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SOIL FERTILITY EXPERIMENTS WITH PEANUTS IN 1968

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THE COOPERATIVE RESEARCH PROGRAM which was begun in 1967 between farmers and Auburn University to better define soil fertility requirements of peanuts and to improve correlation between fertilizer requirements and soil-test values was continued in 1968. The cooperation of several county Extension personnel contributed to the success of the program.

Thirty-three experiments were conducted in 1968 in 4 counties (Covington, Geneva, Henry, and Houston). Twenty-three experiments were harvested (18 in Geneva, 3 in Houston and 1 each in Covington and Henry).

The experimental area on each farm was divided into either 8 or 12 plots, each plot being 4 rows wide and 100 feet long. Each farmer fertilized, planted, cultivated, dusted, and harvested peanuts within all plots the same as those in the remainder of his field. Four plots of each experiment received no additional treatment; the remaining plots received one of the following treatments: (1) a complete fertilizer, (2) potassium, (3) calcium, (4) magnesium, (5) zinc, or (6) boron.

FERTILIZER-RATE EXPERIMENTS

Residual versus direct application. Three experiments were conducted to determine if fertilizer should be applied directly to peanuts when peanuts were following a crop that had been amply fertilized. Corn was the preceding crop in all 3 experiments. The experimental fertilizer used within the test area was the same as that used by the farmer on the rest of his field. It was drilled at planting by the farmer on 4 of the experimental plots; the other 4 plots received no fertilizer. One experiment was with the Florigiant variety and two were with the Early Runner. All 3 soils tested "medium" in both P and K. The results in Table 1 show a definite yield increase for fertilizer in one experiment (Baxley farm), a possible yield increase in a second experiment

TABLE 1. EFFECT OF FERTILIZER ON YIELD AND SMK OF EARLY RUNNER PEANUTS IN 1968

Farmer	County	Soil type	Per acre soil-test values			Per acre rate of farmer's fertilizer	Per acre rate of experiment fertilizer	Yield per acre		SMK	
			pH	P	K			No extra fert.	fert.	No extra fert.	Extra fert.
				Lb.	*Lb.*	*Lb.*	*Lb.*	*Lb.*	*Lb.*	*Pct.*	*Pct.*
Residual fertilizer experiment											
E. Grace[1]	Geneva	Ruston sandy loam	5.7	27 (M)	67 (M)	None	450 of 0-14-14	2,080	2,130	68	66
L. Cotton	Geneva	Norfolk sandy loam	5.8	34 (M)	76 (M)	None	250 of 6-12-24	2,780	2,890	69	68
H. Baxley	Geneva	Norfolk sandy loam	5.1	32 (M)	110 (M)	None	185 of 6-24-24	**2,230***	**2,470***	60	59
Broadcast fertilizer experiment											
T. Seay	Geneva	Norfolk sandy loam	5.6	59 (H)	162 (H)	300 of 0-10-30	150 of 7-21-14	2,520	2,500	69	67
G. B. Register	Geneva	Norfolk sandy loam	5.9	90 (H)	136 (H)	500 of 0-10-20	300 of 4-12-12	1,770	1,720	69	67

[1] Florigiant variety; per cent "extra-large-kernel" was 35 for "farmer's fertilizer" and 33 for extra "experimental fertilizer."
* Yields in bold-face type indicate yields on fertilized plots were statistically greater than on unfertilized plots.

TABLE 2. THE EFFECT OF EXTRA POTASSIUM AT RATE OF 50 POUNDS PER ACRE OF K (60 POUNDS K_2O) ON YIELD AND PER CENT SOUND MATURE KERNEL (SMK) OF PEANUTS IN 1968

Farmer	County	Soil type	Soil-test K per acre	Per acre rate of farmer's fertilizer	Gypsum added	Yield per acre		SMK	
						No extra K	Extra K	No extra K	Extra K
			Lb.	*Lb.*		*Lb.*	*Lb.*	*Pct.*	*Pct.*
A. Barnes	Geneva	Orangeburg sandy loam	144 (H)	275 of 0-10-20	No	1,510	1,490	69	70
G. Crowley	Houston	Orangeburg sandy loam	130 (H)	250 of 6-24-24	Yes	3,680	3,600	66	68
J. D. Donaldson	Geneva	Norfolk sandy loam	102 (M)	400 of 2-6-12	No	1,640	1,570	61	59
G. Outlaw	Geneva	Norfolk sandy loam	136 (H)	200 of 0-10-30	No	3,510	3,400	71	72
E. A. Stewart	Geneva	Ruston sandy loam	84 (M)	250 of 0-10-20	No	2,320	2,160	69	68

(Cotton farm), and no yield increase in the third experiment (Grace farm).

Two rates of fertilizer. Two experiments compared two rates of fertilizer applied directly to peanuts without regard to fertilizer applied to the preceding crop. Both soils tested "high" in P and K and probably needed no fertilizer to produce maximum yields in 1968. However, a maintenance application of fertilizer is recommended. Frequently, farmers add considerably more than the maintenance rate. The lowest fertilizer rate on the Register farm was a broadcast application of 500 lb. per acre of 0-10-20; the lowest rate on the Seay farm was a broadcast application of 150 lb. per acre of muriate of potash plus 500 lb. per acre of basic slag. Neither of these experiments was designed to determine if the broadcast application of fertilizer was necessary for maximum yield. They were intended to show that peanuts growing on a soil testing "high" surely did not need more than a broadcast maintenance fertilizer application. One-half of the plots received additional fertilizer in the drill at planting time; the other half received only a broadcast fertilizer. The results in Table 1 show that the additional fertilizer drilled at planting time failed to increase either yields or per cent SMK on either farm. The broadcast application was ample fertilizer for maximum yield as well as for maintenance of soil phosphorus and potassium.

Whereas fertilizer either had no effect on yield or increased yield slightly, there appeared to be a general trend toward lower SMK values at the higher fertilizer rates. Lower SMK values would offset the value of a slight yield increase from fertilizer and, of course, decrease the value of harvested nuts when there is no yield increase.

POTASSIUM (K) EXPERIMENTS

Since soils of the peanut area in Alabama are generally "low" to "medium" in soil K, a tendency has developed to add a relatively high rate of K directly to the peanut crop regardless of the soil-test K level. The merit of this practice has not been adequately determined. Because of the potentially detrimental effect of high soil-K on available soil-Ca (so essential for normal kernel development), these experiments were designed to determine if higher rates of K fertilizer would, in fact, reduce yield or per cent SMK. Five of these experiments were harvested, and Early Runner was the variety in each case.

Soils were selected that tested "medium" or "high" in soil K and to which the farmer had fertilized his peanuts with 40 to 50 lb. per acre of K (48 to 60 lb. K_2O) prior to or at planting time. The experimental K was then topdressed over the row at a per acre rate of 50 lb. (60 lb. K_2O) soon after seedling emergence. Furthermore, gypsum was not top-dressed to supply extra Ca in 4 of the 5 experiments. Gypsum would be expected to counteract any detrimental effect caused by high K fertilizer.

The data in Table 2 show that yields ranged from 1,500 to 3,700 lb. per acre, and in no case was there a yield increase or SMK increase from the extra K fertilizer. Neither was there a particular disadvantage. Although there appeared to be a slight trend toward a yield reduction from the extra K, this trend was far from being conclusive.

CALCIUM (Ca) EXPERIMENTS

Six experiments were harvested in which calcium was applied as a topdressing at early blooming: five at a rate of 1,000 lb. of gypsum per acre and one at 500 lb. (Either rate is considered to be in excess of the amount needed for these soils). Soil-test Ca ranged between 160 lb. per acre (low) and 464 lb. per acre (high), and soil pH ranged between 5.0 and 5.9. Results of the calcium experiments are summarized in Table 3.

The Early Runner variety was planted in 5 experiments. Yield was increased by gypsum in only one case. On soils testing "medium" or "high" in Ca,

TABLE 3. THE EFFECT OF TOPDRESSING CALCIUM AT RATE OF 1,000 POUNDS PER ACRE OF GYPSUM ON YIELD AND PER CENT SOUND MATURE KERNEL (SMK) OF PEANUTS IN 1968

Farmer	County	Soil type	Soil pH	Soil-test Ca per acre	Yield per acre		SMK	
					No Gypsum	Gypsum	No Gypsum	Gypsum
				Lb.	*Lb.*	*Lb.*	*Pct.*	*Pct.*
			Early Runner variety					
H. Anderson	Covington	Tifton sandy loam	5.6	315 (M)	2,570	2,530	65	65
A. Barnes	Geneva	Orangeburg sandy loam	6.0	400 (H)	1,510	1,570	69	70
L. Davis	Geneva	Kalmia loamy sand	5.2	195 (L)	**2,930***	**3,350***	68	69
T. Davis[1]	Geneva	Norfolk sandy loam	5.6	319 (M)	2,930	3,090	68	66
G. B. Register	Geneva	Norfolk sandy loam	5.9	464 (H)	2,410	2,290	69	68
			Florigiant variety					
C. Hughes[2]	Houston	Tifton fine sandy loam	5.0	160 (L)	**2,330***	**2,840***	**55***	**68***

[1] Experimental rate of gypsum was 500 lb./A.
[2] Per cent extra-large-kernel was 26 for "no gypsum" and 34 for "gypsum" treatment.
* Yield and percentages SMK in bold-face type indicate yields on gypsum plots statistically greater than on non-gypsum plots.

there was no response to added gypsum. However, on the L. Davis farm, which tested "low" in Ca (195 lb. per acre), there was a 420-lb. per acre yield increase from topdressing with gypsum.

The Florigiant variety was planted in one experiment. It was on a soil that tested "low" in Ca (160 lb. per acre). Topdressing with gypsum increased yield by 510 lb. per acre. Gypsum also increased SMK by 13 per cent and "extra-large-kernels" by 8 per cent on this farm.

BORON (B) EXPERIMENTS

Three experiments with boron were harvested. Data in Table 4 show that neither yield, SMK, nor per cent "hollow-heart" was affected by boron fertilizer in any of the 3 experiments.

Since "hollow-heart" is the visual symptom of B deficiency in peanuts, the incidence of this physiological disorder was measured in all other experiments, as well as in the B-experiments. Although 1968 was considered to be an unusually dry year and B deficiency has been reported to be worse during droughts, there were few incidences of "hollow-heart." In no case did "hollow-heart" exceed 1 per cent of the sample.

Peanuts from each plot of every experiment was sampled and checked for "hollow-heart." There was no "hollow-heart" on any plot where soil-test B was more than 0.14 lb. per acre. Seven experiments had soil-test B levels of 0.14 lb. per acre or less, and the incidence of "hollow-heart" for each of these "low" boron soils, along with soil-test B levels, are listed in Table 5. Where application of boron was made

TABLE 4. THE EFFECT OF BORON APPLIED AT RATE OF 1 POUND PER ACRE OF B ON YIELD, PER CENT SOUND MATURE KERNEL (SMK), AND PER CENT HOLLOW-HEART OF PEANUTS IN 1968

Farmer	County	Soil type	Soil-test B per acre	Yield per acre		SMK		Hollow-heart	
				No B	Added B	No B	Added B	No B	Added B
			Lb.	*Lb.*	*Lb.*	*Pct.*	*Pct.*	*Pct.*	*Pct.*
M. L. Burch	Geneva	Norfolk sandy loam	0.20	3,340	3,190	72	70	0.0	0.0
T. Davis	Geneva	Norfolk fine sandy loam	0.16	2,930	2,910	65	64	0.0	0.0
L. Davis[1]	Geneva	Kalmia loamy sand	0.10	2,930	3,200	68	67	0.0	0.0

[1] General peanut field was dusted by airplane with B containing fungicide, which probably drifted onto experimental area.

TABLE 5. THE OCCURRENCE OF "HOLLOW-HEART" IN ALL EXPERIMENTS WITH SOIL-TEST B OF 0.14 LB. PER ACRE OR LESS

Farmer	Soil type	Percentages of plots with "hollow-heart"	Boron added	Soil-test B per acre	Soil-test Ca per acre	Soil pH
		Pct.		*Lb.*	*Lb.*	
		Florigiant variety				
C. Hughes	Tifton fine sandy loam	8	Yes	0.14	160	5.0
J. Hardwick	Norfolk sandy loam	37.5	No	0.12	464	5.8
		Early Runner variety				
E. A. Stewart	Ruston sandy loam	0	Yes	0.14	470	6.0
L. Cotton	Norfolk sandy loam	0	Yes	0.14	452	5.8
H. Anderson	Tifton sandy loam	50	No	0.14	315	5.6
A. Barnes	Orangeburg sandy loam	33	No	0.11	848	6.0
L. Davis	Kalmia loamy sand	0	Yes[1]	0.10	195	5.2

[1] Probably supplied B through drift from airplane-applied B-containing fungicide to remainder of peanut field.

TABLE 6. THE EFFECT OF ADDING MAGNESIUM SULFATE AT THE RATE OF 20 POUNDS PER ACRE OF MG ON YIELD, PER CENT SOUND MATURE KERNELS (SMK), AND EXTRA LARGE KERNELS (ELK) OF PEANUTS IN 1968

Farmer	County	Soil type	Soil-test Mg per acre	Yield		SMK		ELK	
				No Mg	Added Mg	No Mg	Added Mg	No Mg	Added Mg
			Lb.	*Lb.*	*Lb.*	*Pct.*	*Pct.*	*Pct.*	*Pct.*
J. Hardwick	Henry	Norfolk sandy loam	54 (H)	1,590	1,660	67	65	27	23
C. Hughes	Houston	Tifton fine sandy loam	15 (L)	**2,330***	**1,890***	**55***	**50***	**26***	**19***

* Yields and percentages in bold-face type are statistically different.

by the farmer, there was no occurrence of "hollow-heart"; where no boron was added to these "low" boron soils, "hollow-heart" occurred in each case. The only exception to this was a single plot (out of 12) on the Hughes farm. The soil boron levels that resulted in "hollow-heart" in 1968 agree very closely with the results found in 1967 on similar experiments.

Since the availability of soil B has been reported to be affected by the level of soil Ca and soil pH, these values have been included in Table 5. In these experiments, however, there appears to have been no relationship between B deficiency and either soil Ca or soil pH.

MAGNESIUM (Mg) EXPERIMENTS

Two experiments with magnesium were harvested, both with the Florigiant variety, one in Houston and one in Henry County. Magnesium sulfate was used as a topdressing in the row soon after planting at the rate of 20 lb. per acre of Mg. The Mg level was "high" (54 lb. per acre) on one soil and "low" (15 lb. per acre) on the other soil. Results of the Mg experiments are summarized in Table 6 and show that the extra Mg did not increase yield but tended to reduce both SMK and extra-large-kernel (ELK) percentages. The experiment on the Hughes farm showed a reduction in yield where Mg was added. This soil was "low" in Ca, had a soil pH of only 5.0, and gypsum was not added to correct Ca deficiency. Extra Mg might be expected to reduce yields under these conditions because it lowers Ca availability and aggravates Ca deficiency.

ZINC (Zn) EXPERIMENTS

Two experiments were harvested in which zinc was applied as a topdressing in the row soon after seedling emergence at the rate of 10 lb. per acre of zinc sulfate. Both were conducted in Geneva County on Norfolk sandy loam soils. Relatively high yields were obtained in both experiments, and zinc fertilizer had no effect on yield or quality of nuts, Table 7.

SUMMARY

Results of experiments in 1968 showed a few responses to fertilizer treatments. A complete fertilizer increased yield in one out of 3 experiments; extra potassium tended to decrease yield but this was not conclusive; gypsum increased yield on 2 soils "low" in calcium but did not on 4 soils testing "medium" or "high"; "hollow-heart" (B deficiency) occurred on soils "low" in soil B and not fertilized with boron; magnesium fertilizer was detrimental in one out of two experiments; zinc fertilizer was without effect.

Similar experiments on farmer's fields are planned for 1969 in the continuing effort to improve the basis for fertilizing peanuts.

TABLE 7. THE EFFECT OF ZINC APPLIED AT RATE OF 10 POUNDS PER ACRE OF ZINC SULFATE ON YIELD AND PER CENT SOUND MATURE KERNEL (SMK) OF PEANUTS IN 1968

Farmer	County	Soil type	Soil-test Zn per acre	Yield per acre		SMK	
				No Zn	Added Zn	No Zn	Added Zn
			Lb.	*Lb.*	*Lb.*	*Pct.*	*Pct.*
E. Baxley	Geneva	Norfolk sandy loam	2.5	2,510	2,570	60	59
L. Cotton	Geneva	Norfolk sandy loam	5.0	2,650	2,710	67	69