bu.* | *Bu.* | *Bu.* | *Bu.* | *Bu.* | *Bu.* |
| 1 Standard[1] | | 151 | | 119 | 135 | 37 | 44 | 32 | 45 | 40 |
| 2 Drilled | D | 150 | D | 119 | 135 | 37 | 43 | 28 | 50 | 39 |
| 3 PK soybean | R | 127 | R | 136 | 132 | 37 | 43 | 30 | 52 | 41 |
| 4 No P | O | 137 | O | 130 | 134 | 36 | 43 | 29 | 48 | 39 |
| 5 No K | U | 126 | U | 116 | 121 | 33 | 45 | 29 | 51 | 40 |
| 6 PK both crops | G | 154 | G | 108 | 131 | 38 | 43 | 35 | 49 | 41 |
| 7 Double PK | H | 151 | H | 112 | 132 | 33 | 45 | 28 | 52 | 39 |
| 8 Triple PK | T | 139 | T | 117 | 128 | 35 | 41 | 34 | 50 | 40 |
| CV (%) | | 13 | | 13 | 14 | 7 | 7 | 16 | 9 | 10 |
| LSD 10% | | NS | | NS | NS | NS | NS | NS | NS | NS |

[1]The standard treatment was 40-40-40 plus 80 N broadcast for corn with no fertilizer for soybeans.

TABLE 16. SOIL-TEST P AND K AT THE BLACK BELT SUBSTATION, 1978-81

| Treatment | Applied annually | Soil test | | | | | |
|---|---|---|---|---|---|---|---|
| | | Mar. 1977 | | Nov. 1979 | | Nov. 1981 | |
| | | *Lb./acre* | *Index* | *Lb./acre* | *Index* | *Lb./acre* | *Index* |
| | | | | **Phosphorus** | | | |
| 4 | No P | 19 | L 60 | 12 | VL 30 | 23 | L 60 |
| 6 | 40 $P_2O_5$ | - | - | - | - | 36 | L 70 |
| 8 | 60 $P_2O_5$ | - | - | - | - | 42 | M 80 |
| | | | | **Potassium** | | | |
| 5 | No K | 380 | VH160 | 430 | VH180 | 420 | VH180 |
| 6 | 40 $K_2O$ | - | - | - | - | 450 | VH190 |
| 8 | 60 $K_2O$ | - | - | - | - | 450 | VH190 |

## Prattville Experiment Field, Lucedale Sandy Clay Loam, Tables 17 and 18

Soil on the Prattville Field had been highly fertilized with P before the area was acquired by the Experiment Station in 1928. The level of P in the soil had been built to *High* levels and summer crops have seldom shown response to P. Vetch and clovers, which grow in cool seasons, have generally responded to P. This red soil is higher in soil K than most sandy soils of the Coastal Plain. It has generally responded to low rates of K, but response has been less than on most other Coastal Plain soils.

The site tested H150 in P and H110 in K when this experiment was started in 1977. Yields of cotton have not been good because of a succession of droughty years since the experiment was started. There has been no response to P, even in the fifth year when yields averaged 2,600 pounds seed cotton and 30 bushels of soybeans per acre. There was a small response to K in cotton in 1979 but not in subsequent years or in the 5-year average. Soybeans did not respond to P or K.

Soil-test P and K changed little where none was applied and were increased by annual applications of 40 and 60 pounds per acre of $P_2O_5$ and $K_2O$.

TABLE 17. RESPONSE TO P AND K BY COTTON AND SOYBEANS ON THE PRATTVILLE EXPERIMENT FIELD, 1977-81

| Treatment | Seed cotton yield/acre | | | | | | Soybean yield/acre | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1977 | 1978 | 1979 | 1980 | 1981 | 5-yr. av. | 1977 | 1978 | 1979 | 1980 | 1981 | 5-yr. av. |
| | *Lb.* | *Lb.* | *Lb.* | *Lb.* | *Lb.* | *Lb.* | *Bu.* | *Bu.* | *Bu.* | *Bu.* | *Bu.* | *Bu.* |
| 1 Standard[1] | 2,090 | 1,480 | 1,890 | 1,210 | 2,650 | 1,860 | | 14 | 22 | | 30 | 22 |
| 2 Drilled | 1,930 | 1,530 | 1,910a[2] | 1,210 | 2,530 | 1,820 | D | 15 | 21 | D | 30 | 22 |
| 3 PK soybean | 2,120 | 1,640 | 1,800 | 1,170 | 2,570 | 1,860 | R | 17 | 21 | R | 29 | 22 |
| 4 No P | 2,070 | 1,660 | 1,910a | 1,120 | 2,640 | 1,880 | O | 15 | 21 | O | 31 | 23 |
| 5 No K | 2,310 | 1,580 | 1,770b | 1,180 | 2,570 | 1,880 | U | 17 | 22 | U | 29 | 23 |
| 6 PK both crops | 2,190 | 1,620 | 1,930a | 1,120 | 2,620 | 1,900 | G | 17 | 21 | G | 28 | 22 |
| 7 ½ PK | 2,340 | 1,580 | 1,880 | 1,130 | 2,640 | 1,920 | H | 14 | 23 | H | 31 | 22 |
| 8 1½ PK | 2,290 | 1,550 | 1,910a | 1,190 | 2,600 | 1,910 | T | 16 | 22 | T | 30 | 23 |
| CV (%) | 9 | 11 | 5 | 8 | 6 | 8 | | 13 | 8 | | 9 | 10 |
| LSD 10% | NS | NS | 130 | NS | NS | NS | | NS | NS | | NS | NS |

[1]The standard treatment was 80-80-80 applied preplant for cotton with no fertilizer to soybeans.
[2]Values in a column followed by different letters are statistically different at the 5 percent level.

TABLE 18. SOIL-TEST P AND K AT THE PRATTVILLE EXPERIMENT FIELD, 1977-81

| Treatment | Applied annually | Soil test | | | | | |
|---|---|---|---|---|---|---|---|
| | | Apr. 1977 | | Nov. 1979 | | Dec. 1981 | |
| | | *Lb./acre* | *Index* | *Lb./acre* | *Index* | *Lb./acre* | *Index* |
| | | | | **Phosphorus** | | | |
| 4 | No P | 74 | H150 | 66 | H140 | 73 | H150 |
| 6 | 40 $P_2O_5$ | - | - | - | - | 96 | H190 |
| 8 | 60 $P_2O_5$ | - | - | - | - | 100 | H200 |
| | | | | **Potassium** | | | |
| 5 | No K | 181 | H110 | 170 | H100 | 158 | H100 |
| 6 | 40 $K_2O$ | - | - | - | - | 208 | H120 |
| 8 | 60 $K_2O$ | - | - | - | - | 226 | H130 |

### Tennessee Valley Substation, Dewey Silt Loam, Tables 19 and 20

The red soils of the limestone valleys in north Alabama, such as Dewey and Decatur, are among the most productive soils in the State with good management. They have higher clay contents and cation-exchange capacities than most row crop soils in Alabama. Therefore, they are classified in Group 3 among soil groupings used by Auburn's Soil Testing laboratory. In comparison with other Alabama soils, research has shown that lower soil-test P values and higher soil-test K values are adequate for top yields on these red soils. The soil fertility index and the ratings used on soil test reports are adjusted for these differences among soil groups.

The soil in this experiment was M90 in P and M100 in K in 1977. The recommendation would have been 60 pounds per acre of $P_2O_5$ and $K_2O$ for cotton and 40 pounds per acre for soybeans. The data show response to P by cotton in 3 of the 6 years and in the average. Cotton responded to K in 3 years but not in the 6-year average. Soybeans produced an average response to P of about 2 bushels per acre. These responses are normal for these *Medium* P soil-test levels.

Because of the small responses for the first 5 years, the experiment was moved in 1982 to an area that was L70 in P and M80 in K, and on which greater responses to both nutrients were anticipated. Yields in 1982 averaged 3,690 pounds of seed cotton and 59 bushels of soybeans with no significant differences among treatments. The recommendations would have been 90-100-50 and 0-80-40 for cotton and soybeans, respectively. These data again indicate that present recommendations are more than adequate for top yields. Rates applied slightly increased both P and K over the 1977-80 period.

TABLE 19. RESPONSE TO P AND K BY COTTON AND SOYBEANS AT THE TENNESSEE VALLEY SUBSTATION, 1977-82

| Treatment | Cotton yield/acre | | | | | | | Soybean yield/acre | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1977 | 1978 | 1979 | 1980 | 1981 | 1982[1] | 6-yr. av. | 1977 | 1978 | 1979 | 1980 | 1981 | 1982[1] | 6-yr. av. |
| | *Lb.* | *Lb.* | *Lb.* | *Lb.* | *Lb.* | *Lb.* | *Lb.* | *Bu.* | *Bu.* | *Bu.* | *Bu.* | *Bu.* | *Bu.* | *Bu.* |
| 1 Standard[2] | 1,460a[3] | 1,770b | 2,870 | 2,150 | 2,240a | 3,710 | 2,370 | 14 | 20 | 45 | 20 | 16b | 57 | 29 |
| 2 Drilled | 1,410 | 2,070a | 2,720 | 2,210a | 2,200 | 3,930 | 2,420a | 16 | 23a | 46 | 21 | 18 | 60 | 31 |
| 3 PK soybean | 1,200b | 1,980 | 2,680 | 2,200a | 2,080 | 3,470 | 2,270b | 15 | 21 | 46 | 18 | 17 | 60 | 30 |
| 4 No P | 1,220b | 1,810b | 2,950 | 2,100 | 1,970b | 3,590 | 2,270b | 15 | 18b | 44 | 17 | 17 | 59 | 28 |
| 5 No K | 1,340 | 1,820b | 2,670b | 2,020b | 2,030 | 4,010 | 2,320 | 15 | 23a | 44 | 19 | 16b | 58 | 29 |
| 6 PK both crops | 1,290 | 2,020a | 3,000a | 2,170 | 2,090 | 3,580 | 2,360 | 14 | 22a | 43 | 18 | 16b | 60 | 29 |
| 7 ½ PK | 1,260 | 1,910 | 2,830 | 2,230a | 2,070 | 3,640 | 2,320 | 17 | 23a | 46 | 17 | 16 | 59 | 30 |
| 8 1½ PK | 1,200b | 2,020 | 2,730 | 2,240a | 1,990 | 3,570 | 2,290 | 18 | 22a | 46 | 18 | 19a | 59 | 30 |
| CV (%) | 12 | 7 | 7 | 5 | 8 | 11 | 10 | 9 | 10 | 3 | 26 | 10 | 3 | 9 |
| LSD 10% | 220 | 200 | 270 | 160 | NS | NS | 120 | NS | 3 | NS | NS | 2 | NS | 11 |

[1]Site was changed in 1982.
[2]The standard treatment was 80-80-80 applied preplant for cotton with no fertilizer to soybeans.
[3]Values in a column followed by different letters are statistically different at the 5 percent level.

TABLE 20. SOIL-TEST P AND K AT THE TENNESSEE VALLEY SUBSTATION, 1977-82

| Treatment | Applied annually | Soil test | | | | | |
|---|---|---|---|---|---|---|---|
| | | Apr. 1977 | | Nov. 1979 | | Mar. 1982[1] | |
| | | *Lb./acre* | *Index* | *Lb./acre* | *Index* | *Lb./acre* | *Index* |
| | | | | **Phosphorus** | | | |
| 4 | No P | 23 | M 90 | 21 | M 80 | 15 | L 70 |
| 6 | 40 $P_2O_5$ | - | - | 27 | M100 | - | - |
| 8 | 60 $P_2O_5$ | - | - | 31 | H110 | - | - |
| | | | | **Potassium** | | | |
| 5 | No K | 240 | M100 | 250 | H110 | 134 | M 80 |
| 6 | 40 $K_2O$ | - | - | 280 | H120 | - | - |
| 8 | 60 $K_2O$ | - | - | 290 | H130 | - | - |

[1]Site was changed in 1982.

## Wiregrass Substation, Dothan Fine Sandy Loam, Tables 21 and 22

The soil-test levels in the experiment on the Wiregrass Substation were *High* in both P and K in 1977. No response to P was anticipated because this soil has been *High* in P since the station was acquired in 1928. Summer crops have never produced response to P at this location. A response to K was expected after the first year or two, because the soil K level was borderline between *Medium* and *High*. This did not occur because the K level of the untreated plots did not drop during the 5 years of the experiment.

Corn yields were unsatisfactory because of a drought in each year from 1977 through 1981. Only in 1980 did yields reach the 50 bushels per acre level. Response to P or K was not expected or found at these yield levels.

Peanuts produced better yields than did corn under these drought conditions, but averaged only 2,600 pounds per acre over the 6 years. Response to P or K was not found. The indicated response to P in 1978 is not considered dependable since it did not occur in subsequent years or in the average. The lack of response to K indicates this soil has the capacity to release substantial amounts of K annually to support a growing crop. The soil K level on the unfertilized plots remained about the same through the 5 years. It was increased by annual application of 40 and 60 pounds per acre of $K_2O$.

These data on peanuts agree with those of Hartzog and Adams *(4)* in which they got no response to P or K in 34 experiments on farmers' fields.

TABLE 21. RESPONSE TO P AND K BY CORN AND PEANUTS AT THE WIREGRASS BELT SUBSTATION, 1977-82

| Treatment | | Corn yield/acre | | | | | | Peanuts yield/acre | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 1977 | 1978 | 1979 | 1980 | 1981 | 4-yr. av. | 1977 | 1978 | 1979 | 1980 | 1981 | 1982 | 6-yr. av. |
| | | *Bu.* | *Bu.* | *Bu.* | *Bu.* | *Bu.* | *Bu.* | *Lb.* | *Lb.* | *Lb.* | *Lb.* | *Lb.* | *Lb.* | *Lb.* |
| 1 Standard[1] | | | 22 | 22 | 64 | 23 | 33 | 3,500 | 2,990a[2] | 2,180 | 1,630 | 3,290 | 2,600 | 2,680 |
| 2 Drilled | D | 23 | 28 | 53 | 22 | 31 | 3,170 | 2,540 | 2,290 | 1,120 | 3,150 | 2,660 | 2,420 |
| 3 PK Peanuts | R | 28 | 17 | 49 | 21 | 29 | 3,510 | 2,880a | 2,470 | 1,470 | 3,570 | 2,380 | 2,670 |
| 4 No P | O | 24 | 22 | 55 | 22 | 31 | 2,350 | 2,210b | 1,990 | 1,410 | 3,490 | 2,600 | 2,510 |
| 5 No K | U | 16 | 19 | 56 | 22 | 28 | 3,360 | 2,700 | 1,940 | 1,650 | 3,490 | 2,610 | 2,620 |
| 6 PK both crops | G | 28 | 18 | 61 | 24 | 33 | 3,220 | 2,930a | 2,430 | 1,120 | 3,540 | 2,740 | 2,660 |
| 7 Double PK | H | 27 | 21 | 72 | 24 | 36 | 3,570 | 3,050a | 2,380 | 1,140 | 3,460 | 2,600 | 2,700 |
| 8 Triple PK | T | 29 | 18 | 57 | 24 | 32 | 3,440 | 2,600 | 2,280 | 1,130 | 3,520 | 2,710 | 2,630 |
| CV (%) | | 27 | 30 | 23 | 17 | 26 | 8 | 16 | 19 | 28 | 10 | 11 | 13 |
| LSD 10% | | NS | NS | NS | NS | NS | NS | 620 | NS | NS | NS | NS | NS |

[1]The standard treatment was 40-40-40 plus 80 N broadcast for corn with no fertilizers for peanuts.
[2]Values in a column followed by different letters are statistically different at the 10 percent level.

TABLE 22. SOIL-TEST P AND K AT THE WIREGRASS SUBSTATION, 1977-81

| Treatment | Applied annually | Soil test | | | | | |
|---|---|---|---|---|---|---|---|
| | | Apr. 1977 | | Nov. 1979 | | Nov. 1981 | |
| | | *Lb./acre* | *Index* | *Lb./acre* | *Index* | *Lb./acre* | *Index* |
| | | | | **Phosphorus** | | | |
| 4 | No P | 90 | H180 | 86 | H170 | 75 | H150 |
| 6 | 40 $P_2O_5$ | - | - | - | - | 106 | VH210 |
| 8 | 60 $P_2O_5$ | - | - | - | - | 105 | VH210 |
| | | | | **Potassium** | | | |
| 5 | No K | 94 | H 90 | 79 | M 80 | 118 | H100 |
| 6 | 40 $K_2O$ | - | - | - | - | 148 | H120 |
| 8 | 60 $K_2O$ | - | - | - | - | 145 | H120 |

## SUMMARY AND CONCLUSIONS

Average yields for corn, soybeans, cotton, and peanuts for all locations are assembled in tables 23 and 24. Average yield of corn at all locations was 82 bushels per acre. Although the soil-test P level was *Low* at the Black Belt Substation and *Medium* at the Lower Coastal Plain, Sand Mountain, and Tennessee Valley substations, the only significant response to P found in average yield of corn was at the Lower Coastal Plain Substation where the no-P treatment produced the lowest yield. Treatment No. 4, which received no P during the 5 or 6 years, averaged 82 bushels per acre for all locations, the same as Treatment No. 1. Soybeans on treatments No. 1 and No. 4 averaged 33 bushels at 9 locations and no location produced a response to P. Cotton showed a small response to P at the Tennessee Valley Substation where the soil-test P level was *Medium*, but showed no response at Prattville where the soil-test P level was *High*.

Soils at the Brewton Experiment Field and Gulf Coast, Lower Coastal Plain, Sand Mountain, and Tennessee Valley substations were originally *Medium* in K. Only at the Gulf Coast Substation was there a significant response to K. Cotton and peanuts did not respond to K. Treatment No. 5, which received no K, produced the lowest corn yields at six locations and in the overall average, but this difference was only 4 bushels in the average and was not statistically different from the standard Treatment No. 1 or from the overall average of all treatments.

Since so little response to P or K was found in these experiments, differences in method or time of application of fertilizer would not be expected. Placing the P and K in or beside the row at planting increased corn yield only at the Gulf Coast Substation. It made no difference whether P and K were applied to corn or to soybeans or were split between the two crops and applied annually. The double

TABLE 23. SUMMARY OF YIELDS OF CORN AND COTTON FROM DIFFERENT RATES AND TIMES OF APPLICATION OF P AND K AT 10 LOCATIONS, 1977-82

| Treatment | Corn yield/acre | | | | | | | | | Seed cotton/acre | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Gulf Coast 5 yr. | Monroe-ville 5 yr. | Brewton 3 yr. | Lower Coastal Plain 3 yr. | Sand Moun-tain 4 yr. | Upper Coastal Plain 2 yr. | Black Belt 2 yr. | Wire-grass 4 yr. | Average 28 location-years | Pratt-ville 5 yr. | Tennessee Valley 6 yr. |
| | *Bu.* | *Bu.* | *Bu.* | *Bu.* | *Bu.* | *Bu.* | *Bu.* | *Bu.* | *Bu.* | *Lb.* | *Lb.* |
| 1 Standard | 115 | 78 | 84 | 82 | 70 | 78 | 135 | 33 | 82 | 1,860 | 2,370 |
| 2 Drilled | 125a | 77 | 89 | 81 | 71 | 75 | 135 | 31 | 84 | 1,820 | 2,420a |
| 3 PK soybean | 115 | 78 | 87 | 90a | 73 | 71 | 132 | 29 | 82 | 1,860 | 2,270b |
| 4 No P | 120 | 77 | 81 | 78b | 73 | 73 | 134 | 31 | 82 | 1,880 | 2,270b |
| 5 No K | 111b | 76 | 75 | 87 | 74 | 60 | 121 | 28 | 78 | 1,880 | 2,320 |
| 6 PK both crops | 115 | 80 | 87 | 81 | 70 | 54 | 131 | 33 | 81 | 1,900 | 2,360 |
| 7 Double PK | 122 | 79 | 86 | 87 | 73 | 60 | 132 | 36 | 84 | 1,920 | 2,320 |
| 8 Triple PK | 123a | 79 | 90 | 89 | 70 | 56 | 128 | 32 | 83 | 1,910 | 2,290 |
| LSD 10% | 8 | NS | NS | 9 | NS | NS | NS | NS | - | NS | 120 |
| Original soil-test | | | | | | | | | | | |
| P index | H110 | H130 | H140 | L70 | M90 | M 80 | L60 | H180 | - | H150 | M 90 |
| K index | M 80 | H 90 | M 80 | M80 | M80 | H100 | VH160 | H 90 | - | H110 | M100 |

TABLE 24. SUMMARY OF YIELDS OF SOYBEANS AND PEANUTS FROM DIFFERENT RATES AND TIMES OF APPLICATION OF P AND K AT 10 LOCATIONS, 1977-82

| Treatment | Soybean yield/acre | | | | | | | | | | Peanuts /acre |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Gulf Coast 5 yr. | Monroe-ville 6 yr. | Brewton 5 yr. | Lower Coastal Plain 2 yr. | Sand Moun-tain 4 yr. | Upper Coastal Plain 2 yr. | Black Belt 4 yr. | Pratt-ville 4 yr. | Tennessee Valley 6 yr. | Average 38 location-years | Wire-grass 6 yr. |
| | *Bu.* | *Bu.* | *Bu.* | *Bu.* | *Bu.* | *Bu.* | *Bu.* | *Bu.* | *Bu.* | *Bu.* | *Lb.* |
| 1 Standard | 38 | 32 | 38 | 30 | 40 | 31 | 40 | 22 | 29 | 33 | 2,680 |
| 2 Drilled | 40a | 33 | 37 | 29 | 39 | 30 | 39 | 22 | 31 | 33 | 2,420 |
| 3 PK soybean | 39 | 33 | 37 | 29 | 41 | 33 | 41 | 22 | 30 | 34 | 2,670 |
| 4 No P | 39 | 33 | 36 | 29 | 40 | 31 | 39 | 23 | 28 | 33 | 2,510 |
| 5 No K | 38b | 33 | 36 | 29 | 40 | 32 | 40 | 23 | 29 | 33 | 2,620 |
| 6 PK both crops | 40a | 34 | 38 | 30 | 41 | 34 | 41 | 22 | 29 | 34 | 2,660 |
| 7 Double PK | 40a | 31 | 38 | 31 | 40 | 35 | 39 | 22 | 30 | 34 | 2,700 |
| 8 Triple PK | 40a | 32 | 37 | 30 | 40 | 32 | 40 | 23 | 30 | 34 | 2,630 |
| LSD 10% | 2 | NS | NS | NS | NS | NS | NS | NS | NS | — | NS |

and triple rates applied in treatments No. 7 and No. 8 did not increase yields over the single rate in Treatment No. 1.

Study of the soil-test data from all locations shows that where no P was applied for 4 years, average soil-test P dropped from 49 pounds per acre to 42 pounds. This was a drop of about 2 pounds per acre per year, which in several cases lowered the level from *High* to *Medium*. The 40 and 60 pounds per acre rates of $P_2O_5$ increased levels of soil-test P by averages of 20 and 30 pounds P, respectively, over the average 4 years of application. It took about 4.5 pounds of P or 10 pounds $P_2O_5$ to increase soil-test P 1 pound, in the average for all locations.

Soil-test K changed little where none was applied between first and last samplings. Several locations showed small increases, which demonstrates that soil-test K fluctuates between seasons and is less stable than soil-test P. Where 40 and 60 pounds per acre of $K_2O$ were applied annually, soil-test K was usually increased slightly. Average of values for all locations showed that 4.7 pounds of applied K or 5.6 pounds of $K_2O$ raised soil-test K 1 pound.

Results of these experiments agree with previously published reports from experiments on units of the Alabama Agricultural Experiment Station and on farmers' fields in cooperative experiments. Some of these publications are listed in the Bibliography. These data show that the recommendations of P and K based on soil tests by the Auburn University Soil Testing Laboratory should be adequate for these crops on Alabama soils. They strongly support the decisions made in 1976 to discontinue maintenance recommendations of P and K for these crops at *High* soil-test levels. In most cases in these experiments, response was not found at *Medium* soil-test levels.

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