

LIME AND FERTILIZER EXPERIMENTS ON SOYBEANS

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FRONT COVER: A 40-bushel crop of soybeans in a lime-fertilizer experiment in West Tennessee.

SUMMARY AND CONCLUSIONS

THIS publication summarizes 12 lime and/or fertilizer experiments on soybeans conducted in the west Tennessee area over the 5-year period, 1960-1964. The work was done on a variety of soils covering a wide range in drainage, texture, and fertility. The soil series represented are: Memphis, Loring, Grenada, Calloway, and Henry on the uplands, and Dexter, Collins, Hatchie, and Tunica on terrace and bottom positions. These soils range in internal drainage from well-drained to poorly-drained and in texture from loam to clay loam. A majority of the soils were low in phosphorus, but ranged from very low to high in potassium. Soil reaction (pH) values ranged from 5.0 to 6.1.

Most of the experiments were conducted over a period of at least 3 years. Lime was applied only at the beginning of the experiments at rates of 2, 3, 4, 6, 8, and 12 tons per acre. In the lime-fertilizer experiments, fertilizer was applied annually at rates ranging from 0-30-30 to 0-120-120 (N-P₂O₅-K₂O) per acre. In the fertilizer experiments, nitrogen was applied at rates of 30 and 60 pounds of N and phosphorus, and potassium at rates of 40, 80, 120, and 160 pounds of P₂O₅ and K₂O.

In general, soybeans responded more to lime than to fertilization. In the lime-fertilizer experiments, the average increase from lime was 6 bushels per acre per year; the average increase from fertilizer was 2.7 bushels. In three experiments a 6-ton lime rate was as effective as a 12-ton rate; in two other experiments 4 tons was as effective as 8 tons; and in still another experiment 2 tons was as effective as 4 tons. From this it can be inferred that lime rates between 2 and 4 tons per acre would have given near maximum yield increases in all of the experiments, at least for the period over which they were conducted. One example of the value of lime is illustrated by an experiment on Loring silt loam in which, over a 5-year period, the limed treatment produced 29 bushels more soybeans than did the unlimed treatment.

No response to nitrogen, phosphorus or potassium was obtained in fertilizer experiments of 2 years' duration on Loring, Tunica, and Collins soils.

Boron had no effect on soybean yields in tests conducted under limed and unlimed conditions on Loring and Tunica soils.

LIME AND FERTILIZER EXPERIMENTS ON SOYBEANS

by

O. H. Long, J. R. Overton, E. W. Counce, and Tom McCutchen¹

INTRODUCTION

THE acreage of soybeans in Tennessee has more than doubled in the last 10 years. According to the Tennessee Crop Reporting Service, soybeans was planted on 654,000 acres in 1964, and the prospects are that plantings will be increased to 726,000 acres in 1965. The value of the crop exceeds \$35 million annually. Acreage in soybeans now exceeds that in cotton by over 100,000 acres. Soybeans is often grown on acid soils without liming; frequently the crop is unfertilized. Numerous lime and fertilizer experiments on soybeans were conducted by the University of Tennessee Agricultural Experiment Station in the period 1960-1964. It is the purpose in this publication to present the results from these experiments.

LIME-FERTILIZER EXPERIMENT ON LORING SILT LOAM

A lime-fertilizer experiment was conducted for the 5-year period, 1960-1964, on Loring silt loam at Ames Plantation. Composite samples of the surface soil and subsoil collected before the experiment was started tested as follows: Surface soil, pH = 5.2, P = 15 (low), K = 210 (high); subsoil, pH = 4.8, P = 6 (low), K = 200 (high). Ground agricultural limestone was applied at rates of 6 and 12 tons

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per acre on April 15, 1960. Fertilization was 0-120-120 ($\text{N-P}_2\text{O}_5\text{-K}_2\text{O}$) pounds per acre annually until 1963, when the rate was reduced to 0-40-40. The fertilizer was applied broadcast; the land was then bedded before planting. Unlimed and unfertilized check treatments were also provided. The lime treatments were the main plots and these were divided into fertilized and unfertilized sub-plots.

Soybean yields for the different lime-fertilizer treatments are shown in Table 1. For the three lime treatments the yields are averages of the fertilized and unfertilized plots, and for the two fertilizer treatments they are averages of the three lime treatments.

Little or no response to lime was obtained in 1960, the first year of the experiment. In 1961 and 1962, however, a marked response to lime was obtained. Responses to lime were less pronounced in 1963 and 1964. The 5-year average yield on the unlimed treatment was 26.7 bushels per acre, compared with yields of 32.4 and 31.5 bushels on the 6-ton and 12-ton lime treatments, respectively. The response to fertilizer was small throughout the 5-year period, averaging less than 1 bushel. A general view of this experiment is shown in Figure 1.



Figure 1. Soybeans in a lime-fertilizer experiment on Loring silt loam at Ames Plantation.

Table 1.—Yields of soybeans (Lee variety) in a lime-fertilizer experiment on Loring silt loam, Ames Plantation, 1960-1964

(Yields are averages of 4 replications)

Lime treatment (tons ag. lime/acre)	Yield of soybeans in bushels per acre					
	1960	1961	1962	1963	1964	5-yr. av.
0	27.6	23.4	30.9	26.7	24.7	26.7
6	29.4	32.6	40.0	31.8	28.1	32.4
12	26.9	32.0	40.7	31.3	26.7	31.5
L. S. D. (5%)	N.S.	3.4	3.4	N.S.	N.S.	...
Fertilized	27.5	29.7	38.1	30.2	27.2	30.5
No fertilizer	28.4	29.0	36.3	29.7	25.7	29.8
L. S. D. (5%)	N.S.	N.S.	1.3	N.S.	N.S.	...

pH of surface soil	1960	1961	1962	1964
Unlimed	5.8	5.9	5.8	6.4
6-ton lime rate	7.1	7.3	7.3	7.5
12-ton lime rate	7.3	7.5	7.4	7.7

Soil reaction (pH) values over the course of the experiment are shown at the bottom of Table 1. Tests made on surface soil samples collected from every plot in October 1960 (about 6 months after liming) indicated average pH values of 5.8 on the unlimed soil, 7.1 on the 6-ton lime treatment, and 7.3 on the 12-ton lime treatment. The pH of the unlimed soil continued to average about 5.8 through 1962, but had increased to 6.4 on samples collected in 1964. It is believed that this rise in pH occurred because lime was dragged from the adjacent limed plots onto the unlimed plots in the various turning and cultivating operations. This lime contamination of the unlimed plots may account for the decline in lime response in 1963 and 1964. When the experiment was concluded in 1964, the average pH of the limed soil was 7.5 and 7.7 on the 6-ton and 12-ton lime treatments, respectively.

LIME-FERTILIZER EXPERIMENT ON TUNICA CLAY LOAM

An experiment similar to that on Loring soil, discussed above, was conducted on Tunica clay loam in the Mississippi River bottom at Fort Pillow State Farm; this experiment was continued for a period of only 3 years (1960-1962). Soil tests made before the

experiment was started indicated that the surface layer of this soil has a high exchange capacity (about 30 me per 100 grams of soil), a base saturation of about 60%, and was medium in phosphorus (24 lb. P per acre) and very high in potassium (500 lb. K per acre). The pH of the soil before liming was 5.8 to 5.9.

Ground agricultural limestone was applied at rates of 6 and 12 tons per acre on April 7, 1960. Fertilizer was applied broadcast annually at the rate of 0-120-120 pounds per acre and the land then bedded before planting.

Soybean yields for the different lime and fertilizer treatments are shown in Table 2. Only a slight response to lime was obtained in this experiment. The 3-year average yields were 39.1, 41.5, and 42.6 bushels per acre for the unlimed, the 6-ton and the 12-ton lime treatments, respectively. These yields are the highest of those reported in this publication. Differences in yields among these three lime treatments are not statistically significant. There was no response to fertilization.

Table 2.—Yields of soybeans (Lee variety) in a lime-fertilizer experiment on Tunica clay loam, Fort Pillow State Farm, 1960-1962

(Yields are averages of 4 replications)

Lime treatment	Yield of soybeans in bushels per acre						
	Fertilized			No fertilizer			3-yr. av. (Fert. and no fert.)
	1960	1961	1962	1960	1961	1962	
No lime	43.2 (5.8)*	37.8 (5.6)	38.0 (5.5)	38.9 (5.9)	37.4 (5.6)	39.2 (5.4)	39.1
Limed 6 tons/a.	39.7 (6.5)	39.9 (6.7)	41.7 (6.5)	43.7 (6.2)	41.1 (6.6)	43.0 (6.6)	41.5
Limed 12 tons/a.	39.9 (6.1)	44.5 (7.0)	44.1 (7.0)	43.7 (6.1)	43.5 (6.6)	39.6 (6.6)	42.6
Average	40.9			41.1			...

*Figures in parentheses are pH values of the soil on samples collected each year of the experiment. Each value is an average of 4 determinations.

Soil reaction (pH) values over the 3-year period are shown in parentheses in Table 2 directly under the soybean yields. By 1962, two years after liming, the soil had attained a pH of 6.5 to 6.6 on the 6-ton lime treatment and a pH of 6.6 to 7.0 on the 12-ton lime treatment.

DEPTH OF INCORPORATION OF LIME AND FERTILIZER IN AN EXPERIMENT ON DEXTER SILT LOAM

An experiment was conducted over a 4-year period on Dexter silt loam at the West Tennessee Experiment Station, Jackson, in which at its beginning lime and fertilizer were incorporated with the soil to two depths—6 inches and 12 inches. The site selected was in Bermudagrass and had been pastured for several years. Results from some chemical tests made on the soil before the experiment was started were as follows:

Depth (inches)	pH	P (lb./acre)	Exchangeable cations (me/100 grams of soil)			Cation exchange capacity	Base satur- ation (%)
			K	Ca	Mg		
0-6	4.8	12 (low)	0.35	2.10	1.56	9.00	45
6-12	4.7	13 (low)	0.27	2.50	2.10	12.00	41

Hydrated lime ($\text{Ca}(\text{OH})_2$) was applied in late March 1960 at rates calculated to achieve 100% and 150% base saturations. The amounts of lime mixed in the surface (0-6 inches) and subsoil (6-12 inches) layers were calculated separately. An unlimed check treatment was also included. Where lime was mixed to a depth of 12 inches, the 6- to 12-inch layer was limed first. This was accomplished by turning the soil, one furrow at a time, to a depth of 6 inches. The required amounts of lime and fertilizer were distributed along the bottom of this furrow, then mixed with the subsoil, using a rotary tiller, before the next furrow was turned. Incorporation in the surface layer was accomplished by broadcasting the lime and fertilizer on the turned soil, followed by disking to a depth of 6 inches. All treatments were tilled to a depth of 12 inches regardless of whether lime and fertilizer were incorporated to this depth.

Liming of the soil to 100% base saturation to a depth of 12 inches required the equivalent of about 6 tons of calcium carbonate per acre; to a depth of 6 inches, about $2\frac{1}{2}$ tons. Liming to 150% base saturation to a depth of 12 inches required the equivalent of about $11\frac{1}{4}$ tons of calcium carbonate; to a depth of 6 inches, about $4\frac{3}{4}$ tons. These lime rates were calculated from the chemical data shown above.

Fertilization was at a uniform rate of 0-120-120 per acre annually over the entire area. In the first year one-half the fertilizer was mixed in the subsoil, with or without lime, where the 12-inch incorporation was made. In succeeding years five-sixths of the fertilizer was broadcast on the surface and disked in; one-sixth was applied in the row.

Soybean yields for the 4-year period, 1960-1963, are shown in Table 3. Yields were in the 30-bushel range in 1962 but, due to a severe drought at fruiting time, were only about 10 bushels in 1963.

An average yield increase of about 2 bushels was obtained from lime; liming to a base saturation level of 100% gave slightly higher yields than liming to a base saturation level of 150%. The yields as shown are averages for both depths of lime incorporation. Incorporation of lime and/or fertilizer to a 12-inch depth was slightly superior to a 6-inch incorporation, producing 1 bushel more soybeans as a 4-year average. Differences in yields among the three lime treatments and between the two depths of incorporation were not statistically significant.

Table 3.—Yields of soybeans (Lee variety) in a lime-fertilizer depth of incorporation experiment and changes in pH over time on Dexter silt loam, West Tennessee Experiment Station, Jackson, 1960-1963
(Yields and pH values are averages of 3 replications)

Lime treatment	Yield of soybeans in bushels per acre				
	1960	1961	1962	1963	4-yr. av.
Unlimed (check)	22.7	17.1	27.8	11.4	19.8
Limed to base saturation of 100%	23.6	21.8	30.6	10.8	21.7
Limed to base saturation of 150%	22.1	21.0	32.1	9.1	21.1

Depth of lime and/or fertilizer incorporation	Yield of soybeans in bushels per acre				
	1960	1961	1962	1963	4-yr. av.
6 inches	22.3	19.5	29.2	10.2	20.3
12 inches	23.2	20.4	31.0	10.6	21.3

Lime treatments	pH values on dates specified:		
	1-11-61	1-4-62	March 1964
Unlimed (check)			
0-6 inches	5.2	5.4	5.4
6-12 inches	5.0	5.2	5.1
Limed to base saturation of 100%			
0-6 inches	6.5	6.5	6.3
6-12 inches	6.6	6.7	6.5
Limed to base saturation of 150%			
0-6 inches	7.1	7.4	7.1
6-12 inches	7.3	7.3	7.2

In the course of this experiment surface and subsoil samples were taken three times from every plot—first in January 1961, then in January, 1962 and finally in March 1964. Each sample was tested for pH, P, and K. The pH values are shown at the bottom of Table 3.

The lower lime rate raised the pH to about 6.5 and the higher lime rate resulted in a further rise to a pH of about 7.2. Near maximum pH had been attained by the time of the first sampling—about 10 months after liming. This rapid reaction of lime with the soil can be attributed to the fine particle size of the liming material used.

LIME-FERTILIZER EXPERIMENTS ON HATCHIE AND CALLOWAY SOILS

Similar lime-fertilizer experiments were started in 1962 on Hatchie loam at West Tennessee Experiment Station, Jackson, and on Calloway silt loam at Ames Plantation, Grand Junction. In both experiments the lime treatments were 0, 4, and 8 tons of agricultural limestone per acre. On the fertilized plots, fertilization was 0-40-40 (N-P₂O₅-K₂O) pounds per acre annually, the fertilizer being applied either in the row or broadcast, followed by bedding.

Soybean yields for the 3-year period, 1962-1964, are shown in tables 4 and 5. The yields shown opposite the three lime treatments are averages under fertilized and unfertilized conditions; likewise, the yields opposite the fertilizer treatments are averages under limed and unlimed conditions.

Table 4.—Yields of soybeans (Lee variety) in a lime-fertilizer experiment on Hatchie loam, West Tennessee Experiment Station, 1962-1964
(Yields are averages of 4 replications)

Lime treatment (tons ag. lime/acre)	Yield of soybeans in bushels per acre			
	1962	1963	1964	3-yr. av.
0	36.9	19.7	35.3	30.6
4	36.8	17.5	33.5	29.3
8	37.9	18.0	33.3	29.7
L. S. D. (5%)	N.S.	N.S.	N.S.	...
Fertilized	39.5	20.0	36.3	31.9
Unfertilized	34.9	16.9	31.8	27.9
L. S. D. (5%)	4.3	N.S.	2.0	...
(1%)	...	...	2.7	...

Table 5.—Yields of soybeans (Lee variety) in a lime-fertilizer experiment on Calloway silt loam, Ames Plantation, 1962-1964

(Yields are averages of 4 replications)

Lime treatment (tons ag. lime/acre)	Yield of soybeans in bushels per acre			
	1962	1963	1964	3-yr. av.
0	16.9	13.5	9.7	13.4
4	29.0	17.2	20.0	22.1
8	31.9	18.7	19.4	23.3
L. S. D. (5%)	3.8	2.5	3.8	...
(1%)	5.7	3.4	5.2	...
Fertilized	27.2	17.1	18.4	20.9
Unfertilized	24.7	15.8	14.3	18.3
L. S. D. (5%)	1.6	N.S.	3.1	...
(1%)	2.3	...	...	...

Soybeans failed to respond to lime on the Hatchie soil (Table 4); the 3-year average yield was about 30 bushels per acre on the limed and unlimed treatments. There was, however, a response to fertilization. With fertilizer, soybeans yielded as a 3-year average 31.9 bushels per acre compared with a yield of 27.9 bushels where the crop was unfertilized.

The pH of the soil was 5.6 when sampled in March 1962, just before lime was applied. Available phosphate and potassium levels were high (35 pounds P and 190 pounds K per acre). When sampled again in November 1962, the pH averaged 5.0 on the unlimed treatment, 6.0 where limed at the 4-ton rate, and 6.5 where limed at the 8-ton rate. In March 1964, average pH values were 5.3, 6.2, and 6.6 on the unlimed, 4-ton, and 8-ton limed treatments, respectively.

Soybeans responded to both lime and fertilizer on the Calloway soil (Table 5). The 3-year average yield on the unlimed treatment was 13.4 bushels per acre and 22.1 and 23.3 on the 4-ton and 8-ton lime treatments, respectively—an average increase of 9.3 bushels from lime. Fertilized soybeans averaged 20.9 bushels compared with 18.3 bushels where unfertilized—an increase of 2.6 bushels from fertilization.

When this soil was sampled in April 1962, about 1 month before liming, soil tests were as follows: pH=5.1, P=7 (low), K=110 (low). When sampled again in November 1962, about 6 months after liming, the average pH values were 4.8, 5.8, and 6.4 on the unlimed, 4-ton, and 8-ton lime treatments, respectively. When sampled in March 1964, the pH values averaged 5.3, 6.3, and 6.7.

LIME-FERTILIZER EXPERIMENT ON CALLOWAY SILT LOAM

Another lime-fertilizer experiment was conducted on Calloway silt loam at Ames Plantation, similar to the one described above except that it was at a different location and was started 1 year later. The lime rates were 2 tons and 4 tons per acre; the lime was applied April 22, 1963. Where fertilizer was applied, the rate was 0-40-40 (N-P₂O₅-K₂O) pounds per acre, applied in the row before bedding. Soybean yields are shown in Table 6.

Soybeans responded markedly to lime in both years, but there was no response to fertilization. On the unlimed soil, the 2-year average yield was 16.2 bushels and 28.2 bushels where the soil was limed. The 2-ton rate of lime was just as effective as the 4-ton rate.

Tests made on soil samples collected in 1963 from every plot before any lime or fertilizer was applied averaged as follows: Surface soil—pH=5.1, P=12 (low), K=170 (medium); subsoil (6-12")—pH=5.0, P=7 (low), K=130 (low). Soil tests made on samples collected from every plot in March 1964 gave an average pH value of 5.3 for the unlimed plots, 6.0 where lime had been applied at the 2-ton rate and 6.5 where limed at the 4-ton rate.

Failure to obtain a response to fertilization in this experiment is believed to be due to the medium level of potassium in the soil at the beginning of the experiment (170 pounds K per acre). In the

Table 6.—Yields of soybeans (Lee variety) in a lime-fertilizer experiment on Calloway silt loam, Ames Plantation, 1963-1964

(Yields are averages of 4 replications)

Lime treatment (tons ag. lime/acre)	Yield of soybeans in bushels per acre		
	1963	1964	2-yr. av.
0	16.1	16.3	16.2
2	25.1	31.8	28.5
4	26.1	29.5	27.8
L. S. D. (5%)	3.3	3.7	...
(1%)	4.5	5.1	...
Fertilized	22.2	25.7	24.0
Unfertilized	22.7	26.0	24.4
L. S. D. (5%)	N.S.	N.S.	...

other experiment on Calloway soil where a response was obtained from fertilizer, the potassium level of the soil was low (110 pounds K).

LIME-FERTILIZER EXPERIMENT ON GRENADA SILT LOAM

A lime-fertilizer experiment on Grenada silt loam near the University of Tennessee, Martin Branch, was started in 1962 and is still in progress. Soil tests, made before the experiment was started, indicated a pH of 6.1, low phosphorus (7 pounds P per acre) and very low potassium (55 pounds K per acre). Agricultural limestone was applied in April 1962 at rates of 0 and 3 tons per acre. The fertilizer treatments were: 1) no fertilizer, 2) potassium (0-0-40), and 3) phosphorus and potassium (0-40-40), both expressed on the oxide basis. These fertilizers were applied annually in the row. Yields for the 3-year period, 1962-1964, are shown in Table 7.

Soybeans showed no response to lime but a significant response to fertilization. Potassium alone was about as effective in increasing yields as when it was combined with phosphorus. The 3-year average yield without fertilizer was 18.1 bushels per acre; with potassium fertilization, 23.7 bushels; and with phosphorus-potassium fertilization, 24.3 bushels.

Potassium deficiency symptoms were observed on the unfertilized plots in the second and third year of the experiment, the symptoms being much more pronounced where lime had been applied. Growth response to potassium fertilization and potassium deficiency symptoms in the 1963 crop are shown in Figure 2.

Table 7.—Yield of soybeans (Lee variety) in a lime-fertilizer experiment on Grenada silt loam, University of Tennessee Martin Branch, 1962-1964

Lime or fertilizer treatment*	Yield of soybeans in bushels per acre			
	1962	1963	1964	3-yr. av.
Limed 3 tons/acre	26.4	16.8	22.1	21.8
Unlimed	27.0	17.0	22.9	22.3
L. S. D. (5%)	N.S.	N.S.	N.S.	...
No fertilizer	24.5	14.7	15.2	18.1
Potassium	26.9	18.8	25.5	23.7
Phosphorus and potassium	28.8	17.2	26.9	24.3
L. S. D. (5%)	N.S.	2.4	2.8	...
(1%)	...	3.4	3.9	...

*Fertilizers applied annually in the row at rates of 0-0-40 or 0-40-40 (N-P₂O₅-K₂O) per acre using 60% muriate of potash or 0-20-20 commercial fertilizer.



Figure 2. Soybeans on Grenada silt loam, University of Tennessee, Martin Branch, Martin, 1963. TOP: Plot on left was fertilized with potassium; plot on right received no fertilizer. Both plots were limed. BOTTOM: Close-up of potassium deficiency symptoms on limed, unfertilized plot.

PAIRED LIME-FERTILIZER EXPERIMENT ON MEMPHIS AND LORING SOILS

At Milan Field Station a 4-acre field, about one-half of which is Memphis silt loam and the other half Loring silt loam, provided an opportunity to measure soybean production under limed and fertilized conditions on two adjacent soil types.

Ground limestone was applied at rates of 2 and 4 tons per acre. Fertilization was either 0-40-40 or 0-30-30 (N-P₂O₅-K₂O) pounds per acre. Unlimed and unfertilized check plots were also provided. Soybean yields on the two soils for a 2-year period are presented in Table 8.

A pronounced response to both lime and fertilizer was obtained on both soils. On the unlimed, unfertilized plots the average yield was only 14.9 bushels per acre. Fertilizer alone increased the yield to 20.7 bushels, and where both fertilizer and lime (2 tons) were applied, the yield was 33.7 bushels. Lime at the 4-ton rate produced

Table 8.—Yields of soybeans (Lee variety) in a lime-fertilizer experiment on adjacent Memphis and Loring soils, Milan Field Station, 1963-1964 (Yields are from only 1 replication)

Lime and fertilizer treatment*	Yield of soybeans in bushels per acre				
	Memphis silt loam		Loring silt loam		Both soils 2-yr. av.
	1963	1964	1963	1964	
No lime, no fertilizer	11.9	15.2	15.4	17.2	14.9
No lime, fertilized	20.7	20.8	16.6	24.6	20.7
2 tons lime/A., fertilized	32.4	36.7	28.8	36.8	33.7
4 tons lime/A., no fertilizer	30.7	37.2	29.8	34.7	33.1
4 tons lime/A., fertilized	33.8	38.4	30.8	36.2	34.8

*Lime was applied on April 2, 1963, one-half before turning and one-half after turning. Rate of fertilization was 0-40-40 (N-P₂O₅-K₂O) per acre in 1963 and 0-30-30 in 1964; fertilizer banded in row.

yields only slightly higher than those obtained at the 2-ton rate. It is of interest to note, however, that the 4-ton lime treatment, unfertilized, produced almost as much soybeans as the fertilized 2- and 4-ton lime treatments.

Soil tests on samples collected before the experiment was started gave the following results: Memphis soil, pH=5.2, P=7 (low), K=240 (high); Loring soil, pH=5.2, P=6 (low), K=170 (medium). By December 1963, about 8 months after liming, soil pH values had risen to 6.1-6.2 on the limed Memphis soil and to 6.2-6.5 on the limed Loring soil. A further rise in pH was observed on the limed Loring soil when tests were made on samples collected in January 1965, with values in the range 6.4-6.7. The pH of the limed Memphis soil remained unchanged.

LIME-FERTILIZER EXPERIMENT ON GRENADA-HENRY SOIL

An experiment was started at the Milan Field Station in 1964 on an area that is largely Henry silt loam but which contains some Grenada silt loam. Soil tests on samples collected in December, 1963

indicated a pH range of 5.1 to 5.7, a phosphorus level of 3 to 6 pounds of P (very low), and a potassium level of 60 to 70 pounds of K (very low).

Part of the area was limed at the rate of 2 tons per acre on April 18, 1964. Fertilizer was applied at two rates: 0-30-30 and 0-60-60 (N-P₂O₅-K₂O) pounds per acre, banded in the row. Unlimed and unfertilized checks were also provided. Soybeans were planted on May 25. Yield data are presented in Table 9.

Yields ranged from 25.7 bushels on the unlimed, unfertilized check to 39.3 bushels on the limed treatment, fertilized at the higher rate.

Table 9.—Yields of soybeans (Lee variety) in a lime-fertilizer experiment on a Grenada-Henry soil at Milan Field Station, 1964
(Yields are averages of 2 replications)

Lime treatment	Yield of soybeans in bushels per acre			
	No fertilizer	Fertilized 0-30-30/A.	Fertilized 0-60-60/A.	Average
limed 2 tons/A.	35.8	38.5	39.3	37.9
Unlimed	25.7	31.5	33.8	30.3
Average	30.8	35.0	36.5	...

The data indicate about a 7-bushel increase from lime and about a 5-bushel increase from fertilization. The higher rate of fertilization showed about a 1-bushel increase over the lower rate of fertilization.

Tests made on soil samples collected from the limed area in January 1965 gave pH values in the range 5.8-6.1.

FERTILIZER EXPERIMENTS ON SOYBEANS

Three fertilizer experiments were conducted on soybeans in 1960 and 1961 to study the separate effects on nitrogen, phosphorus, and potassium on yield. Acre rates of fertilization were 0, 30, and 60 pounds of N and 0, 40, 80, 120, and 160 pounds both of P₂O₅ and K₂O. The fertilizers were applied broadcast each year, followed by bedding. Lime was not a variable in these three experiments; it was applied, however, at a uniform rate of 6 tons per acre in two of them. The yields obtained with the various fertilizer treatments for the 2-year period are shown in Table 10. The experiment on Loring silt loam was located in the same field and adjacent to the lime-fertilizer experiment already discussed (see Table 1); the same was true for the experiment on Tunica clay loam (see Table 2). Soil test values on these two soils have already been given. The experiment on Collins silt loam was located at Fort Pillow State Farm; this ex-

periment was not limed. Soil tests on the Collins soil gave the following results: pH=5.8, P=27 (high), K=125 (low).

No significant yield response to nitrogen, phosphorus, or potassium was obtained in either year of any of the three experiments. Although

Table 10.—Yields of soybeans (Lee variety) in a nitrogen-phosphorus-potassium fertilizer experiment on 3 soils, 1960-1961

(All yields are averages of 4 replications)

Fertilizer treatment (pounds per acre)			Yields of soybeans in bushels per acre					
			Loring silt loam		Tunica clay loam		Collins silt loam	
N	P ₂ O ₅	K ₂ O	1960	1961	1960	1961	1960	1961
0	0	0	29.2	29.5	45.8	40.4	34.7	29.7
0	120	120	26.3	29.5	45.3	39.2	41.2	37.1
30	120	120	29.4	29.3	43.8	36.7	35.3	37.0
60	120	120	26.8	30.7	41.1	37.2	34.7	33.3
0	0	120	28.5	26.8	38.1	32.0	33.2	29.0
0	40	120	28.2	28.1	48.0	40.2	37.8	34.9
0	80	120	27.3	27.6	35.5	31.5	35.3	28.0
0	160	120	29.0	29.6	38.2	32.6	...	...
0	120	0	29.3	28.8	39.6	36.0	29.7	27.9
0	120	40	27.4	28.1	40.5	33.2	36.2	32.1
0	120	80	26.6	29.4	41.5	39.8	35.1	32.8
0	120	160	28.3	26.7	42.0	38.5	37.0	34.9
Yearly av. yield			28.0	28.7	41.6	36.4	35.5	32.4
C. V. (%)			9.4	9.6	17.7	16.7	14.4	16.0

there was considerable variation in average yields among the various treatments on the Tunica and Collins soils in both years, the differences are not significant, due to the rather wide variation in yield among the four replications of the various treatments. The high coefficients of variability (C.V.), ranging from 14.4% to 17.7%, are an indication of this variation. The coefficients of variability are lower in the experiment on the Loring soil but the spread between the treatment with the lowest yield and the treatment with the highest yield was only 3 to 4 bushels.

Attention is called to the fact that in both years the Tunica soil produced the highest yields and the Loring soil the lowest, while the yields on Collins were intermediate.

BORON ON SOYBEANS

Although boron deficiency has not been reported in soybeans under field conditions, responses by cotton to boron on heavily-limed soils suggested that this micronutrient be tested on soybeans

where the soil had been limed at high rates. Therefore, beginning in 1962 boron was superimposed on the lime-fertilizer experiments on Loring silt loam (see Table 1) and Tunica clay loam (see Table 2) by applying boron at a rate of one-half pound of B per acre on one-half of each plot. The other half received no boron. These boron applications were made in 1962, 1963, and 1964 on the Loring soil, and in 1962 on the Tunica soil.

The results were as follows:

<u>Soil type</u>	<u>Year</u>	<u>Bushels of soybeans per acre</u>	
		<u>Boron</u>	<u>No boron</u>
Loring silt loam	1962	37.4	37.0
	1963	30.0	29.9
	1964	26.9	26.1
Tunica clay loam	1962	40.3	41.5

From these results it is concluded that boron had no effect on the yields of soybeans regardless of whether the soil was limed at rates of 6 and 12 tons per acre or was not limed.

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