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RESULTS of LIME and GYPSUM EXPERIMENTS with RUNNER PEANUTS

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For years it has been said that peanuts are hard on soil. This is true if peanuts are harvested. When both peanuts and hay are removed, even greater amounts of nutrient elements are taken from the soil than when only the nuts are harvested and the hay is returned to the land.

When both peanuts and hay are removed year after year, the plant food elements are "mined" from the soil and lower yields result. This brings up the question, "What soil amendments and fertilizers are needed to replace these plant nutrient elements in the soil and how much is it necessary to add to maintain yields or to increase yields on low-producing soils?"

Results of field experiments at the Wiregrass Substation and with cooperating farmers give answers to this question. Results of these tests show specifically:

1. That peanuts grown and gathered from the same land year after year "mined" the soil of its supply of calcium and potash.

2. That applications of phosphate, potash, and calcium (as either lime or gypsum) restored yields.

3. That a low percentage of sound, mature kernels was a good indication of calcium deficiency in the soil.

4. That applications of either lime or gypsum (land plaster) to soils producing low-grade or light, "poppy" peanuts increased yields where enough potash had been supplied.

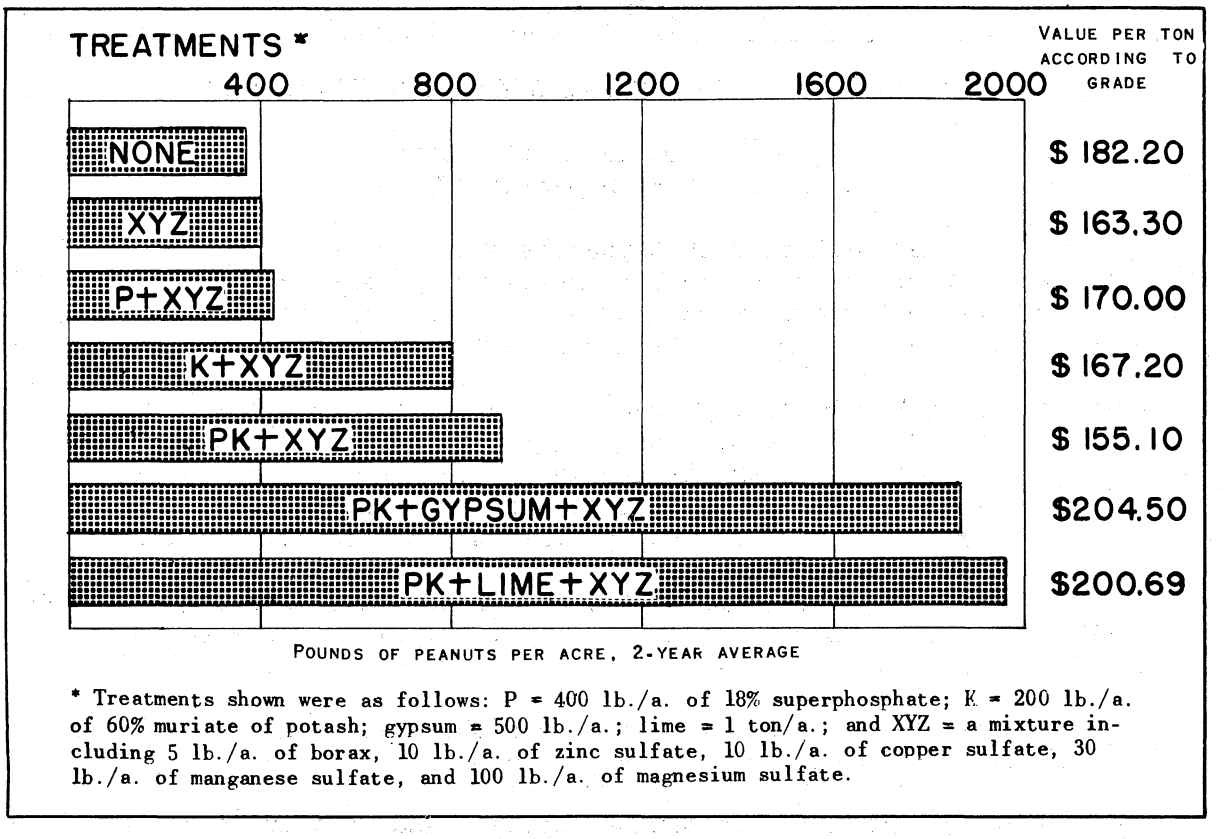
5. That applications of lime or gypsum always increased the percentage of sound mature kernels whenever the yield was increased.

Results of Experiments at Wiregrass Substation

The experiments at the Wiregrass Substation, near Headland, Alabama, were located on an area that had been depleted by continuous cropping to peanuts since 1932. The area is almost level so erosion is not a problem. The yields from 1932 to 1936 ranged between 1,500 and 2,000 pounds of peanuts per acre. Since 1944, the yields have been less than 500 pounds per acre. An experiment was started on this area in 1949 to find out what fertilizer materials were needed to restore yields. Seven of the main treatments and their effects upon yields are shown in Figure 1.

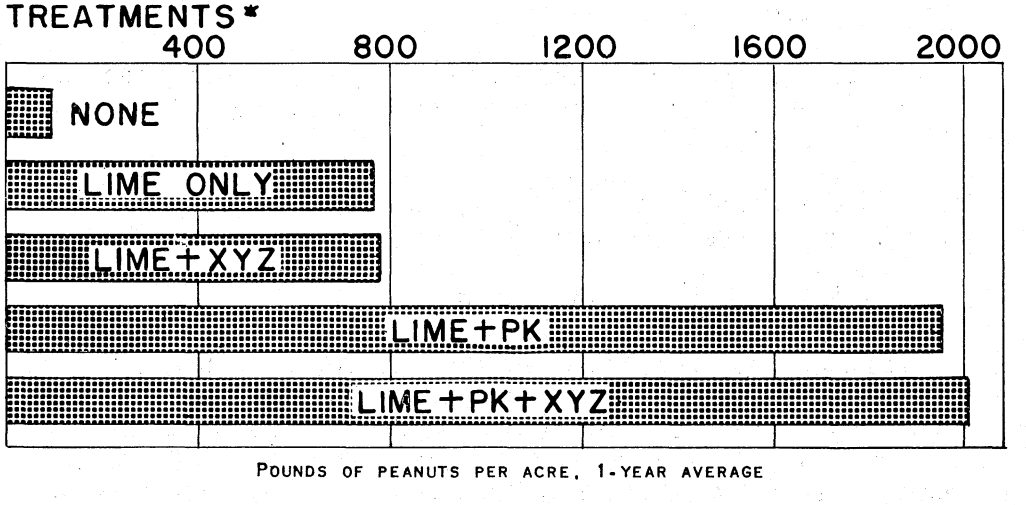
* Wiregrass Substation, Headland, Alabama

FIGURE 1. Average Yield of Peanuts from Different Treatments on Depleted Soil and Value According to Grade, Wiregrass Substation, 1949-1950



* Treatments shown were as follows: P = 400 lb./a. of 18% superphosphate; K = 200 lb./a. of 60% muriate of potash; gypsum = 500 lb./a.; lime = 1 ton/a.; and XYZ = a mixture including 5 lb./a. of borax, 10 lb./a. of zinc sulfate, 10 lb./a. of copper sulfate, 30 lb./a. of manganese sulfate, and 100 lb./a. of magnesium sulfate.

FIGURE 2. Average Yield of Peanuts from Different Treatments on Depleted Soil, Wiregrass Substation, 1950



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The 2-year average yields graphically compared in Figure 1 show that 200 pounds per acre of muriate of potash brought yields up to 797 pounds per acre of peanuts and to 891 pounds per acre when applied with superphosphate. Evidently, this soil still contained a fairly good supply of phosphate. Where lime or gypsum was added in addition to superphosphate and muriate of potash, yields were 1,859 pounds per acre from gypsum and 1,943 pounds per acre from lime. Use of lime or gypsum also gave large increases in grade and price per ton of peanuts. These results show that both calcium and potash were needed to restore the yield of peanuts.

In 1950, another test was started to determine the effects of lime alone. The treatments and the 1950 yields of peanuts from this test are shown in Figure 2.

These results show that both lime and potash are necessary to restore the yield of peanuts to approximately a ton per acre. The lime alone produced 762 pounds per acre and lime plus the minor element mixture produced 774 pounds per acre of peanuts. Thus, the reason for the greatly reduced yields of peanuts on this soil appears to be that both lime and potash were "mined" from the soil by continuous cropping. Therefore, both potash and calcium were needed to restore peanut yields.

The need for both calcium and potassium by peanut soils has also been shown by the results of more than 40 cooperative field experiments with farmers.

Results of Cooperative Tests with Farmers

The experiments to measure the effects of applications of lime and gypsum on runner peanuts have been conducted for 2 years in four counties of the Wiregrass area of Alabama. The following treatments were repeated four times in each experiment: (1) an untreated check, (2) lime at 1 ton per acre, (3) gypsum at 400 pounds per acre, and (4) both lime and gypsum at the 1-ton and 400-pound rates. The lime was applied at least 10 weeks before planting and the gypsum (land plaster) was dusted on the peanut foliage at early blooming stage. Yield data were obtained from 18 tests in 1949 and from 26 tests in 1950. Of the 26 tests harvested in 1950, 12 were tests begun in 1949, while the other 14 were started in 1950.

Results of these cooperative tests show that insufficient potash supplied by the soil and by the fertilizer applied limited the yields of peanuts. The yields obtained in 1949 from the plots that received neither lime nor gypsum were not closely related to the soil content of exchangeable calcium (usable form by plants). They were, however, definitely related to the "available" potassium. The "available" potassium was considered to be the sum of the exchangeable potash in the soil plus the potash supplied by the fertilizer applied to the peanuts. On the plots where the calcium needs of the peanuts were met by applying gypsum, the relation between yields and available potash was highly significant. Thus, it would seem that adequate amounts of potassium are also necessary if the full benefits of applications of lime or gypsum are to be obtained from peanuts. Both lime and potash should be applied to many of these soils.

The results of a number of tests indicate that use of large amounts of potash usually increases the yield on plots receiving lime or gypsum, whereas yield and quality and shelling percentage of peanuts decrease when calcium is deficient. Plenty of available potassium favors the setting of nuts, but calcium is necessary for their development. Thus, the production of light peanuts, or "pops," is a result of calcium deficiency in the soil.

One of the objectives of this work is to determine the relationship between yield of peanuts and calcium content of the soil. For this reason, some tests were located on soils with a relatively high calcium content in order to determine the level of soil calcium below which peanuts would respond to lime. The results have shown that the replaceable calcium content of soils is a good index of the need for lime or gypsum.

Of the 26 tests harvested in 1950, 12 were on soils that had an exchangeable calcium content equivalent to 710 pounds or less of calcium carbonate or lime per acre. The average increase in yield of peanuts on these 12 soils was 240 pounds per acre from lime, 283 pounds per acre from gypsum, and 286 pounds per acre from both lime and gypsum. Of the soils containing more calcium than the equivalent of 710 pounds of lime per acre, only one gave an increase in yield of more than 200 pounds of peanuts per acre. The average response of six soils having a medium content of exchangeable calcium, namely between 720 and 900 pounds of lime per acre, was 22 pounds of peanuts per acre from lime, 90 pounds from gypsum, and 44 pounds from both lime and gypsum. Eight soils had an exchangeable calcium content equivalent to 900 pounds of lime or more per acre. They produced average increases in yield of 20 pounds per acre from lime, 74 pounds from gypsum, and 54 pounds per acre from both lime and gypsum. Thus, all of the soils of low calcium content and one of medium calcium content responded to lime and gypsum treatments. These results are given in Table 1.

The results of these tests also show that the grade or percentage of sound mature kernels is also a good indication of calcium deficiency in the soil. Of the 18 tests harvested in 1949, three had less than 61 per cent sound mature kernels on the no-lime or no-gypsum plots; the average increase in peanut yields from gypsum was 484 pounds per acre. Seven tests fell between 61 and 69.9 per cent sound mature kernels and had an average increase in yield from gypsum of 133 pounds per acre. Peanuts from the other eight tests graded 70 per cent and above, and the average increase from gypsum was 26 pounds per acre.

The 1950 results are given in Table 2. Ten tests had less than 60 per cent sound mature kernels on the untreated check plots. The average increases in yields were 258 pounds per acre from lime, 257 pounds per acre from gypsum, and 304 pounds of peanuts per acre from both lime and gypsum. Another 10 of these tests had percentages of sound mature kernels ranging between 60 and 70 per cent and yield increases of 62 pounds per acre from lime, 141 pounds from gypsum, and 203 pounds from both lime and gypsum. The other six tests had a percentage of sound mature

Table 1. Yields and Percentages of Sound Mature Kernels of Peanuts from Calcium Treatments on Soils of Different Calcium Levels, 26 Cooperating Farms, Southeast Alabama, 1950

Treatment of lime and gypsum per acre 1/	Average peanut yields and percentages sound mature kernels from soils of different calcium levels					
	Low Ca soil 2/		Medium-low Ca soil 3/		Medium-high Ca soil 4/	
	Av. yield per acre	Av. SMK	Av. yield per acre	Av. SMK	Av. yield per acre	Av. SMK
	Pounds	Pct.	Pounds	Pct.	Pounds	Pct.
None	1,361	58.9	1,515	63.3	1,497	62.0
Lime, 1 ton	1,601	64.2	1,537	66.0	1,517	62.2
Gypsum, 400 lb.	1,644	63.9	1,605	66.1	1,571	63.3
Lime, 1 ton and gypsum, 400 lb.	1,647	65.2	1,559	66.3	1,551	64.5

1/ Cooperating farmers used the same fertilizer and application rate on these tests as they used normally for their peanut crops.
2/ Available (exchangeable) calcium in these soils (12 tests) are equivalent to less than 710 pounds of lime per acre.
3/ Available calcium in these soils (6 tests) equal to a lime equivalent of 710 to 900 pounds per acre.
4/ Available calcium in these soils (8 tests) equal to more than 900 pounds of lime per acre.

Table 2. Yields of Peanuts and Percentages of Sound Mature Kernels from Calcium-Treated Soils in Relation to Percentages of Sound Mature Kernels from Untreated Soils, 26 Cooperating Farms, Southeast Alabama, 1950

Treatment per acre 1/	SMK less than 60 per cent 2/		SMK 60 to 70 per cent 2/		SMK 70 per cent and over 3/	
	Average yield/A	Average SMK	Average yield/A	Average SMK	Average yield/A	Average SMK
	Pound	Pct.	Pound	Pct.	Pound	Pct.
None	1,331	55.3	1,442	63.1	1,610	66.6
Lime, 1 ton	1,589	61.8	1,504	64.4	1,607	67.1
Gypsum, 400 lb.	1,588	61.5	1,583	65.3	1,704	67.1
Lime, 1 ton and gypsum, 400 lb. ...	1,635	64.4	1,645	66.3	1,453	65.1

1/ Each test was fertilized by the cooperative farmer the same as he normally fertilized his peanuts.
2/ Average of 10 tests.
3/ Average of 6 tests.

kernels on the untreated plots of 70 per cent and above. The average increase in yield of these six tests was 94 pounds per acre from the gypsum treatment; on the average, they showed a slight decrease in yield from the limed plots. Thus, these results show that the grade or percentage of sound mature kernels not only is a good indication of calcium deficiency in the soil, but it is also a satisfactory index as to whether lime or gypsum treatments will increase yields. On soils that produce low grade, or light "poppy" peanuts, lime or gypsum treatments can be expected to result in yield increases if sufficient potash is also supplied to the peanuts or to the preceding crop.

Based on the results obtained in this study, it is probable that in Southeastern Alabama between 40 and 50 per cent of the soils need more calcium and 75 to 90 per cent of them need more potassium for best peanut yields. On many of the soils, a maximum response in yield to either lime or larger applications of potash is dependent upon supplying the other nutrient element.