Fertilizer, Gypsum, and Lime Experiments with Peanuts in Alabama

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CONTENTS

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Fertilizer, Gypsum, and Lime Experiments with Peanuts in Alabama, 1967-1972

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THE PEANUT CROP is the major source of agricultural income in southeastern Alabama and a major income producer for the State. In 1972, for example, income from peanuts in Alabama was $53 million, which ranked peanuts third in total farm income from all field crops in the State.

Peanuts were grown on 187,000 acres in Alabama in 1971, with 13 counties having more than 1,000 acres, Figure 1. On this acreage, 85 per cent were planted to runner type, 14 per cent to Virginia type, and 1 per cent to Spanish type, Table 1. Runners have always been popular in Alabama. They were grown on 99 per cent of the acreage as late as 1962. Introduction of the Florigiant variety in the mid-1960's progressively reduced runners to a low of 69 per cent of the total acreage by 1970. This trend was reversed in 1971 with increased availability of planting seed of the newer Florunner variety.

The dominant runner variety during the early 1960's was Dixie Runner; in the mid and late 1960's, it was Early Runner; in 1971, it became Florunner. Florigiant became the dominant Virginia-type variety in the mid 1960's. The Spanish varieties are Argentine and Starr but occupy only a small acreage.

Peanut yields have almost doubled during the 10-year period, 1963-1972. This increase is due primarily to better varieties, better leafspot control, better cultural practices, more effective herbicides, improved harvesting practices such as inverters and dryers, greater use of lime, and a more balanced soil fertility program.

The discovery of these yield-increasing practices was no accident. Each practice was the product of careful agricultural research, primarily by state agricultural experiment stations such

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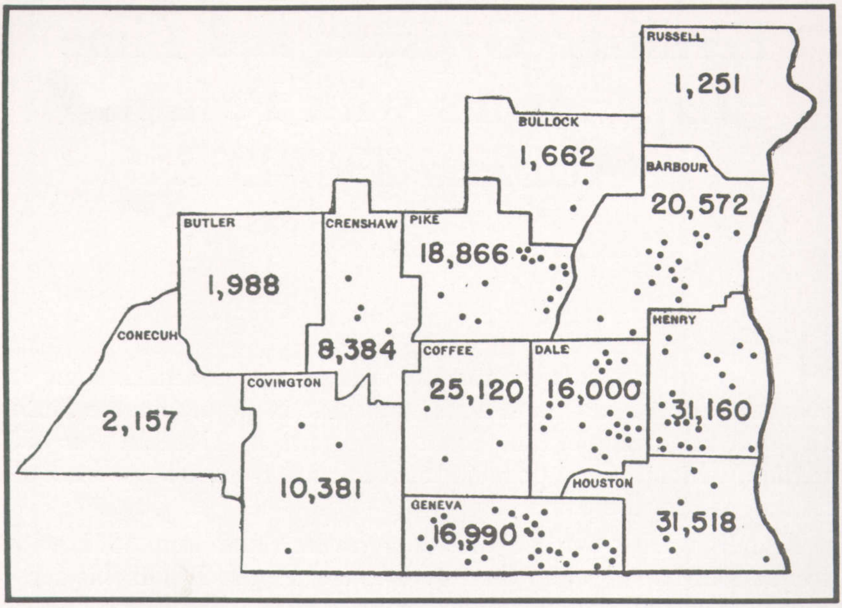

FIG. 1. Alabama counties with more than 1,000 acres of peanuts in 1971. The number in each county is the planted peanut acreage for that county. Each dot represents the location of a fertilizer, gypsum, or lime experiment during 1967-1972.

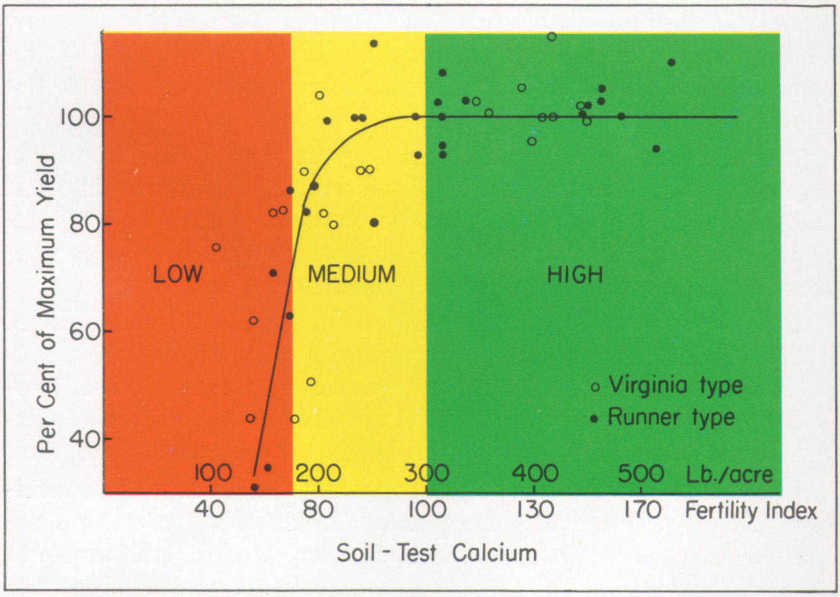

FIG. 2. Effect of soil-test calcium level upon the maximum yield of peanuts.

TABLE 1. TOTAL ACRES AND YIELD PER ACRE FOR PEANUT TYPES IN ALABAMA DURING 1963-72[1]

Year	Runner-type		Virginia-type		Spanish-type	
	Acres	Yield/acre	Acres	Yield/acre	Acres	Yield/acre
	No.	*Lb.*	*No.*	*Lb.*	*No.*	*Lb.*
1963	177,118	1,173	1,126	1,377	3,326	990
1964	175,472	1,271	3,089	1,603	4,173	1,161
1965	175,042	1,318	6,144	1,991	5,702	1,293
1966	161,381	1,195	11,258	1,717	5,593	992
1967	149,069	1,323	14,649	1,796	4,744	1,046
1968	142,823	1,337	23,810	1,737	4,778	1,129
1969	129,062	1,472	44,196	1,841	6,254	1,214
1970	125,511	1,640	52,265	1,848	5,272	1,269
1971	158,918	2,116	25,654	2,025	2,686	1,381
1972	175,556	1,887	14,000	1,962	940	1,405

[1] Data obtained from Statistical Reporting Service, United States Department of Agriculture, Montgomery, Alabama.

as the one at Auburn University. The value of agricultural research to peanut farmers cannot be pinpointed, but an approximate value can be made by using some simple arithmetic on the yields in Table 1. If yield increases from 1963 to 1972 are the result of research findings, then research increased yields by 297,000 tons during the last 10 years. At $250 per ton, this added $74 million to the gross income of Alabama's peanut farmers. That averages out to be a $7.4-million dollar dividend each year.

EARLY FERTILIZER AND LIME EXPERIMENTS

Research with peanuts has many goals, one of which is to determine soil fertility requirements for maximum yield and high quality. Auburn University has demonstrated an active interest in this area since the early 1900's when Duggar and coworkers *(3,4)* began experimenting with lime and fertilizer needs on farmers' fields.

The need for more sophisticated experiments caused Alabama's Agricultural Experiment Station to buy a large farm near Headland, Alabama in 1928. It was named the Wiregrass Substation. Its main purpose was to do extensive experimentation with peanuts, especially with fertilizer and lime. Many valuable experiments have been conducted on the Station during its 45-year history *(1,2,6,7)*.

To supplement the research at the Wiregrass Substation, Auburn University also conducted many fertilizer and lime experiments on farmers' fields in the Wiregrass area during 1938-1954 *(1,6,7)*.

Results of this research consistently showed only small or insignificant yield increases from fertilizers. In contrast, highly profitable yield increases were found where lime was used on low pH soils and where gypsum was used on low calcium soils.

This early work showed that supplemental calcium, as gypsum or lime, would sometimes increase both yield and grade of peanuts. It also showed that "poppy" peanuts were good indicators of the need for calcium.

To make soil fertility findings available and useful to all farmers and applicable to all their fields, the Auburn University Soil Testing Laboratory was established in 1952. The results obtained in these early field experiments served as the backbone and foundation of the fertilizer and lime recommendations made to farmers for peanuts by Auburn's Soil Testing Lab. Without a field testing program, such as the one Auburn conducts, soil testing is not reliable and does not serve the interest of the farmer. Commercial soil testing, for example, does not serve the best interest of Alabama's farmers unless it uses Auburn's soil testing procedures and recommendation guides.

A NEW SOIL FERTILITY PROJECT

Very few soil fertility experiments were conducted with peanuts in Alabama during the period of 1955-1966. During this time, however, new varieties and new practices had greatly increased yields. At the same time, neighboring states had greatly increased their recommended fertilizer rates for peanuts without publishing supporting research data. Thus, an obvious need for updating field research data had developed by the mid-1960's for this major income-producing crop in Alabama.

To answer this challenge, Auburn University began a new soil research program for peanuts in 1967. Its goal was to determine the fertilizer and lime requirements of peanuts being grown on a variety of soil types in the Wiregrass area. Further, these requirements were to be incorporated into Auburn's soil testing program to keep its recommendations up-to-date. In order to realize these objectives, it was decided that the experiments would be located on farmers' fields in the major peanut-producing counties. Experiments on the Wiregrass Substation had consistently shown little or no response to applied fertilizer.

Nature of Experiments

The field experiments described are the result of the cooperative efforts of farmers, the Alabama Peanut Producers Association, and Auburn University. Farmers permit the experiments to be located within their regular peanut fields. They do all the plowing, planting, and other cultural practices needed for growing and harvesting peanuts. By locating experiments on farmers' fields and using their practices, a wide range of soil and climatic conditions are encountered and tested. Farmers also contribute to the project through their Alabama Peanut Producers Association. The Association makes a significant financial contribution to the project each year.

Auburn University Agricultural Experiment Station agronomists select experimental sites, apply experimental fertilizers and lime, help with harvest, measure yields, grade peanuts, and soil test. They also make observations during the growing season and record the condition and progress of each experiment. Experiments are dropped when rigorous experimental conditions are not maintained for any reason. This has resulted in about one-third of the experiments being discontinued each year before yield records are taken. During the period of 1967-1972, 120 experiments on farmers' fields were harvested.

Soil Testing

Soil testing is the means by which fertilizer needs on one farmer's field can be applied to other farmers' fields. General fertilizer recommendations are not reliable because soils have been greatly changed by past fertilizer and liming practices. Several field and laboratory experiments are required to make fertilizer recommendations based on soil testing. Field experiments are required that compare yields on fertilized or limed soil against yields on the same soil without fertilizer or lime. Soil-test values are required for each experiment. Then, yields are related to soil-test values in the following manner:

1. If the yield without fertilizer is less than 50 per cent of that with fertilizer, then the **Soil Test Rating** is **VL** (very low).

2. If the yield without fertilizer is 50-75 per cent of that with fertilizer, then the **Soil Test Rating** is **L** (low).

3. If the yield without fertilizer is 75-99 per cent of that with fertilizer, then the **Soil Test Rating** is **M** (medium).

4. If the yield without fertilizer is equal to that with fertilizer, then the **Soil Test Rating** is **H** (high), **VH** (very high), or **EH** (extra high).

One of the above ratings appears on each soil test report that farmers receive from Auburn's Soil Testing Laboratory. The **Soil Test Rating** is shown by the letters, **VL, L, M, H, VH,** or **EH** for phosphorus (P), potassium (K), magnesium (Mg), and calcium (Ca).

A number follows each **Soil Fertility Rating** on Auburn's soil test report. That number is the **Soil Fertility Index.** It shows the soil's fertility status in that particular nutrient without regard to what crop might be grown. A low number means the soil is depleted and should be built up. A high number means a high state of fertility, and fertilizer containing that nutrient is not needed.

When are Yields Really Different?

Peanut farmers can count on at least three things: death, taxes, and a soil that is everything but uniform. Some spots in the field are more sandy than others, surface soil is deeper in some places, nematodes or diseases are worse in some spots. This raises serious questions about experiments on such fields.

Question 1. If your peanut field were divided into nothing but 100-foot rows, would each row make exactly the same amount of peanuts? If your answer to that question is "yes," you are not a bona fide peanut farmer. A real farmer would know better.

Question 2. If two, side-by-side, 100-foot rows are picked separately, would you get exactly the same amount of peanuts from each? Not very likely! Why? Because of the natural variations in all the things that go into making a peanut yield. If yields from two rows differed by only 1 pound, this would be equal to a 150-pound difference when expanded to an acre basis.

Question 3. If fertilizer is added to one of the side-by-side rows and it makes more peanuts, was it because of the fertilizer? Some would be tempted to say "yes" because they would expect fertilizer to increase yield. But this may be wrong. The fertilized row could have been just naturally more productive and the fertilizer had nothing to do with the yield.

Question 4. If the fertilized row makes fewer peanuts, was it because of the fertilizer? Again the temptation is to say "no" because one does not expect fertilizer to lower yield This may be right. The fertilized row may have been just naturally less productive because of different soil conditions.

Question 5. How can you tell if the difference in peanuts from the two rows is due to fertilizer or to some unknown cause? It is done by comparing yields from more than one pair of rows. If most or all of several pairs favor fertilizer, then it is a good bet that the yield difference is caused by the fertilizer. In the experiments reported here, four pairs are compared in each test (each pair is called a "replication").

Question 6. Why are four pairs (or replications) needed? For the same reason that you must flip a coin more than once to know that it will not come up heads every time. If fertilizer is needed, some unknown factor may keep fertilizer from giving the highest yield in one pair of rows, but it will not do that in all pairs. With comparisons between four such pairs available, the mathematical "law of probability" can be applied to the yields. It tells whether the difference in average yields is due to chance (as in coin flipping) or is due to fertilizer. These mathematical calculations are called "statistics."

Question 7. How is this principle used to interpret yields? If mathematics (statistics) shows that the difference in yield between fertilized and unfertilized rows was due to chance, then it may be concluded that fertilizer had no effect. If, on the other hand, the difference was not likely due to chance and it would be expected to happen 9 out of 10 times, the fertilizer is credited with increasing (or decreasing) yield.

The interpretation of all yields (and grades) in the tables is based upon "statistics," as described. If a yield difference is large enough to be more than just due to chance, the yield will appear in bold-face type with a footnote symbol by it.

FERTILIZER EXPERIMENTS

Adding fertilizer is a general practice for all crops in the peanut area. Unlike most other crops, however, peanut yields are usually not increased by direct application of fertilizer. Nevertheless, farmers continue to fertilize peanuts with a "just-in-case" philosophy.

Peanuts do not respond to fertilizers like other crops because the peanut plant is exceptionally efficient at getting its needed nutrients from the soil. It is much more efficient than cotton, for example, and its fertilizer needs are much less. Consequently, soil-test levels for P and K must be quite low before peanut yields are increased by fertilizer.

Varieties and practices have changed considerably since the 1950's, when Auburn stopped conducting those earlier fertilizer experiments, and yields have more than doubled. Because of this, new fertilizer experiments were started in 1967. These experiments have used fertilizer in two ways: (a) a combination of phosphorus and potassium (P and K); and (b) potassium only.

P and K Experiments

The experiments have been located on farms showing a wide range of soil-test levels. Each experimental area was divided into eight plots, with each plot consisting of four 100-foot rows. Four of the plots received fertilizer; the other four did not. Results from 21 of these experiments are given in Table 2.

The correct interpretation of the yields in Table 2 is essential. As explained previously, mathematics, or "statistics," tells whether fertilizer probably caused higher yields or not. If fertilizer was not the cause of a higher yield, then the fertilizer was of no value. An example of how it works follows:

The first experiment listed in Table 2 (G. Croft's farm) shows that fertilized plots averaged a 110-pound higher yield than the unfertilized plots. Was the 110 pounds due to fertilizer? Actually, not every fertilized plot yielded more than its unfertilized companion plot, and yield differences were not very much in any case. Finally, "statistics" showed that the difference in yield was only by "chance." Therefore, fertilizer did not affect yield.

A look at the yields in Table 2 shows that "no fertilizer" yields were sometimes higher than "fertilizer" yields and sometimes lower. In no case, was the difference very much. Even more important, however, is the fact that no yield difference was due to fertilizer. It was due to chance in every case. The average yield of all experiments was 2,770 pounds per acre without fertilizer and 2,780 pounds with fertilizer. The only possible conclusion to be reached from these yields is that fertilizer was not needed. Neither did fertilizer affect grade in any case.

TABLE 2. EFFECT OF PHOSPHORUS (P) AND POTASSIUM (K) FERTILIZERS ON YIELD AND GRADE OF PEANUTS, ALABAMA, 1969-1972

Site No.	Variety and farmer	County	Soil type	Soil-test rating and index[1]		Yield per acre[2]		Grade[3]	
				P	K	No fert.	Fert.	No fert.	Fert.
						Lb.	*Lb.*	*Pct.*	*Pct.*
	Florigiant								
93	G. Croft	Dale	Fuquay loamy sand	L 60	VL 0	2,350	2,460	67	64
92	F. C. Martin	Barbour	Blanton loamy sand	VL 30	L50	2,150	2,210	69	67
95	P. L. Baker	Dale	Lucy loamy sand	M 90	L60	1,550	1,640	63	62
72	B. Deloney, Jr.	Dale	Lucy loamy sand	VH290	L60	4,590	4,600	73	74
38	R. Griffin	Barbour	--------	L 70	M70	3,270	3,480	73	72
49	R. Harris	Dale	--------	M 90	M70	2,440	2,630	74	71
39	M. Hatton	Henry	--------	H110	M70	2,880	2,270	68	67
67	J. Bostick	Henry	Dothan loamy sand	M100	M70	2,630	2,320	66	67
51	G. Croft	Dale	--------	H110	M80	--------	--------	63	63
36	G. Walker	Henry	--------	M 80	M80	2,190	2,060	68	66
35	R. Logan	Dale	--------	H110	M80	2,860	3,080	74	75
37	H. Thompson	Dale	--------	M100	M80	3,930	3,560	66	67
17	E. Grace	Geneva	--------	M 80	M80	2,080	2,130	68	66
	Florunner								
71	L. & J. Johnson	Henry	Fuquay loamy sand	L 60	L60	2,700	2,560	73	69
96	W. Buie	Houston	Unclassified	M 80	M70	1,590	1,770	62	65
94	B. Deloney, Jr.	Dale	Lucy loamy sand	L 60	M70	3,240	3,220	77	76
52	E. Sanders	Henry	--------	H120	M80	--------	--------	73	72
73	D. Morgan	Henry	Fuquay loamy sand	H190	M80	4,330	4,540	74	73
48	G. Croft	Dale	--------	H150	H90	3,990	4,060	71	71
	Early Runner								
70	T. D. Fuqua	Barbour	Dothan loamy sand	VH260	M70	3,150	3,430	77	75
50	B. Deloney, Jr.	Dale	--------	H120	M80	2,650	2,470	71	71
18	L. Cotton	Geneva	--------	M 80	M80	2,780	2,890	69	68
19	H. Baxley	Geneva	--------	M 80	H100	2,230	2,470	60	59
	Virginia Bunch 67								
40	H. Hartzog	Barbour	--------	H110	H90	1,370	1,370	67	67
					Av.	2,770	2,780	69	69

[1] See Appendix Table A for soil analysis.
[2] Yields were not increased by fertilizer, according to "statistics."
[3] Grade means sound mature kernels.

K Experiments

A tendency has developed for farmers to add higher rates of K fertilizer to peanuts than is needed. This is potentially detrimental because high rates of K may interfere with the nuts' ability to get enough calcium. The purpose of the "K only" experiments was to see if this potential danger was of practical importance to the farmer.

The results of 11 such experiments are given in Table 3. The extra fertilizer had no effect on yield or grade in any experiment. Any difference was due to chance only. The average yield per acre was 2,190 pounds without the extra K and 2,160 pounds with it. In other words, the extra K fertilizer was neither beneficial nor harmful to the peanuts in any experiment.

According to the soil-test rating system, all of the soils in the "P-K" and "K only" experiments should be rated **H** because fertilizer failed to increase yield in any of them. However, a look at Tables 2 and 3 shows that the majority of soils were not rated **H** in both P and K. Several soils are rated **L**, which means that fertilizer should have increased yield. But it did not. Then why do we rate soils **L** when our definition says it ought to be **H**?

The answer to that question is based on reasoning, not scientific proof. Actually, the P and K ratings shown in Tables 2 and 3 are the **Soil Test Ratings** for corn and grasses. Since peanuts should be grown in rotation with other crops, it is not believed that peanuts should be allowed to deplete the soil to the point that the other crops suffer. At the present time, it is not known how low soil K must be before its rating would be **L** for peanuts, according to our definition.

These are the reasons that Auburn's Soil Testing Laboratory does not recommend that fertilizer be applied to peanuts but that it be applied to the crop in rotation with peanuts. Soils should be sampled for the crop preceding peanuts and then fertilized according to recommendations for that crop.

CALCIUM (Ca) AS A NUTRIENT

Calcium is the one soil nutrient that has affected peanut yields and quality in a highly consistent manner. This is because of the unique way in which peanuts must get calcium for pod development.

TABLE 3. EFFECT OF EXTRA POTASSIUM AT RATE OF 60 POUNDS PER ACRE OF POTASH (K_2O) ON YIELD AND GRADE OF PEANUTS, ALABAMA, 1967-1968

Site No.	Variety and farmer	County	Soil-test rating and index for K[1]	Fertilizer K_2O used by farmer	Yield per acre[2]		Grade[3]	
					Farmer's K only	Farmer's K + extra K	Farmer's K only	Farmer's K + extra K
				Lb./A.	*Lb.*	*Lb.*	*Pct.*	*Pct.*
	Florigiant							
6	W. F. Morton	Dale	M 80	75	1,110	1,140	74	74
	Early Runner							
9	W. L. Piland	Covington	M 70	0	1,930	1,660	74	75
23	E. A. Stewart	Geneva	H 90	50	2,320	2,160	69	68
7	T. Seay	Geneva	H100	50	2,530	2,750	74	75
25	J. D. Donaldson	Geneva	H100	50	1,640	1,570	61	59
8	A. Barnes	Geneva	H110	45	1,550	1,730	74	74
24	G. Crowley	Houston	H110	60	3,680	3,600	66	68
22	G. Outlaw	Geneva	H110	60	3,510	3,400	71	72
21	G. B. Register	Geneva	H110	105	1,770	1,720	69	67
26	A. Barnes	Geneva	VH220	55	1,510	1,490	69	70
20	T. Seay	Geneva	VH200	95	2,520	2,500	69	67
				Av.	2,190	2,160	70	70

[1] See Appendix Table A for soil analysis.
[2] Yields were not increased or decreased by fertilizer, according to "statistics."
[3] Grade means sound mature kernels.

Like other plants, the root system of peanut plants absorb all the calcium needed for vegetative growth. Calcium absorbed in this manner moves freely through the stems into the leaves and flowers. Probably all soils in the Wiregrass area have enough calcium to meet this need, unless they are unusually acid.

However, a special need for calcium develops after the peg from the pollinated flower enters the soil. Immediately after the peg enters the soil, calcium stops moving from the main stem of the plant to the peg. Yet, the peg must get calcium if it is to develop into a filled pod. Consequently, the developing pod must get whatever calcium it needs from the surrounding soil. Because of this unusual way in which calcium is obtained by peanut pods, soil surrounding the nuts is frequently deficient in calcium unless some has been added. The key to this problem is the amount of calcium in the pegging zone. Having excess calcium in roots, stems, or leaves will make no difference to the pods. The pods must find their own calcium in the soil.

Gypsum Experiments

Gypsum, commonly called "land plaster," has long been used as a source of calcium for peanuts. The practice is to dust it on the peanut plants at early bloom. This is timed so that rains will wash the gypsum into the pegging zone when it is most needed by the growing pods.

Gypsum furnishes both calcium and sulfur but does not raise soil pH. Contrary to a widespread misunderstanding, gypsum is **not** a liming material.

The results of 52 experiments with gypsum are given in Table 4. Soil calcium (Ca) ranged from a low of **L30** to a high of **H180.** These farms are a cross-section of the soils, weather, varieties, yields, and practices of peanut farmers during the period of 1967-1972 in southeastern Alabama.

The results are clear and consistent: (1) no soil with soil-test Ca above **M80** needed gypsum; (2) all soils with soil-test Ca below **L70** needed gypsum (except W. R. Zorn's with a pH of 4.9); (3) the variety had no influence on whether gypsum was needed or not.

Claims are generally made that large-seeded varieties, such as the Florigiant, require a higher soil calcium level than smaller-seeded varieties, such as the Florunner. The data from these experiments refute that claim and show that seed size had nothing to do with it.

The basis of **Soil-Test Ratings** for Ca is shown by the graph in Figure 2 (see page 4). "Per Cent of Maximum Yield" is plotted against soil-test Ca for each gypsum experiment. A "Per Cent of Maximum Yield" of 100 per cent means that the "no gypsum" plots yielded the same as those receiving gypsum. A "Per Cent of Maximum Yield" of 75 per cent means that "no gypsum" plots yielded 75 per cent as much as those receiving gypsum.

The graph also shows that 300 pounds per acre of soil-test Ca has been assigned a rating and fertility index of **H100**, which means that no additional calcium is needed. Soil-test Ca of 200 pounds per acre has been assigned the value **M80**, which means that calcium should be added because yields will probably be increased by it. Soil-test Ca below 175 pounds per acre is rated **L** and yield increases from gypsum or lime would be expected in all cases.

Unlike the P and K ratings, the Ca ratings are intended only for peanuts and are based on experimental proof, as described above and shown in Figure 2 and Table 4.

Slag Experiments

Basic slag has been used for several years as a liming material and sometimes as a calcium source for peanuts. It is primarily an impure lime containing phosphorus and is almost insoluble in water. It is much less soluble than gypsum, for example. Nevertheless, it has been used to some extent as a topdressing material at blooming time.

The results of 16 experiments in which basic slag or Fairfield slag was compared to gypsum as a dusting-on material are given in Table 5. Most of the soils had plenty of calcium so that neither gypsum nor slag affected yields. However, two soils were low enough for gypsum to increase yield, whereas slag did not (H. Hartzog in Barbour County and D. Averett in Coffee County). Another soil was low enough in Ca for both gypsum and slag to increase peanut grade, even though yields were not "statistically" different (F. Thrash in Pike County). The conclusion to be drawn from these experiments is that gypsum is a better source of calcium than slag if they are going to be dusted-on at blooming time.

TABLE 4. EFFECT OF TOPDRESSING GYPSUM ON YIELD AND GRADE OF PEANUTS, ALABAMA, 1967-1972

Site No.	Variety and farmer	County	Soil type	Soil-test rating and index for Ca[1]	Yield per acre		Grade[3]	
					No gypsum	Gypsum	No gypsum	Gypsum
					Lb.	*Lb.*	*Pct.*	*Pct.*
	Florunner							
78	J. Hartzog	Barbour	Tifton loamy sand	L 30	1,230[2]	1,770[2]	65	68
109	H. Baxley (B)	Geneva	Dothan loamy sand	L 60	730[2]	2,350[2]	59[2]	67[2]
106	O. and B. Deal	Dale	Blanton sand	L 70	640[2]	1,840[2]	58[2]	70[2]
111	R. Ward	Henry	Varina sandy loam	L 70	1,070	1,500	63	68
102	F. Thrash	Pike	Dothan loamy sand	L 70	3,490	4,080	67[2]	73[2]
113	P. Blankenship	Dale	Lucy loamy sand	L 70	1,250[2]	1,980[2]	61[2]	69[2]
100	L. Long	Pike	Norfolk loamy sand	M 80	3,600	3,680	68	70
114	J. Hartzog	Barbour	Sunsweet sandy loam	M 80	770	1,070	68	72
97	G. Holmes	Crenshaw	Norfolk loamy sand	M 90	3,700	3,700	73	76
112	T. Kirkland	Dale	Faceville sandy loam	M 90	1,360	1,690	67	69
77	E. Strickland	Crenshaw	Brogdon loamy sand	M100	4,850	4,810	75	76
101	J. Bagents	Crenshaw	Brogdon loamy sand	M100	1,650	1,770	70	72
107	D. and M. Bolin	Geneva	Dothan loamy sand	H110	3,220	3,100	70	70
79	E. Strickland	Crenshaw	Wagram loamy sand	H110	4,230	4,520	76	77
81	O. and B. Deal	Dale	Darco sand	H110	3,320	3,200	70	73
83	J. L. Falkner	Henry	Dothan sandy loam	H140	3,980	3,950	77	76
80	Jack Kelly	Houston	Dothan sandy loam	H150	3,780	3,670	73	75
82	J. L. Falkner	Henry	Tifton sandy loam	H170	3,840	4,050	76	76
108	H. Baxley (A)	Geneva	Dothan loamy sand	H180	2,500	2,260	68	68
	Florigiant							
84	H. Hartzog	Barbour	Dothan loamy sand	L 40	2,060[2]	2,810[2]	51[2]	70[2]
57	J. Childers	Barbour	--------	L 50	1,520[2]	2,000[2]	63[2]	71[2]
53	R. C. Armstrong	Henry	--------	L 60	1,050[2]	2,360[2]	26[2]	59[2]
58	Y. Willoughby	Houston	--------	L 60	1,710[2]	2,750[2]	40[2]	70[2]
28	C. Hughes	Houston	--------	L 70	2,330[2]	2,840[2]	55[2]	68[2]
86	F. Martin	Henry	Troup loamy sand	L 70	2,910[2]	3,500[2]	64[2]	71[2]
99	B. Deloney, Jr.	Dale	McLaurin loamy sand	M 80	670[2]	1,530[2]	43[2]	62[2]
61	R. Griffin	Barbour	--------	M 80	2,690	2,970	68	70
115	F. Martin	Barbour	Blanton loamy sand	M 80	1,050[2]	2,040[2]	46[2]	60[2]

TABLE 4. (Cont'd.)

Site No.	Variety and farmer	County	Soil type	Soil-test rating and index for Ca[1]	Yield per acre		Grade[3]	
					No gypsum	Gypsum	No gypsum	Gypsum
					Lb.	*Lb.*	*Pct.*	*Pct.*
	Florigiant (cont'd.)							
54	F. Martin	Barbour	--------	M 80	2,560	2,450	69	69
98	G. Croft	Dale	Fuquay loamy sand	M 80	1,840	2,250	**48**[2]	**60**[2]
85	D. Averett	Coffee	Red Bay fine sandy loam	M 80	**2,690**[2]	**3,300**[2]	67	70
37	H. Thompson	Dale	--------	M 90	2,850	2,980	73	74
1	R. E. Bryant	Covington	--------	M 90	1,700	1,910	67	67
2	E. C. Brooks	Coffee	--------	M 90	1,600	1,770	71	73
55	D. H. Holland	Dale	--------	H120	2,880	2,780	64	66
42	J. F. Blankenship	Houston	Dothan sandy loam	H120	2,010	1,980	74	73
76	D. and L. McCart	Coffee	Norfolk sandy loam	H130	2,370	2,240	72	74
43	C. R. Andrews	Houston	--------	H140	2,310	2,300	..	--
56	H. Etheridge	Henry	--------	H150	2,690	2,710	62	66
	Early Runner							
27	L. Davis	Geneva	--------	M 80	**2,930**[2]	**3,350**[2]	68	69
3	G. Hataway	Coffee	--------	M 90	2,230	1,950	70	70
60	D. T. Williams	Henry	--------	M100	1,970	1,850	66	65
29	H. Anderson	Covington	--------	H110	2,570	2,530	65	65
30	T. Davis	Geneva	--------	H110	2,930	3,090	68	66
41	B. Deloney, Jr.	Dale	--------	H110	2,250	2,060	70	68
26	A. Barnes	Geneva	--------	H140	1,510	1,570	69	70
5	J. Goolsby	Covington	--------	H150	3,060	3,020	71	72
45	C. Collins	Geneva	--------	H150	1,020	990	62	63
21	G. B. Register	Geneva	--------	H150	2,410	2,290	69	68
4	G. Shields	Geneva	--------	H160	2,560	2,510	74	73
	Virginia Bunch 67							
44	W. R. Zorn	Barbour	--------	L 60	1,730	1,820	71	74
59	J. Hartzog	Henry	----	M 80	**1,770**[2]	**2,150**[2]	**59**[2]	**65**[2]

[1] See Appendix Table A for soil analysis.
[2] Yields or grades in bold face type mean that gypsum increased yield or grade, according to "statistics."
[3] Grade means sound mature kernels.

TABLE 5. EFFECT OF TOPDRESSING GYPSUM, BASIC SLAG, OR FAIRFIELD SLAG ON YIELD AND GRADE OF PEANUTS, ALABAMA, 1969-1972

Site No.	Variety and farmer	County	Soil type	Soil-test rating and index for Ca[3]	Yield per acre			Grade[5]		
					No gypsum or slag	Gypsum	Slag	No gypsum or slag	Gyp-sum	Slag
					Lb.	*Lb.*	*Lb.*	*Pct.*	*Pct.*	*Pct.*
	Florunner									
102	F. Thrash[1]	Pike	Dothan loamy sand	L 70	3,490	4,080	3,800	**67**[4]	**73**[4]	**71**[4]
100	L. Long[1]	Pike	Norfolk loamy sand	M 80	3,600	3,680	3,650	68	70	70
97	G. Holmes[1]	Crenshaw	Norfolk loamy sand	M 90	3,700	3,700	3,910	73	76	74
101	J. Bagents[1]	Crenshaw	Brogdon loamy sand	M100	1,650	1,770	1,410	70	72	68
79	E. Strickland[1]	Crenshaw	Wagram loamy sand	H110	4,230	4,520	4,330	76	77	75
81	O. and B. Deal[2]	Dale	Darco sand	H110	3,320	3,200	3,530	70	73	74
83	J. L. Falkner[2]	Henry	Dothan sandy loam	H140	3,980	3,950	4,020	77	76	76
80	Jack Kelly[2]	Houston	Dothan sandy loam	H150	3,780	3,670	3,740	73	75	73
82	J. L. Falkner[2]	Henry	Tifton sandy loam	H170	3,840	4,050	3,890	76	76	76
	Florigiant									
84	H. Hartzog[1]	Barbour	Dothan loamy sand	L 40	**2,060**[4]	**2,810**[4]	1,590	**51**[4]	**70**[4]	43
61	R. Griffin[1]	Barbour	--------	M 80	2,690	2,970	2,880	68	70	68
85	D. Averett[2]	Coffee	Red Bay fine sandy loam	M 80	**2,990**[4]	**3,300**[4]	2,770	67	70	65
43	C. R. Andrews[1]	Houston	--------	H140	2,310	2,300	2,520	67	66	66
	Early Runner									
60	D. T. Williams[1]	Henry	--------	M100	1,970	1,850	2,020	66	65	65
45	C. Collins[1]	Geneva	--------	H150	1,020	990	1,000	62	63	59
	Virginia Bunch 67									
44	W. R. Zorn[1]	Barbour	--------	L 60	1,730	1,820	1,770	71	74	71

[1] Basic slag.
[2] Fairfield slag.
[3] See Appendix Table A for soil analysis.
[4] Yields or grades in bold face type means that gypsum or slag increased yield or grade, according to "statistics."
[5] Grade means sound mature kernels.

TABLE 6. EFFECT OF LIME OR GYPSUM ON YIELD AND GRADE OF PEANUTS, ALABAMA, 1971-1972

Site No.	Variety and farmer	County	Soil type	Soil pH	Soil-test rating and index for Ca[1]	Yield per acre			Grade[3]		
						No lime or gyp.	Lime	Gyp.	No lime or gyp.	Lime	Gyp.
						Lb.	*Lb.*	*Lb.*	*Pct.*	*Pct.*	*Pct.*
	Florunner										
88	Fomen and Deal	Dale	Lakeland loamy sand	4.9	L 30	-------	**3,740**[2]	**1,410**[2]	----	74	77
114	J. Hartzog	Barbour	Sunsweet sandy loam	5.0	M 80	**770**[2]	**1,350**[2]	1,070	68	72	72
113	P. W. Blakenship	Dale	Lucy loamy sand	5.3	L 70	**1,250**[2]	**1,730**[2]	**1,980**[2]	**61**[2]	**66**[2]	**69**[2]
112	T. Kirkland	Dale	Faceville sandy loam	5.3	M 90	1,360	1,770	1,690	67	68	67
111	R. Ward	Henry	Varina sandy loam	5.4	L 70	1,070	1,580	1,500	63	68	68
110	G. Paramore	Houston	Dothan loamy sand	5.6	M100	3,450	3,520	-------	74	74	----
	Florigiant										
89	E. W. Washington	Henry	Wicksburg loamy sand	5.3	M 80	ND[4]	ND[4]	-------	**57**[2]	**62**[2]	----
87	R. Griffin	Barbour	Fuquay loamy sand	5.4	L 40	-------	3,560	3,510	----	70	69
86	F. Martin	Henry	Troup loamy sand	5.7	L 70	**2,910**[2]	**3,480**[2]	**3,500**[2]	**64**[2]	**70**[2]	**71**[2]

[1] See Appendix A for soil analysis.
[2] Yields or grades in bold face type means that lime or gypsum increased yield or grade, according to "statistics."
[3] Grade means sound mature kernels.
[4] Yields were not determined.

Lime Experiments

The use of lime on certain agricultural lands is about as old as civilized man. Yet, it is the most neglected aspect of soil management in Alabama today. Because lime is not needed on all fields, many farmers apparently believe that lime can be safely ignored. In contrast to the negligent attitude toward lime, farmers use unneeded tons of fertilizer on peanuts each year. Only a better understanding of soil pH and lime by both peanut farmers and fertilizer dealers is going to reverse the dangerous decline in soil pH.

As surely as day follows night, a lower soil pH is going to follow the use of nitrogen fertilizers such as ammonium nitrate, urea, anhydrous ammonia, and ammonium phosphate on the sandy soils of southeastern Alabama. Farmers are using these nitrogen fertilizers, so they are decreasing their soil's pH. At some point, the pH will be too low for good yields. It is just a question of "when."

The questions of when to lime and how much to use are accurately and easily answered by a soil test. Auburn's Soil Testing Laboratory has excellent procedures for determining the amount of lime a soil needs for various crops. The peanut farmer makes a serious mistake when he fails to heed Auburn's lime recommendation.

Lime serves two roles for peanuts: (1) it raises soil pH and eliminates toxic effects of aluminum; and (2) it supplies calcium to the pegging zone. Properly used, it maintains a highly favorable pH and soil Ca, making gypsum applications unnecessary on most soils.

The results of nine recent lime experiments are given in Table 6. Lime was applied in each case on top of turned land in the spring and disked-in before planting, except on the Fomen and Deal farm in Dale County. In all cases, the lime remained in the pegging zone where it would be most beneficial.

The yields in Table 6 are for the first year following spring-applied lime. The increases in yields and grades show that lime was highly beneficial on some soils. Some of the experiments suffered from a severe drought in 1972, and yields on these were low and erratic. The value of lime on such fields was at a minimum. Nevertheless, the data clearly show the reward for liming a low pH, low Ca soil, even where yields are greatly restricted by

TABLE 7. FIRST YEAR RETURNS FROM 1 TON OF LIME PER ACRE TO PEANUTS, YIELDS AND GRADES REPEATED FROM TABLE 6

Soil pH	Yield per acre		Grade[1]		Return for lime[2]
	No lime	Lime	No lime	Lime	
	Lb.	*Lb.*	*Pct.*	*Pct.*	
4.9	1,410	3,740	77	74	$347
5.0	770	1,350	68	72	83
5.3	1,360[3]	1,770[3]	67	68	97
5.3	1,250	1,730	61	66	78
5.4	1,070[3]	1,580[3]	63	68	82
5.7	2,910	3,480	64	70	117

[1] Grade means sound mature kernels.
[2] Based on 1972 prices.
[3] Yield differences were not statistically different.

drought. The most spectacular effect of lime was on the Fomen-Deal farm where yield was increased by 2,330 pounds per acre the first year.

Such first-year responses are especially important for rented lands. Probably half or more of the peanuts grown in Alabama are on rented land. Most farmers believe that they cannot afford to lime these lands because lime is a long-term investment. True, lime is a long-term investment. That is one of its fringe benefits. But even more important, lime is also an excellent short-term investment.

The return figures in Table 7 show what lime can do for peanut income the first year of its use. These returns are based on 1972 prices. Even though yields were severely restricted on four of these fields in 1972 because of drought, $9.00 worth of lime still returned $78-97 in peanuts the first year. Where drought was not a problem, the additional peanuts were worth $347 per acre in one field.

These data show that it does, indeed, pay to lime rented peanut lands of this kind even if the land is to be available only one year. Farmers are robbing themselves when they fail to lime fields whether they are rented for just one year or not.

Spray-on Calcium

Recent claims have been made by certain manufacturers that liquid spray-on calcium materials are effective sources of calcium for peanuts. Such claims are contrary to the scientifically estab-

TABLE 8. EFFECT OF GYPSUM OR MAGI-CAL® ON YIELD AND GRADE OF PEANUTS, ALABAMA, 1972

Site No.	Variety and farmer	County	Soil type	Soil pH	Soil-test rating and index for Ca[1]	Yield per acre: No gyp. or Magi-Cal	Yield per acre: Gyp.	Yield per acre: Magi-Cal	Grade[3]: No gyp. or Magi-Cal	Grade[3]: Gyp.	Grade[3]: Magi-Cal
						Lb.	*Lb.*	*Lb.*	*Pct.*	*Pct.*	*Pct.*
	Florunner										
97	G. Holmes	Crenshaw	Norfolk sandy loam	5.4	M90	3,700	3,700	3,640	73	76	74
	Florigiant										
99	B. Deloney, Jr.	Dale	McLaurin loamy sand	5.5	M80	**670**[2]	**1,530**[2]	310	**43**[2]	**62**[2]	41
98	G. Croft	Dale	Fuquay loamy sand	5.8	M80	1,840	2,250	1,390	**48**[2]	**60**[2]	41

[1] See Appendix Table A for soil analysis.
[2] Yields or grades in bold face type means that gypsum increased yield or grade, according to "statistics."
[3] Grade means sound mature kernels.

lished fact that calcium does not move from leaves to the underground pod in sufficient quantity to be of any value. It has been demonstrated time and again that peanut pods must absorb calcium from the surrounding soil.

In spite of this scientific proof, farmers use such material because of its "pie-in-the-sky" claims. One such material is Magi-Cal®[2], and its use by farmers prompted three experiments with it in 1972 to demonstrate its value to farmers in the area. The results are given in Table 8. In no case was Magi-Cal® of any value. It failed to increase yield in one experiment where gypsum greatly increased it. It also failed to increase grade in the two experiments where gypsum greatly increased grade. Whether the soil was low in calcium or not, the spray-on material was without merit.

BORON (B) EXPERIMENTS

"Hollow-heart" is an internal defect of peanuts that was first recognized as boron (B) deficiency in 1957 *(5)*. It is seen as a hollow, tan or brown area on the inside of the two seed halves (cotyledons). A grower is severely penalized in the price his peanuts bring if they show 1 per cent "hollow-heart" or more.

"Hollow-heart" has not been a major problem for peanut growers in Alabama. Its appearance has usually been restricted to the sandier soils. Of the recent 23 experiments conducted with boron, only four showed symptoms of boron deficiency. In no case was the deficiency severe. Boron fertilizer did not affect yield or grade, regardless of whether "hollow-heart" was present or not, Table 9.

In addition to the specific boron experiments listed in Table 9, all other experiments were examined for "hollow-heart." A few showed minor boron deficiency, but these were only on soils that had less than 0.1 pound of soil-test B per acre and where no boron had been added.

Three of the experiments in Table 9 (sites no. 103, 104, 105) used boron in a Balan-Vernam herbicide mixture, which was applied preplant. Boron was also applied in two experiments by mixing it with the fungicide Benlate (sites no. 104, 105). The peanuts were sprayed twice with the Benlate-boron material at

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[2] Registered Trademark.

TABLE 9. EFFECT OF BORON (B) ON YIELD, GRADE, AND HOLLOW-HEART OF PEANUTS, ALABAMA, 1967-1972

Site No.	Variety and farmer	County	Soil type	Soil-test B[1]	Yield per acre		Grade[2]		Hollow-heart	
					No B	Added B	No B	Added B	No B	Added B
				Lb./A.	*Lb.*	*Lb.*	*Pct.*	*Pct.*	*Pct.*	*Pct.*
	Florunner									
68	M. Flowers	Pike	—	0.07	—	—	61	60	0	0
66	H. E. McDaniel	Pike	Ruston sandy loam	0.07	1,210	1,200	68	67	0	0
52	E. Sanders	Henry	—	0.07	—	—	72	75	0	0
67	L. Windham	Pike	—	0.08	1,390	1,390	65	64	0	0
91	H. E. McDaniel	Pike	Dothan loamy sand	0.09	2,650	2,760	71	73	0	0
62	M. Flowers	Pike	—	0.10	1,470	1,570	72	73	0	0
103	J. E. Mobley	Henry	Fuquay loamy sand	0.11	2,610	2,620	69	69	0	0
104	Wiregrass Sub.	Henry	Dothan sandy loam	0.29	3,110	3,430	69	70	0	0
	Florigiant									
65	L. Shipman	Pike	—	0.06	3,350	3,340	70	71	0	0
64	A. H. Thompson	Dale	—	0.07	—	—	71	71	0	0
27	L. Davis	Geneva	—	0.10	2,930	3,200	68	67	0	0
105	F. C. Martin	Barbour	Blanton loamy sand	0.11	2,080	1,900	66	67	0	0
46	M. Thrash	Pike	—	0.22	1,760	1,670	68	67	0	0
	Early Runner									
14	L. Davis	Geneva	—	0.07	1,680	1,760	65	72	3	0
13	M. Austin	Geneva	—	0.10	2,100	1,980	64	65	2	0
63	B. Drinkard	Pike	—	0.14	2,520	2,600	77	71	0	0
30	T. Davis	Geneva	—	0.16	2,930	2,910	65	64	0	0
12	T. Davis	Geneva	—	0.18	—	—	71	71	0	0
31	M. L. Burch	Geneva	—	0.20	3,340	3,190	72	70	0	0
	Virginia Bunch 67									
15	T. Harden	Pike	—	0.11	—	—	65	62	1	0
90	L. Windham	Pike	Dothan loamy sand	0.12	2,470	2,390	64	64	0	0
47	D. M. Dansby	Pike	—	0.17	1,560	1,670	64	62	0	0
	Dixie Runner									
16	M. Barron	Pike	—	0.07	—	—	46[3]	48[3]	3	1
				Av.	2,300	2,330	67	67	—	—

[1] See Appendix Table A for complete soil analysis.
[2] Grade means sound mature kernels.
[3] Peanuts exposed to inclement weather for long period between digging and harvesting, resulting in unusually low quality nuts and much internal damage.

2-week intervals, with 0.15 pound of B being applied per acre at each spraying.

A routine soil test for boron is not practicable. However, a special test for B was made on all these soils. The recommended practice is to add boron each year at a rate of 0.3 to 1.0 pound of B per acre. Higher rates may be toxic, especially if sprayed on the foliage or applied in the row. Boron may be added in the fertilizer, in gypsum topdressing, in preplant herbicide, or in fungicide spray.

MAGNESIUM (Mg) EXPERIMENTS

Soils of the Wiregrass area are generally low in magnesium. Some crops, such as cotton, need supplemental magnesium on some of these soils. The most practicable and economic way to add magnesium is as dolomitic limestone, although more expensive, soluble sources are available.

It has not been shown that peanuts growing in the soils of southeastern Alabama need supplemental magnesium. Nevertheless, dolomitic limestone (which contains Mg) is recommended on low pH soils that are low in Mg. The dolomitic limestone recommendation is intended to prevent peanuts from mining soil Mg to very low levels, levels that would be inadequate for some other crops in the rotation.

Four recent experiments with magnesium showed no benefit from the added Mg, Table 10, even where soil Mg was low. It is not known just how low soil Mg must be before it affects peanuts.

TABLE 10. THE EFFECT OF Mg ON YIELD AND GRADE OF PEANUTS, ALABAMA, 1967-1968

Site No.	Variety and farmer	County	Soil-test rating & index for Mg[1]	Yield		Grade[3]	
				No Mg	Added Mg	No Mg	Added Mg
				Lb./A.	*Lb./A.*	*Pct.*	*Pct.*
	Early Runner						
10	J. R. Mitchell	Bullock	L 80	2,860	2,740	75	74
11	B. East	Bullock	H170	2,750	2,850	73	74
	Florigiant						
32	J. Hardwick	Henry	H220	1,590	1,660	67	65
28	C. Hughes	Houston	L 60	**2.330**[2]	**1,890**[2]	**55**[2]	**50**[2]

[1] See Appendix Table A for complete soil analysis.

[2] Yield in bold face type means that magnesium decreased yield or grade, according to "statistics."

[3] Grade means sound mature kernels.

The present recommendation is intended to prevent problems with other crops in the rotation. It is known, however, that using higher rates of K fertilizer than are recommended will aggravate Mg deficiency on crops that are sensitive to Mg deficiency.

ZINC (Zn) EXPERIMENTS

Beneficial effects from zinc have been claimed for peanuts by various workers, but such a need has not been shown for Alabama's peanut area. However, corn and pecans in southeastern Alabama frequently suffer from zinc deficiency and zinc is usually recommended for them. The results of two peanut experiments with fertilizer Zn are given in Table 11. They show no need for adding zinc. As long as corn in the rotation receives Zn fertilizer so that it does not suffer from Zn deficiency, it is safe to believe that peanuts will not be Zn deficient, either.

TABLE 11. THE EFFECT OF ZINC ON YIELD AND GRADE OF PEANUTS, ALABAMA, 1968

Site No.	Variety and farmer	County	Soil-test Zn[1]	Yield per acre[2]		Grade[3]	
				No Zn	Added Zn	No Zn	Added Zn
			Lb./A.	*Lb.*	*Lb.*	*Pct.*	*Pct.*
	Early Runner						
33	H. Baxley	Geneva	2.5	2,510	2,570	60	59
34	L. Cotton	Geneva	5.0	2,650	2,710	67	69

[1] See Appendix Table A for complete soil analysis.
[2] Yields were not affected by zinc fertilizer, according to "statistics."
[3] Grade means sound mature kernels.

WINTER COVER CROP

Planting small grain, especially rye, as a winter cover crop has become a fairly common practice in southeastern Alabama. It serves two very useful purposes: (1) it holds the soil against erosion; and (2) it provides much needed winter grazing for cattle. Whether this practice is beneficial to peanuts or not is not known.

Two experiments were conducted during 1970-71 to determine if winter rye had any effect upon the succeeding peanut crop. The results are given in Table 12. They show two significant findings: (1) peanuts behind turned-under rye were no better than those behind winter fallow; (2) fertilizer applied to peanuts in the spring in addition to that in the fall had no effect on yield or grade.

TABLE 12. EFFECT OF RYE AND SPRING-APPLIED FERTILIZER[1] ON YIELD AND GRADE OF PEANUTS, ALABAMA, 1971

Site No.	Variety and farmer	County	Soil type	Soil-test rating & index[2]		Yield per acre[3]				Grade[4]			
						No fertilizer		Fertilizer		No fertilizer		Fertilizer	
				P	K	Rye	Fallow	Rye	Fallow	Rye	Fallow	Rye	Fallow
						Lb.	*Lb.*	*Lb.*	*Lb.*	*Pct.*	*Pct.*	*Pct.*	*Pct.*
	Florunner												
75	W. and M. Marshall	Henry	Faceville sandy loam	H130	M70	4,550	4,790	4,520	4,830	77	78	76	77
	Florigiant												
74	F. Martin	Barbour	Alaga fine sand	H130	M80	3,060	2,770	3,010	2,930	71	69	71	70

[1] All plots received a fall application of fertilizer.
[2] See Appendix Table A for soil analysis.
[3] Yields were not affected by fertilizer, according to "statistics."
[4] Grade means sound mature kernels.

SUMMARY AND DISCUSSION

A new soil fertility project with peanuts was started in 1967 with the main goal of keeping fertilizer and lime recommendations up-to-date. Experiments are located on farmers' fields and represent a wide range in soil and climatic conditions.

Phosphorus and potassium fertilizers failed to increase peanut yields in any of the 34 fertilizer experiments. Adding fertilizer directly to peanuts is an uneconomical practice. Fertilizer should be added only to the crops in rotation with peanuts.

Peanut pegs and pods must absorb whatever calcium they need from surrounding soil. This makes calcium deficiency a special problem with peanuts.

If soil-test calcium is **M80** or less, gypsum or lime should be added to raise soil calcium level. Otherwise, lower yields and lower grades of peanuts can be expected.

Gypsum, frequently called "land plaster," is an excellent calcium source on all soils low in calcium.

Agricultural limestone is an excellent source of calcium on low pH soils. The first year that a field is limed, however, a supplemental application of gypsum is recommended on low calcium soils because the lime may not get thoroughly mixed into the pegging zone.

Agricultural limestone serves two important roles: (1) it raises soil pH; and (2) it supplies calcium. Dolomitic limestone also supplies magnesium.

Low pH land should be limed for peanuts regardless of whether it is owned, rented, or borrowed.

Basic slag and Fairfield slag are not satisfactory calcium materials for topdressing at blooming time.

Magi-Cal® and other spray-on calcium materials are not suitable sources of calcium for peanuts.

Boron deficiency appears as concealed damage in the kernel. It is known as "hollow-heart." It is not widespread in Alabama. Soil testing for boron is not practicable. Boron deficiency is best prevented by adding 0.3 to 1.0 pound of B per acre mixed with fertilizer, gypsum, herbicide, or leafspot fungicide.

Fertilizer, gypsum, and lime should be used according to Auburn University's Soil Testing Laboratory. It is the best guide available to the peanut farmers of Alabama because it is based on results from their own fields.

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APPENDIX TABLE A. SOIL-TEST VALUES OF CHECK PLOTS IN EXPERIMENTS ON FARMERS' FIELDS

Location number	Farmer	Soil pH	Soil-test values (lb./A.)[1]					Year
			Ca	Mg	P	K	B	
1	Bryant	5.5	240	36	35	108	......	1967
2	Brooks	5.4	243	28	68	116	0.13	1967
3	Hataway	5.0	254	35	43	140	0.14	1967
4	Shields	5.3	484	81	86	127	0.24	1967
5	Goolsby	6.4	448	48	125	104	......	1967
6	Morton	5.9	331	65	105	71	......	1967
7	Seay	5.8	461	76	57	102	0.09	1967
8	Barnes	5.8	502	26	87	129	0.20	1967
9	Piland	6.4	400	24	75	45	......	1967
10	Mitchell	5.7	286	18	84	67	0.08	1967
11	East	5.9	267	42	86	111	......	1967
12	T. Davis	5.5	307	26	24	95	0.18	1967
13	Austin	5.7	201	51	42	52	0.10	1967
14	L. Davis	5.5	240	24	104	95	0.07	1967
15	Harden	5.7	224	18	70	52	0.11	1967
16	Barron	6.4	240	36	68	32	0.07	1967
17	Grace	5.7	430	27	27	67	0.16	1968
18	Cotton	5.8	452	81	34	76	0.14	1968
19	Baxley	5.1	403	75	32	110	0.42	1968
20	Seay	5.6	736	33	59	162	0.22	1968
21	Register	5.9	464	66	90	136	0.21	1968
22	Outlaw	5.5	300	44	52	136	0.18	1968
23	Stewart	6.0	470	30	67	84	0.14	1968
24	Crowley	5.5	546	54	69	130	0.18	1968
25	Donaldson	5.7	528	27	92	102	0.16	1968
26	Barnes	6.0	400	74	45	172	0.11	1968
27	L. Davis	5.2	195	33	34	52	0.10	1968
28	Hughes	5.0	160	15	75	87	0.14	1968

APPENDIX TABLE A. (*Cont'd.*)

Location number	Farmer	Soil pH	Soil-test values (lb./A.)[1]					Year
			Ca	Mg	P	K	B	
29	Anderson	5.6	315	72	50	73	0.14	1968
30	T. Davis	5.6	318	48	80	103	0.16	1968
31	Burch	5.4	351	93	57	104	0.20	1968
32	Hardwick	5.8	464	54	94	83	0.12	1968
33	Cotton	5.8	600	78	34	97	0.18	1968
34	Baxley	5.4	470	89	70	136	0.42	1968
35	Logan	6.0	284	44	57	73	0.19	1969
36	Walker	5.9	450	104	34	70	0.24	1969
37	Thompson	5.2	224	39	44	80	0.22	1969
38	Griffin	6.0	281	33	20	46	0.20	1969
39	Hatton	5.4	219	21	51	55	0.21	1969
40	H. Hartzog	5.4	284	41	57	92	0.19	1969
41	Deloney	5.2	320	32	34	79	0.24	1969
42	Blankenship	5.6	357	34	72	93	0.23	1969
43	Andrews	5.2	420	44	57	83	0.22	1969
44	Zorn	4.9	144	6	61	49	0.21	1969
45	Collins	5.9	452	30	121	94	0.26	1969
46	Thrash	5.6	347	23	77	66	0.22	1969
47	Dansby	5.1	188	13	123	80	0.17	1969
48	Croft	6.0	398	63	76	91	0.12	1970
49	Harris	5.1	360	22	37	52	0.10	1970
50	Deloney	5.3	256	28	58	64	0.12	1970
51	Croft	6.3	475	82	56	61	0.12	1970
52	Sanders	6.1	268	78	62	70	0.07	1970
53	Armstrong	5.2	138	16	64	100	0.11	1970
54	Martin	4.6	203	22	38	113	------	1970
55	Holland	5.5	348	40	73	86	0.20	1970
56	Etheridge	5.5	450	60	41	110	0.14	1970
57	Childers	5.0	108	7	50	52	0.05	1970
58	Willoughby	4.9	142	7	38	58	0.11	1970
59	Hartzog	5.1	189	21	28	108	0.13	1970
60	Williams	4.7	263	34	119	160	0.31	1970
61	Griffin	5.2	187	28	95	76	------	1970
62	Flowers	5.6	236	40	54	105	0.10	1970
63	Drinkard	5.8	417	28	76	78	0.13	1970
64	Thompson	5.0	147	15	31	42	0.07	1970
65	Shipman	5.5	248	30	52	65	0.06	1970
66	McDaniel	5.2	120	10	53	43	0.07	1970
67	Windham	5.2	105	10	53	44	0.08	1970
68	Flowers	5.1	124	16	67	72	0.07	1970
69	Bostick	5.5	157	14	47	56	------	1971
70	Fuqua	6.2	466	41	130	55	------	1971
71	Johnson	5.7	319	28	14	37	0.07	1971
72	Deloney	6.4	648	59	145	39	------	1971
73	Morgan	6.2	409	42	94	79	------	1971
74	Martin	5.9	272	27	65	53	------	1971
75	Marshall	5.6	190	51	63	72	------	1971
76	McCart	5.6	392	19	65	76	------	1971
77	Strickland	6.0	294	55	47	69	------	1971
78	J. Hartzog	4.9	64	10	19	68	------	1971
79	Strickland	5.8	319	27	88	60	------	1971
80	Kelly	6.3	453	81	87	85	------	1971
81	Deal	6.0	337	57	57	59	------	1971
82	Falkner	6.3	512	102	172	169	------	1971
83	Falkner	6.1	402	75	131	90	------	1971
84	H. Hartzog	4.8	87	9	70	58	------	1971

APPENDIX TABLE A. *(Cont'd.)*

Location number	Farmer	Soil pH	Soil-test values (lb./A.)[1]					Year
			Ca	Mg	P	K	B	
85	Averett	5.6	214	40	69	66	------	1971
86	Martin	5.7	167	17	64	57	------	1971
87	Griffin	5.4	90	10	74	43	------	1971
88	Fomen & Deal	4.9	75	3	61	35	------	1971
89	Washington	5.3	186	22	43	35	------	1971
90	Windham	5.9	261	45	54	57	0.12	1971
91	McDaniel	5.8	314	33	53	67	0.09	1971
92	Martin	6.3	274	58	7	29	------	1972
93	Croft	5.4	206	16	15	17	------	1972
94	Deloney	5.8	350	74	14	47	------	1972
95	Baker	6.1	368	34	40	32	------	1972
96	Buie	6.2	536	95	32	43	------	1972
97	Holmes	5.4	240	35	25	63	------	1972
98	Croft	5.8	205	34	16	19	------	1972
99	Deloney	5.5	179	13	27	40	------	1972
100	Long	5.1	210	25	16	57	------	1972
101	Bagents	5.2	296	32	20	78	------	1972
102	Thrash	5.0	174	14	63	40	------	1972
103	Mobley	5.7	362	25	24	31	0.11	1972
104	Substation	5.9	616	70	27	95	0.29	1972
105	Martin	6.3	274	58	7	29	0.11	1972
106	Deal	5.8	152	26	5	30	------	1972
107	Bolin	5.7	310	69	60	49	------	1972
108	Baxley (A)	5.8	528	68	71	100	------	1972
109	Baxley (B)	5.4	140	17	66	41	------	1972
110	Paramore	5.6	292	27	45	43	------	1972
111	Ward	5.4	160	27	35	60	------	1972
112	Kirkland	5.3	254	33	48	71	------	1972
113	Blankenship	5.3	174	24	37	44	------	1972
114	Hartzog	5.0	213	27	52	109	------	1972
115	Martin	6.3	194	71	19	41	------	1972

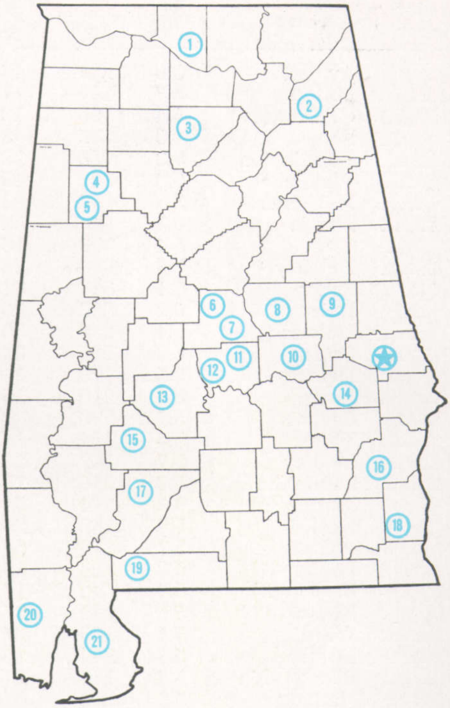
[1] See Appendix Table B for methods of analysis.

APPENDIX TABLE B. SOIL-TEST METHODS FOR DATA IN APPENDIX TABLE A

Element	Extracting solution	Soil:solution ratio	Shaking time	Analytical method
P	0.05*N* HCl + 0.025*N* H_2SO_4	1:4 (5g soil)	5 min.	colormetrically (molybdate)
K	0.05*N* HCl + 0.025*N* H_2SO_4	1:4 (5g soil)	5 min.	atomic absorption
Ca	*N* NH_4OAc, pH 7.0	1:4 (5g soil)	5 min.	flame photometry
Mg	0.05*N* HCl + 0.025*N* H_2SO_4	1:4 (5g soil)	5 min.	atomic absorption
B	Hot water	1:2 (20g soil)	5 min. reflux	colormetrically (curcumin)
Zn	0.05*N* HCl + 0.025*N* H_2SO_4	1:4 (5g soil)	5 min.	atomic absorption
pH	Water suspension	1:1 (20g soil)	stand for 1 hr.	pH meter

AGRICULTURAL EXPERIMENT STATION SYSTEM OF ALABAMA'S LAND-GRANT UNIVERSITY

With an agricultural research unit in every major soil area, Auburn University serves the needs of field crop, livestock, forestry, and horticultural producers in each region in Alabama. Every citizen of the State has a stake in this research program, since any advantage from new and more economical ways of producing and handling farm products directly benefits the consuming public.



Research Unit Identification

★ Main Agricultural Experiment Station, Auburn.

1. Tennessee Valley Substation, Belle Mina.
2. Sand Mountain Substation, Crossville.
3. North Alabama Horticulture Substation, Cullman.
4. Upper Coastal Plain Substation, Winfield.
5. Forestry Unit, Fayette County.
6. Thorsby Foundation Seed Stocks Farm, Thorsby.
7. Chilton Area Horticulture Substation, Clanton.
8. Forestry Unit, Coosa County.
9. Piedmont Substation, Camp Hill.
10. Plant Breeding Unit, Tallassee.
11. Forestry Unit, Autauga County.
12. Prattville Experiment Field, Prattville.
13. Black Belt Substation, Marion Junction.
14. Tuskegee Experiment Field, Tuskegee.
15. Lower Coastal Plain Substation, Camden.
16. Forestry Unit, Barbour County.
17. Monroeville Experiment Field, Monroeville.
18. Wiregrass Substation, Headland.
19. Brewton Experiment Field, Brewton.
20. Ornamental Horticulture Field Station, Spring Hill.
21. Gulf Coast Substation, Fairhope.