BULLETIN 302 DECEMBER 1956

FERTILITY REQUIREMENTS *of* RUNNER PEANUTS *in* *Southeastern Alabama*

AGRICULTURAL EXPERIMENT STATION
of the ALABAMA POLYTECHNIC INSTITUTE
E. V. Smith, Director
Auburn, Alabama

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FIRST PRINTING 6M, DECEMBER 1956

Fertility Requirements of Runner Peanuts in Southeastern Alabama

C. E. SCARSBROOK, Associate Soil Chemist
J. T. COPE, JR., Associate Agronomist

PEANUTS ARE GROWN on more than 200,000 acres in Alabama. Approximately 90 per cent of this acreage is in nine counties in the southeastern portion of the State.

Most of the soils on which peanuts are grown have a sandy surface with a sandy clay subsoil. In their original state these soils had a very low content of phosphorous, whereas the content of potassium, calcium, and organic matter varied from medium to low. The phosphorus content has been altered by past fertilization practices, and it is now generally medium to high. Large annual applications of fertilizer are required for profitable production of most crops on these soils.

Fertilizer requirements of peanuts have been difficult to determine because peanuts produce reasonably satisfactory yields at lower fertility levels than most other crops. However, they are extremely "hard on the soil" when grown with little or no fertilizer added. Nutrient deficiencies are not apparent until the soil has been seriously depleted of one or more essential elements. Exceptionally high rates of fertilizer are required for satisfactory production of cotton and other crops on land that has been used for peanuts that were not well fertilized, especially with potassium and calcium.

Based on many years research in Alabama, the Agricultural Experiment Station of the Alabama Polytechnic Institute makes the following general recommendations for peanuts: **(1) No nitrogen should be used for peanuts, and (2) fairly heavy rates of potash and lime should be applied.** Fertilizer and liming practices currently in use in the State are in sharp contrast to these recommendations. Blackstone *(1)* in a survey of 135 farms in the peanut area of Alabama in 1950 found the following: (a) 86 per cent of the acreage was fertilized with some mixed fertilizers, (b) more than 60 per cent of farmers used fertilizers containing nitrogen on peanuts, (c) average amounts of fertilizer nutrients applied per acre to peanuts were 8 pounds of N, 32 pounds of P_2O_5, and 22 pounds of K_2O, (d) only 20 per cent of the farmers surveyed had applied lime or basic slag in the last 5 years, and (e) 10 per cent of the farmers applied no fertilizer of any kind to peanuts.

The purpose of this bulletin is to summarize the results of fertility experiments with runner peanuts. These experiments were conducted on the Main Station, Auburn; the Wiregrass Substation, Headland; and cooperatively with farmers near Auburn and in southeastern Alabama.

NITROGEN

The earliest published research by this Station on nitrogen fertilization of peanuts dates back to 1917. In that year Duggar et al. *(6)* concluded that profitable yield increases were not obtained from nitrogen fertilization.

Data from cooperative tests, Table 1, show no advantage from applying up to 18 pounds of nitrogen. This table is a record of 38 tests on soils of the Norfolk series, which is one of the principal soils used for peanut production in southeastern Alabama.

Sturkie et al. *(7)* showed an important difference in the fertility response of Spanish and runner peanuts. They consistently obtained responses from nitrogen on Spanish peanuts, with one field giving an increase of 1,016 pounds of peanuts from 120 pounds of nitrogen.

TABLE 1. FERTILIZER EXPERIMENTS IN COOPERATION WITH ALABAMA FARMERS, 38 EXPERIMENTS,[1] 1938-1939

Treatment	Fertilizer and lime applied		Peanut yield
	Material[2]	Per acre	per acre
No.		*Lb.*	*Lb.*
1	None		963
2	Basic slag	300	1,110
	Muriate of potash	25	
3	Basic slag	300	1,081
4	Colloidal phosphate	300	1,041
5	Superphosphate	150	1,122
6	0-12-6 grade	200	1,122
7	0-12-6 grade	400	1,104
8	3-8-5 grade	300	1,120
9	6-8-4 grade	300	1,143

[1] Tests conducted by J. T. Williamson on soils of the Norfolk Group.

[2] Analysis of materials used: Basic slag, 8 per cent P_2O_5; superphosphate, 16 per cent P_2O_5; collodial phosphate 20 per cent P_2O_5; and muriate of potash, 50 per cent K_2O.

TABLE 2. EFFECT OF FERTILIZERS AND AMENDMENTS ON A NORFOLK SANDY LOAM DEPLETED BY 17 YEARS' CONTINUOUS CROPPING TO PEANUTS WITHOUT FERTILIZATION, WIREGRASS SUBSTATION, 1949-55

Treatment	Treatments in pounds per acre of N, P_2O_5, K_2O + amendments	Yield per acre							
		1949	1950	1951	1952	1953	1954	1955	Average
No.		*Lb.*	*Lb.*	*Lb.*	*Lb.*	*Lb.*	*Lb.*	*Lb.*	*Lb.*
1	None	448	273	207	367	290	38	171	256
2	M.E.[1]	581	228	55	256	182	25	211	220
3	0-32-0 + M.E.	443	407	107	681	399	91	391	360
4	0-0-100 + M.E.	861	735	70	391	254	29	316	379
5	0-32-100 + M.E.	747	1,037	89	683	399	73	450	497
6	0-32-100 + 500 lb. gypsum + M.E.	1,351	2,371	619	1,626	1,125	391	864	1,192
7	0-32-100 + 1 ton lime in 1949 and 1954 + M.E.	1,737	2,152	495	876	653	465	1,314	1,099
8	0-32-100 + 500 lb. gypsum + 1 ton peanut hay + M.E.	1,661	2,143	611	2,161	1,198	587	1,325	1,369
9	32-32-100 + 500 lb. gypsum + M.E.	1,770	2,399	510	1,509	1,270	487	1,100	1,292
10	0-32-100 + 500 lb. gypsum + 1 ton grass hay + M.E.	1,603	2,100	652	2,143	1,125	483	1,274	1,340

[1] Minor element mixture at rate of 5 lb. borax, 5 lb. copper sulfate, 15 lb. manganese sulfate, 10 lb. zinc sulfate, 100 lb. magnesium sulfate, 15 lb. ferrous sulfate, ½ lb. sodium molybdate per acre.

TABLE 3. EFFECT OF FERTILIZERS AND AMENDMENTS ON YIELDS OF PEANUTS GROWN ON NORFOLK SANDY LOAM, MAIN STATION, 1950-55[1]

Treat-ment	Treatment[2]	Yield of sound mature kernels per acre						
		1950	1951	1952	1953	1954	1955	Average
No.		*Lb.*	*Lb.*	*Lb.*	*Lb.*	*Lb.*	*Lb.*	*Lb.*
1	No fertilizer, lime, or other treatment	1,772	1,051	1,685	1,027	197	583	1,052
2	PK	1,711	952	1,489	1,074	280	718	1,037
3	PKL	1,856	881	1,461	1,771	278	1,191	1,240
4	PKLBS	1,916	1,103	1,412	2,043	279	1,522	1,379
5	PKLG	1,830	931	1,603	1,793	333	1,337	1,304
6	PKLG, all P & K broadcast before planting	1,722	1,086	1,615	2,029	354	1,494	1,383
7	PKLG, all P & K in row ahead of planting	1,835	1,120	1,778	1,849	318	1,144	1,341
8	PKLG, vines returned to land	1,971	1,046	1,333	1,979	258	1,461	1,341
9	NPKLG	1,868	1,159	1,546	1,797	314	1,445	1,355
10	PKLG + 200 lb. 0-16-8 every 3 years	1,752	874	1,635	1,795	279	1,190	1,254
11	PKLG + minor element mixture each yr. + 2,000 lb. 0-16-8 every 3 years	1,722	1,028	1,518	1,679	299	1,138	1,231
12	PKLG + 3 ton corn stalks every second year	1,978	1,343	1,723	1,802	303	1,416	1,428
13	PKLG + 6 ton corn stalks every second year	2,103	1,190	1,547	2,168	352	1,701	1,510
14	PKLG + 12,500 lb. green legumes each year	1,891	1,150	1,778	2,101	328	1,547	1,466
15	PKLG + 25,000 lb. green legumes each year	1,998	1,233	1,915	2,135	229	1,074	1,431

[1] Test conducted by D. G. Sturkie.

[2] PK = 64 lb. P_2O_5 and 32 lb. K_2O bedded on + 88 lb. K_2O as sidedressing; L = 2,000 lb. dolomite at beginning of experiment and every 6 years thereafter; N = 64 lb. nitrogen each year as sidedressing; G = 400 lb. gypsum each year; and BS = 400 lb. basic slag applied at blooming time.

Their data support the conclusion that runners do not respond to nitrogen, though at one location they obtained a response to 20 pounds of nitrogen; this response was not obtained at the 40-pound nitrogen rate. Nitrogen had no effect on quality of either Spanish or runner peanuts.

Rogers* obtained no response from nitrogen on yield or quality of runner peanuts in 15 cooperative tests in 1943-44.

Given in Table 2 are the results that show the effects of fertilizers and amendments on land following peanuts grown without fertilizer from 1932 to 1948. Nitrogen had little effect on yields when applied with phosphate, potash, and gypsum even on this severely depleted soil.

Comparison of treatments 5, 6, or 7 with 9 in Table 3 gives little indication of a return from nitrogen in 6 years at Auburn on Norfolk sandy loam.

Peanuts receiving 24 pounds of nitrogen, 32 pounds of P_2O_5, and 16 pounds of K_2O annually in a test at the Wiregrass Substation during 1936-43 averaged 1,617 pounds of peanuts. Plots receiving no nitrogen but the same phosphate and potash averaged 1,640 pounds.

The effect of nitrogen on peanuts was studied in 18 cooperative tests in the commercial peanut growing area of Alabama between 1952 and 1954. Comparison of treatments 7 and 8 with 4 in Table 4 shows that nitrogen had no effect on average yields. At none of the 18 test locations did results show a response to nitrogen either in yield or in percentage sound mature kernels (SMK).

It is often observed that nitrogen causes young peanuts to be greener in color and to grow faster than companion plots without nitrogen. Sometimes the plots receiving nitrogen produce more hay, though this is by no means the rule. Results of experimental work in Alabama show little or no effect of nitrogen additions on yield or quality of runner peanuts.

* Unpublished annual reports of H. T. Rogers, 1943 and 1944.

TABLE 4. AVERAGE YIELDS AND PERCENTAGES SOUND MATURE KERNELS (SMK) FROM 18 COOPERATIVE TESTS IN COFFEE, DALE, GENEVA, HENRY, AND HOUSTON COUNTIES, 1952-54

Treatment	Treatment: Rate per acre			1952 5 tests		1953 8 tests		1954 5 tests		Average 1952-54	
	N, P_2O_5, K_2O	Gypsum	Minor elements	Yield per acre	SMK	Yield per acre	SMK	Yield per acre	SMK	Yield per acre	SMK
No.	*Lb.*	*Lb.*	*Lb.*	*Lb.*	*Pct.*	*Lb.*	*Pct.*	*Lb.*	*Pct.*	*Lb.*	*Pct.*
1	0-0-0			605	54	1,267	54	744	57	938	55
2	0-40-60			736	53	1,274	54	759	55	982	54
3	0-0-0	500		758	59	1,329	60	784	60	1,019	60
4	0-40-60	500		838	58	1,488	58	823	61	1,123	59
5	0-40-0	500		778	59	1,327	59	728	61	1,008	60
6	0-40-30	500		792	59	1,469	60	816	61	1,100	60
7	20-40-60	500		840	59	1,499	59	778	61	1,116	60
8	40-40-60	500		807	58	1,505	58	768	60	1,106	59
9	20-40-60	500	150[1]	812	60	1,536	59	878	61	1,152	60
	LSD (05)			107	5.0	95	2.4	N.S.	2.7	88	1.8

[1] Minor element mixture at rate of 100 lb. magnesium sulfate, 15 lb. manganese sulfate, 15 lb. ferrous sulfate, 10 lb. zinc sulfate, 5 lb. copper sulfate, 3 lb. borax, and ½ lb. sodium molybdate per acre.

PHOSPHORUS

An increase of 147 pounds of peanuts was obtained from 38 pounds of P_2O_5 in 9 cooperative tests between 1911 and 1921. Some of these tests were reported in 1917 by Duggar et al. *(4)*, who concluded that profitable increases were obtained from superphosphate.

In a comparison of 32 pounds of P_2O_5 from basic slag with no P_2O_5 during 1936-40 at the Wiregrass Substation, yields were 1,444 and 1,431 pounds, respectively. When the source of P_2O_5 was changed to superphosphate, the 1941-43 yields were 1,033 and 1,064 pounds.

Results in Table 1 show an increase of 159 pounds of peanuts from 24 pounds of P_2O_5 in 38 cooperative tests, 1938-39.

P_2O_5 at the 32-pound rate on soil of low fertility increased the per acre yield from 256 to 360 pounds, Table 2. Since this soil was deficient in several essential nutrients, adding only one of the deficient elements would not be expected to greatly increase yields.

Averages of the 1952-54 cooperative tests given in Table 4 indicate no response from phosphorus. None of the individual tests gave a response to phosphorus even when sufficient calcium was added as gypsum.

Most of the experiments reported in this section do not permit evaluation of P_2O_5 on peanut production when ample quantities of the other essential elements were added. These tests would show a response to P_2O_5 if it were the most deficient element.

The failure to obtain a response to P_2O_5 in experiments during recent years is probably due to the build-up of soil phosphorus since World War II because of application of larger amounts of P_2O_5 than that removed by row crops. These soils in their native state were low in P_2O_5 and before heavy phosphorus fertilization, responses were obtained to this element. Farmers who fertilize peanuts nearly always apply more P_2O_5 than the crop removes, since both plants and a ton of peanuts remove only about 15 pounds of P_2O_5. Phosphorus does not leach to any appreciable extent and the amount in excess of that used by the plant accumulates in the soil. However, continuous cropping to peanuts without addition of phosphorus fertilizers would lead to reduced yields.

POTASSIUM

Most of the experiments previously cited also tested the response of peanuts to potassium. As might be expected, results varied widely with location and past fertilization practices. In early studies Duggar et al. *(4)* found that only small yield increases resulted from 24 pounds of potash and concluded that potash fertilization was unprofitable. Similarily no response to potash was obtained by Williamson in cooperative tests in 1938-39, Table 1. Up to 24 pounds of potash applied with 24 pounds of phosphate gave no higher yields than the phosphate alone. However, Rogers* found in 15 cooperative tests during 1943-44 that 30 pounds of potash gave a response and that this amount was usually sufficient for peanuts. The 120-pound rate of potash reduced the shelling percentage four points.

In view of the large amounts of potassium removed by peanuts and the generally low potassium status of these soils, this lack of response needs some explanation. Possible explanations are: (a) the soil's supply of potassium must be depleted to very low levels before responses to potash fertilizers will be obtained; and (b) as the soil is cropped other factors become limiting. A relationship between peanut yields and potash levels in the soil was pointed out by Davis *(2)*. He showed that responses to lime in cooperative tests in southeastern Alabama were often limited by insufficient potash. This relationship is also indicated by a test at the Wiregrass Substation between 1936 and 1943 where basic slag had no effect on yields until potash was applied with the slag, which resulted in an increased yield of 248 pounds.

Where the soil level of essential elements was depleted to low levels by 17 years of continuous peanut cropping without fertilization, 100 pounds of potash applied alone had little effect on yields. These data are given in Table 2. On soils depleted to this extent, good yields could be expected only when calcium, potash, phosphorus, and possibly other elements were added in combination.

In 18 cooperative tests in 1952-54 there was very little increased yield from 0-40-60 pounds per acre (N, P_2O_5, and K_2O) when applied without a source of calcium, Table 4. When applied with gypsum the 0-40-60 yielded 104 pounds more than gypsum alone. Both the 30 and 60 pound rates of potash increased yields but there was little difference in the average increase from the two rates.

Rouse obtained a response to 50 pounds of potash on Norfolk sandy loam at Auburn, Table 5. The 100-pound rate of potash reduced the SMK when no lime was applied, but it had no effect on SMK when either 1 or 2 tons of lime was applied with the potash.

* Unpublished annual reports of H. T. Rogers, 1943 and 1944

TABLE 5. EFFECT OF LIME AND POTASSIUM ON YIELD OF DIXIE RUNNER PEANUTS GROWN ON NORFOLK SANDY LOAM, MAIN STATION, 1950-54[1]

Treatment[2] per acre		Yield of peanuts per acre						SMK
Lime	K_2O	1950	1951	1952	1953	1954	5-yr. av.	5-yr. av.
Lb.	*Lb.*	*Lb.*	*Lb.*	*Lb.*	*Lb.*	*Lb.*	*Lb.*	*Pct.*
0	0	2,890	1,744	2,028	2,041	38	1,748	58
0	25	3,200	1,535	2,734	2,709	45	2,045	58
0	50	3,199	1,826	3,028	3,113	60	2,245	58
0	100	3,251	1,482	3,225	2,329	28	2,063	55
2,000	0	3,217	1,395	2,275	2,321	89	1,859	60
2,000	25	3,360	1,598	2,725	2,997	181	2,172	63
2,000	50	3,970	1,842	2,715	3,058	259	2,369	62
2,000	100	3,628	1,800	3,318	3,403	139	2,458	61
4,000	0	3,485	1,444	2,306	1,852	83	1,834	63
4,000	25	3,621	1,800	2,900	2,819	264	2,281	64
4,000	50	3,583	1,636	2,756	2,940	221	2,227	63
4,000	100	3,390	1,680	3,169	3,333	390	2,392	63

[1] Test conducted by R. D. Rouse.

[2] All plots received 60 lb. P_2O_5 per acre each year.

Any conclusion as to the amount of potash that should be added to peanuts must take into consideration both the yearly response and the long range effect of potash fertilization both on peanut yields and other crops following peanuts. Plants producing a ton crop of peanuts contain about 50 pounds of potash. Since the whole plant is usually removed from the land in Alabama, peanuts "mine" this element from the soil, unless sufficient potash is provided to supply that removed by the plant, leaching, and other losses. Peanuts can obtain sufficient potash for good growth on soils so low in this element that other crops, cotton in particular, would show severe deficiency symptoms.

In Alabama, peanuts seldom respond to more than 30 to 50 pounds of potash, although in exceptional cases response may be obtained from higher rates. When previous crops in rotation with peanuts have been well fertilized with potash, responses to potash on peanuts will seldom be obtained. Two factors must be considered when determining the amount of potash to add to peanuts, namely: (a) In time potash deficiency will occur in soils planted continuously to peanuts, unless enough potash is added to replace that removed by the crop, leaching, and other losses; and (b) peanuts may give maximum yields without added potash, but severe yield reductions may be observed in a succeeding crop unless fertilized with higher than usual amounts of potash.

CALCIUM

The benefit from lime applied to peanuts was shown in one of the earliest bulletins on peanuts published by this Station. Duggar and Funchess *(5)* concluded in 1911 that lime was especially important for runner peanuts, not only because of the large yield increases obtained but also because of the tendency of lime to reduce the percentage of pops.

Davis *(2)* and Davis and Brogden *(3)* emphasized the need for calcium in increasing both yield and quality of peanuts. They showed that "poppy" peanuts were a good indication of the need for calcium.

Rogers *(6)* reported that the critical soil level of calcium for peanuts was between 600 and 800 pounds of calcium carbonate equivalent per acre. He found that lime improved the yield and quality of peanuts and estimated that over 50 per cent of the soils in southeastern Alabama contain less than the critical amount of calcium.

A comparison of sources and methods of applying calcium to peanuts is given in Table 3. Gypsum and basic slag dusted on at blooming time increased the yield an average of 267 and 342 pounds, respectively. Lime broadcast at the beginning of the experiment in 1950 increased the yield 203 pounds per acre.

The data show that the lime applied in 1950 was as effective as the other sources dusted on in the first few years of the experiment. It is apparent that the gypsum and slag treatments were both superior in 1955. This indicates the importance of having periodic soil tests to be certain that an initial lime treatment will supply sufficient calcium. The calcium sources dusted on ensure that sufficient calcium is present in the pegging area at the time needed by the plant.

Data in Table 4 show that the sum of the increases from gypsum alone and 0-40-60 without gypsum was not as great as the increase when gypsum was added with 0-40-60. This interaction between calcium and fertilizer was striking in several of the individual test locations. Such interactions indicate severe soil deficiencies of both elements.

The importance of knowing the lime status of the soil was brought out in experiments at the Main Station, Table 5. The response to lime on plots receiving 100 pounds of potash was much larger in 1953 than in 1950. This is a reflection of the calcium status of the soil during these 2 years.

The plots receiving no lime had a calcium carbonate equivalent of 750 pounds per acre in 1950 but only 400 pounds in 1953. These data also show that, when lime and potash are both deficient, the application of either alone will have little effect on yields.

Calcium in sufficient supply must be present in both the rooting and pegging zone of the plant for maximum production of high quality peanuts. Calcium is found in many fertilizers, in gypsum, and in such liming materials as limestone, basic slag, and oyster shells. Peanuts grow poorly if insufficient calcium is in the root area, but, under the usual fertilizer practices, enough calcium is added in the root area for good plant growth. A more serious problem is the calcium supply in the pegging zone. Calcium is absorbed through the peanut shell, and, if enough calcium is not present around the developing pods, satisfactory yields will not be produced. This explains the satisfactory results obtained from the application of gypsum to peanuts at blooming time.

MINOR ELEMENTS

Minor element deficiencies on peanuts have rarely been reported in Alabama, although in a few experiments large yield increases have been obtained. Davis *(2)* obtained a 1,090-pound increase from a minor element mixture on an overlimed soil. Most of the increase was obtained from the application of zinc. Since overlimed soils are a rarity, response to minor elements from this cause would be unusual.

Comparison of treatments 10 and 11, Table 3, shows no response to minor elements at Auburn.

Minor elements applied alone had no effect on yields on "cropped out" soil, Table 2. On an adjoining test with the same soil history, the minor element mixture increased the average yield 330 pounds per acre from 1950 until 1955, where the plots received 2,000 pounds of limestone in 1950, and 72 pounds of P_2O_5 and 120 pounds of K_2O per acre each year.

Results in Table 4 show no response to minor elements in cooperative tests during 1952-54. One test at one of the 18 cooperative locations gave a large increase from minor elements. On this farm in Dale County, the yield was 457 pounds where 20-40-60 and 500 pounds of gypsum were added. The same treatment plus a minor element mixture gave a yield of 1,073 pounds. This test was conducted under extremely drouthy conditions. A large number of plants died on all plots except where minor elements were added. Not only were there more living plants on the minor element treated plots, but the individual plants yielded more nuts per plant.

Minor elements had no effect on peanut quality in any experiment.

Further research is needed to determine the minor elements responsible for yield increases at the few localities where responses occured. Research thus far has located but few fields that will respond to minor element application.

ORGANIC MATERIALS

There is evidence that organic materials are of value when added to soils where peanuts are grown. They appear to have value above the nutrient content of the material.

Results of experiments with organic materials on peanuts at Auburn are given in Table 3. Comparison of treatment 11 with treatments 12, 13, 14, and 15 shows that organic material increased the yield in every case. It seems safe to assume from what is known about fertility requirements of peanuts that there was no shortage of nutrient elements in treatment 11.

An annual winter legume turned ahead of peanuts resulted in average annual yield increases of about 150 pounds at the Wiregrass Substation and at the Brewton Experiment Field between 1940 and

1954. In another experiment at the Wiregrass Substation, the yields from plots receiving 162 pounds P_2O_5 and 125 pounds of K_2O from commercial sources were compared with plots getting the same amounts in 12,000 pounds of oat straw and commercial sources combined. The 1947-51 average yield with no organic material was 1,000 pounds as compared with 1,367 pounds where part of the nutrients came from oat straw. A similar increase was observed when manure was the source of part of the P_2O_5 and K_2O.

It was found at the Wiregrass Substation between 1942 and 1951 that peanut yields were increased from 1,155 pounds to 1,339 pounds in a corn-peanut rotation by a green manure crop of oats preceding the crop of peanuts. Corn and peanuts received 24 pounds of P_2O_5 and 36 pounds of K_2O each year.

The yield of peanuts at the Wiregrass Substation during 1949-55, Table 2, was increased from 1,192 pounds to 1,369 pounds on a Norfolk loamy sand of low fertility by a yearly application of 1 ton of peanut hay.

The specific effects of organic materials in causing increased yields of peanuts can only be speculation. Certainly the nutritive value of the organic materials was compensated for in some of the experiments where yield increases were obtained. Three possible explanations are: (a) the elements in the organic material become gradually available during the growing season and may thus be available for use at about the rate required by the plant, without danger of causing salt injury; (b) the organic materials may act as a soil conditioner, which could enable more of the pegs to penetrate the soil crust during dry periods; and (c) organic material may aid in causing effective nodulation of the peanut roots.

ROTATIONS

Rotations are of greater importance in maintaining good yields of peanuts than is true with most other crops. They are particularily important when low rates of fertilization are used. Yields cannot be maintained for long periods unless adequate amounts of fertilizer are applied *(8)*. Results from experiments at the Wiregrass Substation have shown that peanuts usually do not respond to direct application of fertilizer when grown in rotation with other well fertilized crops. This is not true when peanuts are grown continuously. On one field of unfertilized peanuts grown in a continuous cropping system, yield dropped from about a ton in 1932 to about 400 pounds in 1948. The productivity was restored (1,500-pound yield) by application of a ton of lime, 72 pounds of P_2O_5, and 120 pounds of K_2O.

Yields of peanuts grown in a rotation with cotton receiving low rates of potash may be satisfactory, but cotton yields will rapidly decline. Studies at the Wiregrass Substation have shown that cotton can be grown satisfactorily in rotation with peanuts if sufficient potassium and lime are applied. Peanuts use the same sources of soil potash as cotton, but are able to extract adequate potash at soil levels that would be seriously deficient for cotton. Corn is not as sensitive to low potash level as is cotton. Consequently, in a rotation with cotton, peanuts, and corn, it is better for the corn to follow the peanuts.

The main advantage of rotating peanuts appears to be the maintenance of potash and lime in the soil, since peanuts are not on the land every year to remove large amounts of potash and lime. A one-bale crop of cotton has about the same amount of potash in the total crop as in a 1-ton peanut crop. However, the whole plant is usually removed in peanuts, whereas most of the potash is returned to the soil in the cotton plant residue. While the effect on potash fertility and lime may be the main advantage of a rotation with peanuts, continuous peanuts are not recommended even when well fertilized because of the greater likelihood of a build-up of nematode, insect, or disease infestations. Usually, higher yields are made in a rotation in which some organic material is incorporated with the soil.

RELATION BETWEEN SOIL TESTS AND YIELD RESPONSES

In the 1952-54 cooperative tests soil samples were taken at all locations in the spring before the experiments were established and were analyzed in the soil testing laboratory. Data in Table 6 show the response to calcium (gypsum), potassium, and phosphorus when

TABLE 6. RESPONSE TO GYPSUM, PHOSPHATE, AND POTASH WHEN THEIR LEVELS IN SOIL ARE LOW, MEDIUM, AND HIGH

Level of element	Av. per acre increase from 500 lb. gypsum in presence of 0-0-0	Av. per acre increase from 500 lb. gypsum in presence of 0-40-60	Av. per acre increase from 60 lb. K_2O	Av. per acre increase from 30 lb. K_2O	Av. per acre increase from 40 lb. P_2O_5
	Pounds	*Pounds*	*Pounds*	*Pounds*	*Pounds*
Low	159 (8)[1]	243 (8)	153 (13)	124 (13)	–2 (5)
Medium	6 (9)	77 (9)	22 (5)	6 (5)	–29 (6)
High	–117 (1)	–15 (1)	———	———	4 (7)

[1] Numbers in parentheses are numbers of tests included in the average .

their levels in the soil were low, medium, or high. The importance of a balanced fertilizer and liming program is brought out in this table. On soils testing low in calcium, gypsum dusted on unfertilized peanuts at early blooming time resulted in an increase of 159 pounds of nuts. On these same soils receiving 0-40-60, the yield increase from gypsum was 243 pounds. No yield increases were obtained from gypsum when used without fertilizer on soils that were medium in calcium. However, there was a 77-pound increase when gypsum was added to these medium-calcium soils receiving fertilizer at the rate of 0-40-60 per acre.

Soil tests for potassium gave an excellent indication of the need for this element. The 13 soils that were low in potassium gave an average increase of 124 pounds of peanuts from 30 pounds of K_2O and 153 pounds of peanuts from 60 pounds of K_2O. Soils that had a medium potassium level produced only a small increase from K_2O. None of the 18 soils tested was high in potassium. This was not surprising, since few of the soils that are used for peanuts in southeastern Alabama have been found to be high in this element.

As has been pointed out previously, none of the 18 soils gave a yield response to phosphorus applied to peanuts. This indicates that peanuts can use phosphorus at a lower soil test level than can most other crops.

SUMMARY

1. **Applications of nitrogen fertilizers on runner peanuts do not affect yields or quality.**

2. The need for phosphorus fertilizer for peanuts has decreased in recent years. The small amount of phosphorus required by peanuts is apparently supplied by residual phosphorus from past fertilization practices. A response from phosphorus can be expected on lands that have not been previously well fertilized, since early studies in Alabama did show a peanut yield response to phosphorus.

3. Peanuts usually respond to 30 to 50 pounds of potash on soils testing medium to low in soil potash. High rates of potash may lower the quality of peanuts if sufficient lime is not present.

4. Calcium is one of the most limiting factors in peanut production in Alabama. A source of calcium should be added when the calcium carbonate equivalent falls below the range of 600 to 800 pounds per acre. The application of calcium in the pegging area on soils deficient in calcium increases both yield and quality of peanuts. Poppy peanuts indicate the need for calcium.

5. When calcium and potash levels of the soil are both low, either one applied alone is often ineffective. However, when applied together the effectiveness of both is increased.

6. Minor elements are seldom needed for peanuts although conditions may exist where responses will be obtained.

7. Organic materials are effective in increasing peanut yields. The reasons for this increase are unknown.

8. Peanuts should always be grown in rotation with other crops.

9. Soil tests for calcium and potash gave excellent indications of the need for these nutrients.

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