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CO-OPERATIVE FERTILIZER EXPERIMENTS WITH COTTON, 1898.

J. F. DUGGAR.

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CO-OPERATIVE FERTILIZER EXPERIMENTS WITH COTTON IN 1898.

BY

J. F. DUGGAR.

SUMMARY.

Under the direction of the Alabama Experiment Station fertilizer experiments with cotton, or "soil tests," were made in forty-one localities in the State. The object was to learn the best fertilizers for the different classes of soil.

Two hundred pounds per acre of cotton seed meal was used to furnish nitrogen, 240 pounds of acid phosphate to supply phosphoric acid, and both one hundred and two hundred pounds of kainit to afford potash. These fertilizers were applied singly, in pairs, and all three together.

Of these experiments thirty afforded definite indications as to the manurial needs of the soils on which they were made.

Acid phosphate was effective on a greater number of soils than was any other single fertilizing material. The great majority of soils needed a mixture of either acid phosphate and cotton seed meal, or of acid phosphate, cottonseed meal and kainit, that is, a complete fertilizer.

Of two complete fertilizers compared, the one containing 100 pounds of kainit (besides acid phosphate and cotton seed meal) was in most soils more profitable than the complete fertilizer containing 200 pounds of kainit per acre.

Averaging the results of the 30 conclusive tests made in 1898, the largest net profit was afforded by the same fertilizer which was most profitable in the greatest number of localities in 1897. This fertilizer consisted of

200 pounds cotton seed meal per acre.
240 pounds acid phosphate per acre.
100 pounds kainit per acre.

This fertilizer mixture contained 2.59 per cent. of nitrogen, 7.75 per cent. of available phosphoric acid, and 2.93 per cent. of potash.

The average yield of the unfertilized plots in 30 localities was 506 pounds of seed cotton per acre. The average increase in the yield of seed cotton was, for the two complete fertilizers, 392 and 435 pounds; for the phosphate and cotton seed meal mixture the average increase was 339 pounds; the average increase for the five other fertilizers or mixtures ranged between 113 and 287 pounds of seed cotton per acre.

Generally fertilizers were profitable, but in some cases loss occurred when material not needed by the soil was supplied. In a number of localities the most suitable fertilizer mixture afforded a profit of more than $5 per acre.

Soils on adjoining farms, even in the same soil belt, vary greatly. The formulas here given are suggestive only. The history of the land and size of plants may help towards an intelligent guess at the probable needs of the soil, but a local fertilizer experiment is the best means of determining this question.

The lime soils of the Tennessee Valley Region and the reddish lime soils of the narrow valleys of the northeastern part of the state seem to need for cotton little or no potash. For these soils the following formula is tentatively suggested:

160 to 240 pounds acid phosphate per acre.
80 to 120 pounds cotton seed meal per acre.

240 to 360 pounds, total per acre.

This contains about 2.2 per cent. of nitrogen, 8 to 10 per cent. of available phosphoric acid, and ½ per cent. of potash.

In that region in Central and Northwest Alabama lying between the Central Prairie Region and the Table Lands and Coal Fields, the chief need of the soil in most localities where tests have been made has been for phosphate; cotton seed meal was also needed. As a fertilizer for cotton in

this region, the above formula is suggested, with the addition of 80 pounds of kainit per acre on the poorest sandy soils and on those where cotton habitually rusts.

For the red clay lands of the central part of East Alabama the above mixture of acid phosphate and cotton seed meal is suggested; for the poorest gray or sandy soils of the same region, it seems advisable to add to this mixture 80 pounds of potash per acre, or to use the formula recommended below for the Southern Long Leaf Pine Region.

In the Southern Long Leaf Pine Region, cotton almost invariably needs phosphate, and to a less extent nitrogen. In some of the soils of this region potash seems to be quite deficient.

The following formula is suggested for cotton on these soils:

60 to 120 pounds cotton seed meal per acre.
120 to 240 pounds acid phosphate per acre.
60 to 120 pounds kainit per acre.

240 to 480 pounds, total per acre.

This fertilizer contains about 1.7 per cent. of nitrogen, 6 to 7.5 per cent. of available phosphoric acid, and 3.5 per cent. of potash.

The lime soils of the Central Prairie Region need drainage and vegetable matter rich in nitrogen rather than the usual commercial fertizers. Melilotus, or tall sweet white clover, used for hay or pasturage and the stubble afterwards plowed under, answers, together with stable manure and cotton seed, the main fertilizer requirement of these soils.

Objects and Methods of the Experiments.

The soils of Alabama differ widely. Hence they require different fertilizers. For most profitable results the fertilizer must be suited to the soil. Misfits are frequent and costly, especially in a State spending several millions of dollars for commercial fertilizers. To decrease such losses is the object of the "soil tests," or local fertilizer experi-

ments conducted under the direction of the Alabama Experiment Station by farmers in different soil belts.

To map the State, even roughly, according to the fertilizer requirements of the prevailing soils, must necessarily be the work of years.

The number of co-operative fertilizer experiments provided for in 1897 was 41, from which 37 reports were received. Thirty of these reports give definite indications, and are discussed at length in this bulletin. The others, deemed inconclusive, are more briefly tabulated.

Small lots of carefully weighed and mixed fertilizers were supplied to each experimenter. Detailed instructions as to how to conduct the experiments and blank forms for reporting results, were also furnished.

The following is the list of those who made the fertilizer tests in 1898 and reported results :

NAME.	POST OFFICE.	COUNTY.	PAGE.
Autrey, A.	Berneys	Talladega	35 & 50
Anderson, J. P.	Thomaston	Marengo	72 & 75
Beeson, Prof. W. J.	Blountsville	Blount	32 & 50
Borland, T. M.	Dothan	Henry	65 & 67
Bevill, W. C.	Bevill	Choctaw	59 & 62
Ballard, J. L.	Jackson	Clarke	48 & 51
Carmichael, D., Jr.	Newton	Dale	92 & 94
Collins, D. K.	Coosa Valley	St. Clair	68
Conner, G.	Brundidge	Pike	92 & 94
Daffin, E. J.	Tuscaloosa	Tuscaloosa	53 & 56
Dill, C. C. L	Dillburgh	Pickens	52 & 56
Dykes, J. W.	Union Springs	Bullock	73 & 75
Fulton, D. T	Hartford	Geneva	77 & 78
Fulton, W. F.	Larimore	DeKalb	31 & 50
Funkey, F.	Tuscumbia	Colbert	93 & 94
Harbuck, W. T.	Hurtsboro	Russell	38 & 49
Horn, C. D.	Coatopa	Sumter	41 & 49
Hayes, E.	Cullman	Cullman	76 & 78
Ingram, W. N.	Marvyn	Russell	54 & 56
Jackson, J. C.	Sulligent	Lamar	33 & 50
Jarrett, R. H.	Sterrett	Shelby	57 & 62
Jones, T. K.	Greensboro	Hale	70 & 75
Logan, J. A.	Gordo	Pickens	45 & 56
Meadows, T. T.	Cusseta	Chambers	37 & 50
McLendon, J. R.	Naftel	Montgomery	63
McIntyre, Prof. P. M.,	Abbeville	Henry	92 & 94
McAlpine, J. A.	Boligee	Greene	92 & 94
Purifoy, W. M.	Snow Hill	Wilcox	40 & 49
Robertson, J. T	LeGrand	Montgomery	58 & 62
Sellars, G. O.	Lumber Mills	Butler	44 & 48
Slaton, J. P.	Tuskegee	Macon	39 & 49
Taylor, Prof. B. A	Wetumpka	Elmore	92 & 94
Terry, J. W	Brewton	Escambia	60 & 62
Thomason, Judge T. J.	Kaylor	Randolph	36 & 50
Watkins, J. C	Burnt Corn	Monroe	42 & 49
Wilcox, J. H.	**Wilson**	**Escambia**	**46 & 48**

The directions sent required each plot to be one-eighth of an acre in area. Rows were 3½ feet apart, and each experimenter was advised to so thin the cotton as to leave the same number of plants on each plot, preferably at distances of 18 inches between plants.

The directions stated that land employed for this test should be level and uniform, not manured in recent years, and not new ground, or subject to overflow, and that it should be representative of large soil areas in its vicinity. The need of perfect uniformity of treatment for all plots (except as to kinds of fertilizers used) was emphasized.

Fertilizers were applied in the usual manner—that is, drilled, ridges afterwards being thrown up above the fertilizers.

The following data, recorded separately for the northern and southern portion of Alabama, are taken from the records of the Alabama Section of the Weather Bureau for 1898:

	Northern.	Southern.
Rainfall for April, inches	4.77	4.11
" " May, "	1.05	.58
" " June, "	.3.00	4.19
" " July, "	5.98	6.15
" " Aug., "	5.46	9.40
" " Sept., "	3.22	3.94
" " Oct., "	5.29	3.16
" " Nov., "	4.17	7.02

A severe drought in May and part of June was general throughout the State. In July and August an excess of rain fell. The records show that there was more than the average amount of sunshine in 1898. Frost occurred earlier than usual.

Black rust seems to have occurred in a smaller number of the experiments than in 1897 and to have done less damage where it did occur.

The Fertilizers Used.

The following prices are used, as representing the usual cost of fertilizers delivered in Auburn:

	Per Ton.
Acid phosphate (High grade)	$12 50
Cotton seed meal	19 00
Kainit	13 75

Prices naturally vary in different localities. Any one can substitute the cost of fertilizers in his locality for the price given above. The above prices for high-grade acid phosphate (dissolved bone) and kainit are a little below the usual price in most localities. The phosphate used was from the Edisto Phosphate Company, Charleston, S. C. Most of the kainit was donated by the German Kail Works, New York City.

In each experiment two plots were left unfertilized, these being plots 3 and 8. The following table shows what kinds and amounts of fertilizers were used on certain plots; the number of pounds of nitrogen, phosphoric acid, and potash supplied per acre by each fertilizer mixture; and the percentage composition and cost per ton of each mixture, the latter being given in order that these mixtures may be readily compared with various brands of prepared guanos:

Pounds per acre of fertilizers, nitrogen, phosphoric acid, and potash used and composition of each mixture.

Plot No.	Fertilizers. Amount per acre.	Fertilizers. Kind.	Mixture contains. Nitrogen.	Mixture contains. †Available phosphoric acid.	Mixture contains. Potash.	Cost of mixture, per ton.
	Lbs.		*Lbs.*	*Lbs.*	*Lbs.*	
1	200	Cotton seed meal.....	13.58	5.76	3.54	
		In 100 *lbs. c. s. meal.**	6.79	2.88	1.77	$ 19.00
2	240	Acid phosphate	.....	36.12	.....	
		In 100 *lbs. acid phos.*	.....	**15.05**	.....	12.50
4	200	Kainit.....	.....	.....	24.60	
		In 100 *lbs. kainit.*	.....	.....	12.30	13.75
5	200	Cotton seed meal	13.58	41.88	3.54	
	240	Acid phosphate				
		In 100 *lbs. above mixt.*	**3.09**	**9.52**	**.80**	15.45
6	200	Cotton seed meal.....	13.58	5.76	28.14	
	200	Kainit.....				
		In 100 *lbs. above mixt.*	**3.39**	**1.44**	**7.03**	16.38
7	240	Acid phosphate	.....	.....	.....	
	200	Kainit.....				
		In 100 *lbs. above mixt.*	.....	**8.21**	**5.59**	13.09
9	200	Cotton seed meal.....	13.58	41.88	28.14	
	240	Acid phosphate				
	200	Kainit.....				
		In 100 *lbs. above mixt.*	**2.12**	**6.54**	**4.39**	14.94
10	200	Cotton seed meal	13.58	41.88	15.84	
	240	Acid phosphate				
	100	Kainit.....				
		In 100 *lbs. above mixt.*	**2.59**	**7.75**	**2.93**	15.11

* Average of many analyses.

† Counting all the phosphoric acid in cotton seed meal as available.

Those farmers who are more accustomed to the word ammonia than to the term nitrogen, can change the figures for nitrogen into their ammonia equivalents by multiplying by 1 3-14.

Unless explained, the term "profit from fertilizers" as used in the following tables, might be misunderstood.

Profit or loss, as there used, is simply the difference between the value of the increase attributed to the fertilizer

(after paying ⅓ cent per pound for picking) and the cost of the fertilizer. To make this more exact, the careful reader may subtract from the apparent profit the cost of applying fertilizers.

The price assumed is 5 cents per pound for lint and $6.67 per ton for seed. This is equal to 1 8-9 cents per pound. Deduct from this the cost of picking, ⅓ cent per pound and we have 1 5-9 cents as the net value per pound of increase of seed cotton; this last figure is used in the following tables.

In determining the increase over the unfertilized plots, the yield of the fertilized plots, Nos. 4, 5, 6 and 7, is compared with both unfertilized plots, lying on either side, giving to each unfertilized plot a weight inversely proportional to its distance from the plot under comparison. This method of comparison tends to compensate for variations in the fertility of the several plots.

It should be remembered that seasons, as well as soils, determine the effects of fertilizers, so that to be absolutely reliable a fertilizer experiment should be repeated for several years on the same kind of soil.

GROUP I. PHOSPHORIC ACID MUCH MORE IMPORTANT THAN POTASH; LATTER NOT NEEDED OR USED AT FINANCIAL LOSS.

Experiment Made by W. F. Fulton, Larimore, DeKalb County.

Dark gray valley soil; subsoil red clay, with lime-rock below.

The field has been in cultivation about seventy-five years. Recent crops were corn in '97, oats in '96, and corn in '95 The original growth was white oak, post oak, red oak, black walnut, hickory, poplar and cedar.

(The reader should consult the tables on pp. 48, 49 & 50 as he reads the report of each experiment.)

Increase of seed cotton per acre when cottonseed meal was added:

To unfertilized plot .... 88 lbs.
To acid phosphate plot .....175 "
To kainit plot..... .....117 "
To acid phosphate and kainit plot .....230 "

Average increase with cotton seed meal .....152 "

Increase of seed cotton per acre when acid phosphate was added:

To unfertilized plot ....504 lbs.
To cotton seed meal plot .....591 "
To kainit plot ....324 "
To cotton seed meal and kainit plot.....437 "

Average increase with acid phosphate .....464 "

Increase of seed cotton per acre when kainit was added:

To unfertilized plot .....142 lbs.
To cotton seed meal plot .....171 "
To acid phosphate plot ....— 38 "
To cotton seed meal and acid phosphate plot 17 "

Average increase with kainit ..... 73 "

Phosphate was much more important than any other material for this soil. It was profitable to add cottonseed meal to phosphate, this combination leading in point of profit, $7.16 per acre, closely followed by acid phosphate alone, with $6.36 per acre. Kainit was not greatly needed.

EXPERIMENT MADE BY PROF. W. J. BEESON, ON FARM OF NINTH DISTRICT AGRICULTURAL SCHOOL, BLOUNTSVILLE, BLOUNT COUNTY.

Dark loam lime soil; subsoil clay.

This field had been used for grass and clover for the two years previous to this test, and in the spring of 1898 was subsoiled. The land had been in cultivation for about twenty-seven years.

Increase of seed cotton per acre when cottonseed meal was added:

To unfertilized plot	328 lbs.
To acid phosphate plot	104 "
To kainit plot	248 "
To acid phosphate and kainit plot	264 "
Average increase with cotton seed meal	**241** "

Increase of seed cotton per acre when acid phosphate was added:

To unfertilized plot	608 lbs.
To cotton seed meal plot	384 "
To kainit plot	440 "
To cotton seed meal and kainit plot	456 "
Average increase with acid phosphate	**472** "

Increase of seed cotton per acre when kainit was added:

To unfertilized plot	64 lbs.
To cotton seed meal plot	— 16 "
To acid phosphate plot	—110 "
To cotton seed meal and acid phosphate plot	56 "
Average decrease with kainit	**1** "

The main need was for acid phosphate, which used alone afforded a profit of $7.97 per acre.

Cotton seed meal increased the yield to an extent just about sufficient to pay for the meal. Kainit was not needed

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EXPERIMENT MADE BY J. E. JACKSON, TWO MILES WEST OF SULLIGENT, LAMAR COUNTY.

Gray clayey valley land; subsoil yellowish clay.

The preceding crop was cotton; the crop of 1896 was corn. The original growth of post oak and short leaf pine had been cleared about thirty years before.

Increase of seed cotton per acre when cottonseed meal was added:

To unfertilized plot	72 lbs.
To acid phosphate plot	278 "
To kainit plot	104 "
To acid phosphate and kainit plot	285 "
Average increase with cotton seed meal	**185** "

Increase of seed cotton per acre when acid phosphate was added:

To unfertilized plot	208 lbs.
To cotton seed meal plot	414 "
To kainit plot	80 "
To cotton seed meal and kainit plot	261 "
Average increase with acid phosphate	**241** "

Increase of seed cotton per acre when kainit was added:

To unfertilized plot	19 lbs.
To cotton seed meal plot	51 "
To acid phosphate plot	—109 "
To cotton seed meal and acid phosphate plot	—102 "
Average decrease with kainit	**38** "

Both acid phosphate and cotton seed meal were important and these two in combination afforded a profit of $4.16 per acre.

Kainit was unnecessary or even harmful.

EXPERIMENT MADE BY A. AUTREY, ¼ MILE EAST OF BERNEYS TALLADEGA COUNTY.

Soil and subsoil stiff red clay.

This field had been in cultivation more than forty years. The original forest growth was oak, hickory and pine.

Increase of seed cotton per acre when cotton seed meal was added:

To unfertilized plot.....192 lbs
To acid phosphate plot.....192 "
To kainit plot.....296 "
To acid phosphate and kainit plot.....168 "

Average increase with cotton seed meal.....212 "

Increase of seed cotton per acre when acid phosphate was added:

To unfertilized plot.....128 lbs.
To cotton seed meal plot.....128 "
To kainit plot .....416 "
To cotton seed meal and kainit plot.....288 "

Average increase with acid phosphate.....240 "

Increase of seed cotton per acre when kainit was added:

To unfertilized plot.....—64 lbs.
To cotton seed meal plot..... 40 "
To acid phosphate plot.....104 "
To cotton seed meal and acid phosphate plot.200 "

Average increase with kainit..... 70 "

Acid phosphate and cotton seed meal were more effective than kainit, but the largest profit was afforded by a complete fertilizer.

EXPERIMENT MADE BY JUDGE T. J. THOMASON, 2 MILES NORTH OF KAYLOR, RANDOLPH COUNTY, ALA.

Dark gray upland; subsoil below.

This field had been cleared about forty years. The original growth is reported as oak, hickory and long leaf pine.

The preceding crop was wheat; cotton occupied the land in 1895 and 1896.

Increase of seed cotton per acre when cotton seed meal was added:

To unfertilized plot	312 lbs.
To acid phosphate plot	98 "
To kainit plot	155 "
To acid phosphate and kainit plot	271 "
Average increase with cotton seed meal	**209** "

Increase of seed cotton per acre when acid phosphate was added:

To unfertilized plot	368 lbs.
To cotton seed meal plot	154 "
To kainit plot	222 "
To cotton seed meal and kainit plot	338 "
Average increase with acid phosphate	**270** "

Increase of seed cotton per acre when kainit was added:

To unfertilized plot	107 lbs.
To cotton seed meal plot	—50 "
To acid phosphate plot	—39 "
To cotton seed meal and acid phosplate plot	134 "
Average increase with kainit	**38** "

Acid phosphate and cotton seed meal were both highly beneficial. Kainit was of little or no value except when combined with these other two and was then only of secondary importance.

EXPERIMENT MADE BY T. T. MEADOWS, ½ MILE NORTH OF CUSSETA, CHAMBERS COUNTY, ALA.

Soil and subsoil red with flint stones.

The field was cleared of the origninal growth of oak and hickory about forty or fifty years ago.

The crop of 1896 was corn (whether with or without peas is not stated) and that of 1897 was cotton.

Increase of seed cotton per acre when cotton seed meal was added:

To unfertilized plot	120 lbs.
To acid phosphate plot	228 "
To kainit plot	115 "
To acid phosphate and kainit plot	—33 "
Average increase with acid phosphate	**107** "

Increase of seed cotton per acre when acid phosphate was added:

To unfertilized plot	152 lbs.
To cotton seed meal plot	260 "
To kainit plot	261 "
To cotton seed meal and kainit plot	117 "
Average increase with acid phosphate	**175** "

Increase of seed cotton per acre when kainit was added:

To unfertilized plot	—8 lbs.
To cotton seed meal plot	—13 "
To acid phosphate plot	107 "
To cotton seed meal and acid phosphate plot	—156 "
Average decrease with kainit	**15** "

Phosphate was the material chiefly needed. Kainit was of no value. Cotton seed meal was useful.

The results for two years agree in indicating that the best fertilizer for this soil was a mixture of acid phosphate and cotton seed meal.

EXPERIMENT MADE BY M. T. HARBUCK, 1½ MILES NORTH EAST OF HURTSBORO, RUSSELL COUNTY.

Light gray soil; yellow retentive subsoil.

The land had been cleared about twenty-five years. The original forest growth was long leaf pine.

The crop in 1897 was corn and peas, in 1896 cotton, 1895 corn and peas.

No rust was noticeable on any of the plots. The season was dry until the 13th of July, after which rain was in excess.

Increase of seed cotton per acre when cotton seed meal was added:

To unfertilized plot	111 lbs.
To acid phosphate plot	199 "
To kainit plot	63 "
To acid phosphate and kainit plot	131 "
Average increase with cotton seed meal	**126 "**

Increase of seed cotton per acre when acid phosphate was added:

To unfertilized plot	111 lbs.
To cotton seed meal plot	199 "
To kainit plot	99 "
To cotton seed meal plot	167 "
Average increase with acid phosphate	**144 "**

Increase of seed cotton per acre when kainit was added

To unfertilized plot	10 lbs.
To cotton seed meal plot	—38 "
To acid phosphate plot	—2 "
To cotton seed meal and acid phosphate plot	—70 "
Average decrease with kainit	**25 "**

Although phosphate was chiefly needed, no fertilizer was very effective. Potash was not needed. Preceding pea crops reduced the effect of cotton seed meal.

EXPERIMENT MADE BY J. P. SLATON, 7 MILES NORTHEAST OF TUSKEGEE, MACON COUNTY.

Rather compact gray sandy soil; subsoil red clay.

This field was cleared of its original forest growth of oak, hickory, gum, maple, long and short leaf pine about 75 years ago.

The land was pastured in 1896, and planted in corn in 1897; it is not stated whether or not peas were grown between the corn rows. There was very little rust on any of the plots; however plot 5 seemed to be the worst affected.

Increase of seed cotton per acre when cotton seed meal was added:

To unfertilized plot	292 lbs.
To acid phosphate plot	322 "
To kainit plot	5 "
To acid phosphate and kainit plot	149 "
Average increase with cotton seed meal	**192 "**

Increase of seed cotton per acre when acid phosphate was added.

To unfertilized plot	332 lbs.
To cotton seed meal plot	362 "
To kainit plot	204 "
To cotton seed meal and kainit plot	348 "
Average increase with acid phosphate	**311 "**

Increase of seed cotton per acre when kainit was added:

To unfertilized plot	115 lbs.
To cotton seed meal plot	—172 "
To acid phosphate plot	—13 "
To cotton seed meal and acid phosphate plot	—186 "
Average decrease with kainit	**64** "

The chief need of this soil was for acid phosphate. Cotton seed meal was also important, but kainit was worse than useless.

The largest profit, $6.77 per acre, followed the use of a mixture of acid phosphate and cotton seed meal.

EXPERIMENT MADE BY W. M. PURIFOY, 2 MILES NORTHEAST OF SNOW HILL, WILCOX COUNTY, ALA.

White bald prairie; subsoil white or yellowish rotten limestone at depth of three inches.

The preceding crop was sorghum. Mr. Purifoy notes that this soil was especially liable to rust but that there was none in 1898.

Increase of seed cotton per acre when cotton seed meal was added:

To unfertilized plot	128 lbs.
To acid phosphate plot	27 "
To kainit plot	227 "
To acid phosphate and kainit plot	141 "
Average increase with cotton seed meal	**131** "

Increase of seed cotton per acre when acid phosphate was added:

To unfertilized plot.....200 lbs.
To cotton seed meal plot..... 99 "
To kainit plot.....209 "
To cotton seed meal and kainit plot.....123 "

Average increase with acid phosphate....158 "

Increase of seed cotton per acre when kainit was added:

To unfertilized plot.....—27 lbs.
To cotton seed meal plot ..... 72 "
To acid phosphate plot.....—18 "
To cotton seed meal and acid phosphate plot. ..... 96 "

Average increase with kainit..... .....41 "

Both phosphate and cotton seed meal increased the yield. Some of the results with kainit are also favorable, especially on plot 10, where with the complete fertilizer containing the smaller amount of kainit there was the largest profit of any plot.

EXPERIMENT MADE BY C. D. HORN, COATOPA, SUMTER COUNTY.

Dark sandy soil; subsoil, red sandy clay.

The field had been cleared about 25 years. The original forest growth was red oak, post oak, black jack, hickory, and short leaf pine.

The land had been in cotton for three years previous to the beginning of the experiment.

Increase of seed cotton per acre where cotton seed meal was added:

To unfertilized plot.....140 lbs.
To acid phosphate plot..... 44 "
To kainit plot.....167 "
To acid phosphate and kainit plot.....— 39 "

Average increase with cotton seed meal.. 78 lbs.

Increase of seed cotton per acre where acid phosphate was added:

To unfertilized plot	190 lbs.
To cotton seed meal plot	94 "
To kainit plot	192 "
To cotton seed meal and kainit plot	— 30 "
Average increase with acid phosphate	**111 lbs.**

Increase of seed cotton per acre when kainit was added

To unfertilized plot	— 8 lbs.
To cotton seed meal plot	30 "
To acid phosphate plot	— 6 "
To cotton seed meal and acid phos. plot	— 89 "
Average decrease with kainit	**18 lbs.**

On every plot there was either a financial loss or only a very small profit. Kainit especially was unnecessary, while acid phosphate and cotton seed meal, used alone, and in most combinations, afforded some increase in yield.

There was no rust in 1893; in 1897, on the other hand, rust was severe and kainit, which checked it, was then the most effective fertilizer.

EXPERIMENT MADE BY J. C. WATKINS, 2 MILES NORTH OF BURNT CORN, MONROE COUNTY.

Gray, sandy and rocky soil; red clay subsoil, 6-8 inches below surface.

The field on which this test was made had been in cultivation about thirty years. The original forest growth is reported as short leaf pine, red and white oak and sweetgum. No note is made of injury from rust.

This field was in cotton in '97, in corn in '95 and '96, and had received little or no fertilizer in recent years. Planting occurred April 28.

The same plots were used for the experiment in 1898 that had been employed in the exactly similar experiment in 1897.

The number of plants per eighth-acre plot was 990. The weather was abnormally dry from planting time until the middle of June; then for two months rains were entirely too frequent and heavy.

Increase of seed cotton per acre when cotton seed meal was added:

To unfertilized plot	292 lbs.
To acid phosphate plot	6 "
To kainit plot	151 "
To acid phosphate and kainit plot	341 "
Average increase with cotton seed meal	**198 lbs.**

Increase of seed cotton per acre when acid phosphate was added:

To unfertilized plot	344 lbs.
To cotton seed meal plot	158 "
To kainit plot	92 "
To cotton seed meal and kainit plot	282 "
Average increase with acid phosphate	**219 lbs.**

Increase of seed cotton per acre when kainit was added:

To unfertilized plot	— 13 lbs.
To cotton seed meal plot	—154 "
To acid phosphate plot	—265 "
To cotton seed meal and acid phos. plot	70 "
Average decrease with kainit	**90 lbs.**

Both acid phosphate and cotton seed meal were highly important, while kainit was useless.

The largest profit $3.85 per acre was obtained when acid phosphate was used alone.

EXPERIMENT MADE BY G. O. SELLARS, 3½ MILES SOUTHWEST OF LUMBER MILLS, BUTLER COUNTY.

Gray sandy soil 8 in. deep; red clay subsoil.

This field, on which the original growth had been long leaf pine and blackjack oak, had been cleared about ten years. In 1896 the crop was cotton; in 1895 and 1897 corn. The stand was good, 8216 stalks per acre, and there was no rust.

Increase of seed cotton per acre when cotton seed meal was added:

To unfertilized plot	272 lbs.
To acid phosphate plot	233 "
To kainit plot	227 "
To acid phosphates and kainit plot	250 "
Average increase with cotton seed meal	**245** "

Increase of seed cotton per acre when acid phosphate was added:

To unfertilized plot	192 lbs.
To cotton seed meal plot	153 "
To kainit plot	228 "
To cotton seed meal and kainit plot	251 "
Average increase with acid phosphate	**206** "

Increase of seed cotton per acre when kainit was added:

To unfertilized plot	10 lbs.
To cotton seed meal plot	— 35 "
To acid phosphate plot	46 "
To cotton seed meal and acid phos. plot	63 "
Average increase with kainit	**21** "

Cotton seed meal and acid phosphate were decidedly beneficial. Kainit was unnecessary. The largest profit,

$3.10 per acre, was obtained by the use of a mixture of cotton seed meal and acid phosphate. In 1897, when rust prevailed, kainit was of somewhat more value than in 1898 when this disease did not appear.

EXPERIMENT MADE BY J. A. LOGAN, 1½ MILES NORTHWEST OF GORDO, PICKENS COUNTY.

Dark ashy second bottom; subsoil red clay.

The field had been cleared probably thirty years or more.

The original forest growth was oak, mulberry, hickory, and some short leaf pine.

The preceding crops were cotton.

Rust was not present on any of the plots. The season was very dry until June 1, after which time the rainfall was abundant. The stand was reported perfect on all plots.

(See Table, page 56.)

Increase of seed cotton per acre when cotton seed meal was added:

To unfertilized plot	56 lbs.
To acid phosphate plot	78 "
To kainit plot	35 "
To acid phosphate and kainit plot	100 "
Average increase with cotton seed meal	**67** "

Increase of seed cotton per acre when acid phosphate was added:

To unfertilized plot	360 lbs.
To cotton seed meal plot	382 "
To kainit plot	46 "
To cotton seed meal and kainit plot	110 "
Average increase with acid phosphate	**224** "

Increase of seed cotton per acre when kainit was added:

To unfertilized plot	59 lbs.
To cotton seed meal plot	38 "
To acid phosphate plot	—255 "
To cotton seed meal and acid phos. plot	—231 "
Average decrease with kainit	**68** "

The chief need of this soil was for acid phosphate. Kainit was not needed. Cotton seed meal was somewhat beneficial, but apparently a much smaller amount of cotton seed meal would have sufficed, say 50 to 100 pounds in combination with 240 pounds of acid phosphate. The largest profit, $4.10 per acre, was obtained by the use of acid phosphate alone. Next in point of profit followed a combination of acid phosphate and cotton seed meal, with a profit of $3.40 per acre.

EXPERIMENT MADE BY J. H. WILCOX, WILSON, ALA.

Clay soil, with some sand and gravel.

1898 was the second year of cultivation, the first crop having been corn. The field was subsoiled before Christmas and planted April 28th.

As a result of unfavorable weather many of the plants on the unfertilized plots and to a less extent on plots 1 and 6, died before fruiting.

(See Table, page 48.)

Increase of seed cotton per acre when cotton seed meal was added:

To unfertilized plot	64 lbs.
To acid phosphate plot	37 "
To kainit plot	45 "
To acid phosphate and kainit plot	134 "
Average increase with cotton seed meal	**70** "

Increase of seed cotton per acre where acid phosphate was added:

To unfertilized plot.....256 lbs.
To cotton seed meal plot.....229 "
To kainit plot.....236 "
To cotton seed meal and kainit plot....325 "

Average increase with acid phosphate....261 "

Increase of seed cotton per acre where kainit was added:

To unfertilized plot.....—2 lbs.
To cotton seed meal plot.....—21 "
To acid phosphate plot.....—22 "
To cotton seed meal and acid phos. plot..... 75 "

Average increase with kainit.....7 "

Evidently acid phosphate was the chief need of this soil. As usual on new ground, cotton seed meal was of but slight benefit. On this new ground, doubtless still abundantly supplied with potash from the recently burned timber, kainit was not needed.

Wilson, Lumber Mills and Jackson experiments with cotton.

Plot No.	Fertilizers. Amount per acre.	Fertilizers. Kind.	Wilson. Yield seed cotton per acre.	Wilson. Increase over unfertilized plots.	Wilson. Profit from Fertilizers.	Lumber Mills. Yield seed cotton per acre.	Lumber Mills. Increase over unfertilized plots.	Lumber Mills. Profit from fertilizers.	Jackson. Yield seed cotton per acre.	Jackson. Increase over unfertilized plots	Jackson. Profit from fertilizers.
	Lbs.		*Lbs.*	*Lbs.*		*Lbs.*	*Lbs.*		*Lbs.*	*Lbs.*	
1	200	Cotton seed meal	64	64	$—.91	648	272	$ 2.33	1016	8	$—1 78
2	240	Acid phosphate	256	256	2.48	568	192	1.48	1280	272	2.73
3	....	No fertilizer	00	.....	.....	376	.....	.....	1008	.....	.....
4	200	Kainit	00	—2	—1.41	368	10	—1.23	1160	136	.73
5	200	Cotton seed meal	296	293	1.15	766	425	3 10	1464	424	3.08
	240	Acid phosphate									
6	200	Cotton seed meal	48	43	—2.61	560	237	.40	1160	104	—1.67
	200	Kainit									
7	240	Acid phosphate	240	234	.76	544	238	.82	1368	296	1.72
	200	Kainit									
8	....	No fertilizer	8	.....	.....	288	.....	.....	1088	.....	.....
9	200	Cotton seed meal	376	368	.94	776	488	2.81	1704	616	5.91
	240	Acid phosphate									
	200	Kainit									
10	200	Cotton seed meal	376	368	1.64	720	432	2.64	1872	784	8.11
	240	Acid phosphate									
	100	Kainit									

Hurtsboro, Tuskegee, Burnt Corn, Snow Hill and Coatopa experiments with cotton.

Plot No.	Fertilizers. Amount per acre.	Fertilizers. Kind.	Hurtsboro. Yield seed cotton per acre.	Hurtsboro. Increase over unfertilized plots.	Hurtsboro. Profit from fertilizers.*	Tuskegee. Yield seed cotton per acre.	Tuskegee. Increase over unfertilized plots.	Tuskegee. Profit from fertilizers.*	Burnt Corn. Yield seed cotton per acre.	Burnt Corn. Increase over unfertilized plots	Burnt Corn. Profit from fertilizers.*	Snow Hill. Yield seed cotton per acre.	Snow Hill. Increase over unfertilized plots	Snow Hill. Profit from fertilizers.*	Coatopa. Yield seed cotton per acre.	Coatopa. Increase over unfertilized plots.	Coatopa. Profit from fertilizers.*
	Lbs.		*Lbs.*	*Lbs*		*Lbs.*	*Lbs*		*Lbs.*	*Lbs.*		*Lbs.*	*Lbs.*		*Lbs.*	*Lbs.*	
1	200	Cotton seed meal	384	111	$—.18	680	292	$ 2.64	528	292	$ 2.64	200	128	$ .09	458	140	$ .26
2	240	Acid phosphate	384	111	.22	720	332	3.66	680	344	3.85	275	200	1.61	508	190	1.45
3	00	No fertilizer	273	....	....	388	....	....	336	....	....	72	....	.....	318	.....	...
4	200	Kainit	280	10	—1.23	508	115	.40	348	—13	—1 50	48	—27	1.80	326	—8	—1.50
5	200	Cotton seed meal Acid phosphate	576	310	1.42	1052	654	6.77	726	350	2.04	304	227	.13	584	234	.24
6	200	Cotton seed meal Kainit	336	73	—2.15	524	120	—1.42	548	138	—1.14	280	200	—.17	542	175	—.56
7	240	Acid phosphate Kainit	368	109	—1.19	728	319	2.07	515	79	—1.65	264	182	— 05	568	184	1.09
8	00	No fertilizer	256	....	.....	414	....	.....	460	....	.....	88	....	.....	416	....	.....
9	200 240 200	Cotton seed meal Acid phosphate Kainit	496	240	—1 05	882	468	2.50	880	420	1.75	408	323	—.24	448	142	2.53
10	200 240 100	Cotton seed meal Acid Phosphate Kainit	536	280	.27	912	498	3.66	696	236	—.41	624	534	4.28	518	102	—.82

*Seed cotton rated at 1 5-9 cents. This is net price, or price after paying ⅓ cent per lb. for picking; 1 8-9 cents (1 5-9 plus ⅓c.) for seed cotton is equivalent to 5 cents per pound for lint and $6.67 per ton for seed.

Berneys, Sulligent, Blountsville, Larimore, Cusseta and Kaylor experiments with cotton.

Plot No.	Fertilizers. Amount per acre.	Kind.	Berneys. Yield seed cotton per acre.	Increase over unfertilized plots.	Profit from fertilizers.	Sulligent. Yield seed cotton per acre.	Increase over unfertilized plots.	Profit from fertilizers.	Blountsville. Yield seed cotton per acre.	Increase over unfertilized plots.	Profit from fertilizers.	Larimore. Yield seed cotton per acre.	Increase over unfertilized plots.	Profit from fertilizers.	Cusseta. Yield seed cotton per acre.	Increase over unfertilized plots.	Profit from fertilizer.	Kaylor. Yield seed cotton per acre.	Increase over unfertilized plots.	Profit from fertilizers.
	Lbs.		*Lbs.*	*Lbs.*		*Lbs.*	*Lbs.*		*Lbs.*	*Lbs.*		*Lbs.*	*Lbs.*		*Lbs.*	*Lbs.*		*Lbs.*	*Lbs.*	
1	200	Cotton seed meal...	600	192	$ 1.08	536	72	$—.78	712	328	$ 3.20	544	88	$—.53	416	120	$—.04	664	312	$ 2.95
2	240	Acid phosphate.....	536	128	.49	672	208	1.73	992	608	7.97	960	504	6.34	448	152	.86	720	368	4.23
3	00	No fertilizer	408	.....	.....	464	.....	.....	384	.....	.....	456	.....	.....	296	.....	.....	352	.....	.....
4	200	Kainit.....	536	—64	—2.37	480	19	—1.09	448	62	.42	616	142	1.53	290	—8	—1.52	464	107	.27
5	200	Cotton seed meal.	712	320	1.58	952	486	4.16	1096	707	7.59	1160	679	7.16	680	380	2.51	928	466	3.96
	240	Acid phosphate ..																		
6	200	Cotton seed meal.	616	232	.32	616	123	1.37	696	305	1.46	768	259	.75	408	107	1.62	728	262	.79
	200	Kainit.....																		
7	240	Acid phosphat.e..	728	352	2.59	560	99	—1.34	888	494	4.80	992	466	4.37	560	257	1.11	800	329	2.23
	200	Kainit.....																		
8	00	No fertilizer.	368	.....	.....	448	.....	.....	396	.....	.....	544	.....	.....	304	.....	.....	376	.....	.....
9	200	Cotton seed meal.	888	520	3.31	832	384	1.19	1152	756	6.96	1240	696	6.04	528	224	—1 30	976	600	4.55
	240	Acid phosphate ..																		
	200	Kainit.....																		
10	200	Cotton seed meal,	792	424	2.51	824	392	2.01	1140	744	7.49	.....	.....	.....	684	380	1.83	960	584	5.00
	240	Acid phosphate ..																		
	100	Kainit.....																		

GROUP II.—PHOSPHORIC ACID MUCH MORE IMPORTANT THAN POTASH; LATTER OF SECONDARY IMPORTANCE, BUT NEEDED.

EXPERIMENT MADE BY J. L. BALLARD FOR SOUTHWEST ALABAMA AGRICULTURAL SCHOOL, JACKSON, CLARKE COUNTY.

Red soil, 5 inches deep; subsoil red clay.

This upland field had been cleared about ten years, the original growth having been long leaf and short leaf pine, oak, sweetgum, dogwood, etc. It was in cotton in 1897 and in corn in 1896, whether with or without cow peas is not stated. (See Table, page 56.)

Increase of seed cotton per acre when cotton seed meal was added:

To unfertilized plot	8 lbs.
To acid phosphate plot	152 "
To kainit plot	—32 "
To acid phosphate and kainit plot	320 "
Average increase with cotton seed meal	**112** "

Increase of seed cotton per acre when acid phosphate was added:

To unfertilized plot	272 lbs.
To cotton seed meal plot	416 "
To kainit plot	160 "
To cotton seed meal and kainit plot	512 "
Average increase with acid phosphate	**340** "

Increase of seed cotton per acre when kainit was added:

To unfertilized plot	136 lbs.
To cotton seed meal plot	96 "
To acid phosphate plot	24 "
To cotton seed meal and acid phosphate plot	192 "
Average increase with kainit	**112** "

Phosphate was more important than either of the other fertilizer materials. However it was profitable to add both cotton seed meal and kainit to the phosphate. A complete fertilizer containing only 100 pounds of kainit per acre gave the best results and afforded a profit of $8.11 per acre. The year before cotton seed meal had given best results.

EXPERIMENT MADE BY C. C. L. DILL, DILLBURGH, PICKENS COUNTY, ALA.

Grayish table land; subsoil red clay.

The field had been cleared about 45 years of the original growth of oak, hickory and short leaf pine, but had grown up in old field pines, which were removed in 1890. Corn with cowpeas between the rows constituted the crop in 1897.

See Table, page 56.)

Increase of seed cotton per acre when cotton seed meal was added;

To unfertilized plot	672 lbs.
To acid phosphate plot	83 "
To kainit plot	643 "
To acid phosphate and kainit plot	170 "
Average increase with cotton seed meal	**392** "

Increase of seed cotton per acre when acid phosphate was added:

To unfertilized plot	736 lbs.
To cotton seed meal plot	147 "
To kainit plot	572 "
To cotton seed meal and kainit plot	99 "
Average increase with acid phosphate	**388** "

Increase of seed cotton per acre when kainit was added:

To unfertilized plot	298 lbs.
To cotton seed meal plot	269 "
To acid phosphate plot	134 "
To cotton s. meal and acid phosphate plot	221 "
Average increase with kainit	**230** "

Both phosphate and nitrogen were of prime importance; kainit was also effective, but to a less extent. All fertilizers returned a large profit whether used alone or in combination. The largest yield was obtained by the use of a complete fertilizer.

EXPERIMENT MADE BY E. J. DAFFIN, 2½ MILES EAST OF TUSCALOOSA, TUSCALOOSA COUNTY, ALA.

Red sandy upland soil 3 in. deep; subsoil stiff red clay.

The time since clearing was more than 60 years.

The original growth was short leaf pine, oak, hickory, gum, beech, mulberry, sassafras, persimmon, cherry, poplar, locust, hackberry and ash.

The preceding crop was cotton.

There was no damage from rust.

(See Table, page 56.)

Increase of seed cotton per acre when cotton seed meal was added:

To unfertilized plot	40 lbs.
To acid phosphate plot	253 "
To kainit plot	197 "
To acid phosphate and kainit plot	158 "
Average increase with cotton seed meal	**162 "**

Increase of seed cotton per acre when acid phosphate was added:

To unfertilized plot	136 lbs.
To cotton seed meal plot	349 "
To kainit plot	292 "
To cotton seed meal and kainit plot	253 "
Average increase with acid phosphate	**257 "**

Increase of seed cotton per acre when kainit was added:

To unfertilized plot	62 lbs.
To cotton seed meal plot	219 "
To acid phosphate plot	218 "
To cotton seed meal and acid phos. plot	123 "
Average increase with kainit	**155** "

Acid phosphate was the chief need of this soil. Cotton seed meal and kainit were also necessary and about equally effective. These results agree with those of 1897. Both years the greatest profit was obtained by the use of a complete fertilizer.

EXPERIMENT MADE BY W. N. INGRAM, MARVYN, RUSSELL, COUNTY.

Gray sandy soil 6 in. deep; subsoil yellow clay.

This hillside had been cleared 25 or 30 years. The original growth was long leaf pine and oak.

All recent crops consisted of cotton.

Assuming that the yield of Plot 9 was reduced by some inequality in the land or in the number of plants, we have omitted this plot in drawing conclusions.

Increase of seed cotton per acre when cotton seed meal was added:

To unfertilized plot	352 lbs.
To acid phosphate plot	266 "
To kainit plot	88 "
Average increase with cotton seed meal	**235** "

Increase of seed cotton per acre when acid phosphate was added:

To unfertilized plot	456 lbs.
To cotton seed meal plot	368 "
To kainit plot	450 "
Average increase with acid phosphate	**425 "**

Increase of seed cotton per acre when kainit was added:

To unfertilized plot	256 lbs.
To cotton seed meal plot	— 8 "
To acid phosphate plot	152 "
Average increase with kainit	**138 "**

The chief need of this soil was evidently for acid phosphate. Cotton seed meal was also advantageous.

Kainit was less important than the other two materials, but somewhat useful.

The largest profit, $7.80 per acre, resulted from the use of a mixture of cotton seed meal and acid phosphate. This was closely followed by a complete fertilizer containing 100 lbs. of kainit per acre.

Dillburgh, Gordo, Tuscaloosa and Marvyn experiments with cotton.

No. Plot	Amount per acre.	FERTILIZERS. KINDS.	Dillburgh. Yield seed cotton per acre.	Dillburgh. Increase over unfertilized plots	Dillburgh. Profit from fertilizers.	Gordo. (Group I.) Yield seed cotton per acre.	Gordo. (Group I.) Increase over unfertilized plots	Gordo. (Group I.) Profit from fertilizers.	Tuscaloosa. Yield seed cotton per acre.	Tuscaloosa. Increase over unfertilized plots	Tuscaloosa. Profit from fertilizers.	Marvyn. Yield seed cotton per acre.	Marvyn. Increase over unfertilized plots	Marvyn. Profit from fertilizers.
	Lbs.		*Lbs.*	*Lbs.*		*Lbs.*	*Lbs*		*Lbs.*	*Lbs.*		*Lbs.*	*Lbs.*	
1	200	Cotton seed meal	1360	672	$ 8.55	720	56	$-1.03	944	40	$-1.28	952	352	3.57
2	240	Acid phosphate	1424	736	9.95	1024	360	4.10	1040	136	.61	1054	454	5.56
3	00	No fertilizer	688	..	.....	664	.....	.....	901	...	.....	600	.....	.....
4	200	Kainit	976	298	3.25	724	59	—.47	960	62	—.42	888	256	2.60
5	200 240	Cotton seed meal. Acid phosphate	1488	819	9.34	1104	438	3.40	1280	389	2.65	1384	720	7.80
6	200 200	Cotton seed meal. Kainit	1600	941	12.47	760	94	—1 82	1144	259	.78	1040	344	2.07
7	240 200	Acid phosphate Kainit	1520	870	10 65	772	105	—1.25	1232	354	2.62	1334	606	6.54
8	00	No fertilizer	640	..	.....	668	.....	.....	872	...	.....	760	...	....
9	200 240 200	Cotton seed meal. Acid phosphate Kainit	1680	1040	11 38	872	204	—1 61	1384	512	3.18	1200	440	2.05
10	240 240 100	Cotton seed meal. Acid phosphate Kainit	1600	960	10 85	1000	332	1.08	1280	408	2.26	1480	720	7.12

GROUP III. PHOSPHORIC ACID AND POTASH BOTH IMPORTANT AND ABOUT EQUALLY EFFECTIVE.

EXPERIMENT MADE BY J. W. JARRETT, 1¼ MILES SOUTHEAST OF STERRETT, SHELBY COUNTY.

Gray sandy branch bottom, shallow soil; subsoil yellow.

The field was cleared at least fifty years ago of its growth of oak, hickory and gum. The field was used for cotton in 1897 and for corn in 1895 and 1896.

(See Table, page 62)

Apparently the very large yield on Plot 1, was due to some irregularity in the soil; in the first set of averages below this plot is included, in the second set it is excluded.

Increase of seed cotton per acre when cotton seed meal was added:

To unfertilized plot	584 lbs.	——
To acid phosphate plot	93 "	93 lbs.
To kainit plot	240 "	240 "
To acid phosphate and kainit plot	114 "	114 "
Average increase with cotton s. meal.	**[211] "**	**87 "**

Increase of seed cotton per acre when acid phosphate was added:

To unfertilized plot	392 lbs.	392 lbs.
To cotton seed meal plot	—285 "	
To kainit plot	373 "	373 lbs.
To cotton seed meal and kainit plot	247 "	247 "
Av. increase with acid phosphate.	**[182] "**	**337 "**

Increase of seed cotton per acre when kainit was added;

To unfertilized plot.....249 lbs.	249 lbs.	
To cotton seed meal plot.....—95		
To acid phosphate plot .....230 "	230 "	
To cotton seed meal and acid phospate plot.....437 "	437 "	
increase with kainit. [205] "	**or 305** "	

Acid phosphate and kainit were both effective and to about the same extent. The largest profit resulted from the use of a complete fertilizer, containing one hundred pounds of kainit.

It is not stated whether cowpeas were grown between the corn rows in 1895 and 1896; if they did this would afford an explanation of the rather slight effect of cotton seed meal.

In 1897 the experiment in this locality was made on fresh land, the main requirement of which was phosphate.

EXPERIMENT MADE BY J. T. ROBERTSON, LEGRAND, MONTGOMERY COUNTY.

Dark gray soil three inches deep; subsoil red clay.

The field had been in cultivation about seventy years. The last three crops were cotton. The original growth was oak, hickory and short leaf pine.

(See Table p. 62.)

Increase of seed cotton per acre when cotton seed meal was added:

To unfertilized plot .....240 lbs.	
To acid phosphate plot .....386 "	
To kainit plot .....522 "	
To acid phosphate and kainit plot .....359 "	
Average increase with cotton seed meal .....377 "	

Increase of seed cotton per acre when acid phosphate was added:

To unfertilized plot .....208 lbs.
To cotton seed meal plot.....354 "
To kainit plot .....363 "
To cotton seed meal and kainit plot .....202 "

Average increase with acid phosphate.....382 "

Increase of seed cotton per acre when kainit was added:

To unfertilized plot .....205 lbs.
To cotton seed meal plot ... .487 "
To acid phosphate plot ....360 "
To cotton seed meal and acid phosphate plot.335 "

Average increase with kainit .....347 "

Cotton seed meal, acid phosphate and kainit were all decidedly beneficial and to about the same extent. The complete fertilizers gave the largest profits, nearly $10 per acre.

EXPERIMENT MADE BY W. C. BEVILL, NINE MILES SOUTHEAST OF BEVILL, CHOCTAW COUNTY.

Dark mulatto table land; subsoil clay.

This field had been cleared fifty years. Long and short leaf pine constituted the principal forest growth.

The two preceding crops were corn.

Rust was present to some extent, especially on Plot 5. The season was extremely dry until June 20th, after which time there was an excess of rainfall. There was a perfect stand of about 1,500 plants to each eighth-acre plot.

(See Table p. 62.)

Increase of seed cotton per acre when cotton seed meal was added:

To unfertilized plot	96 lbs.
To acid phosphate plot	312 "
To kainit plot	224 "
To acid phosphate and kainit plot	296 "
Average increase with cotton seed meal	**232** "

Increase of seed cotton per acre when acid phosphate was added:

To unfertilized plot	8 lbs.
To cotton seed meal plot	224 "
To kainit plot	44 "
To cotton seed meal and kainit plot	120 "
Average increase with acid phosphate	**124** "

Increase of seed cotton per acre when kainit was added:

To unfertilized plot	40 lbs.
To cotton seed meal plot	168 "
To acid phosphate plot	80 "
To cotton seed meal and acid phosphate plot	64 "
Average increase with kainit	**88** "

The most profitable fertilizer was that used on Plot 10, which was a complete fertilizer that contained a half ration of kainit.

EXPERIMENT MADE BY J. W. TERRY, 2¼ MILES NORTH OF BREWTON, ESCAMBIA COUNTY.

Dark gray soil; subsoil red clay.

The field had been in cultivation about 12 years; the crop in 1896 and in 1897 was corn with cow peas between the rows. The forest growth was long leaf pine.

Increase of seed cotton per acre when cotton seed meal was added :

To unfertilized plot.....172 lbs.
To acid phosphate plot..... 67 "
To kainit plot.....116 "
To acid phosphate and kainit plot.....166 "

Average increase with cotton seed meal..... 130

Increase of seed cotton per acre where acid phosphate was added ;

To unfertilized plot.....160 lbs.
To cotton seed meal plot..... 53 "
To kainit plot.....133 "
To cotton seed meal and kainit plot.....183 "

Average increase with acid phosphate.....132 "

Increase of seed cotton per acre when kainit was added :

To unfertilized plot .....169 lbs.
To cotton seed meal plot.....113 "
To acid phosphate plot.....142 "
To cotton seed meal and acid phosphate plot .....241 "

Average increase with kainit.....166 "

The results are not entirely conclusive on account of the difference in yield obtained on the two unfertilized plots, and because of unfavorable seasons. Apparently a complete fertilizer was needed, this giving the greatest profit, which was by no means large.

Sterrett, LeGrand, Bevill and Brewton experiments with cotton.

Plot No.	Fertilizers. Amount per acre.	Kind.	Sterrett. Yield seed cotton per acre.	Sterrett. Increase over unfertilized plots.	Sterrett. Profit from fertilizers.	LeGrand. Yield seed cotton per acre.	LeGrand. Increase over unfertilized plots.	LeGrand. Profit from fertilizers.	Bevill. Yield seed cotton per acre.	Bevill. Increase over unfertilized plots	Bevill. Profit from fertilizers.	Brewton. Yield seed cotton per acre.	Brewton. Increase over unfertilized plots.	Brewton. Profit from fertilizers.
	Lbs.		*Lbs.*	*Lbs.*		*Lbs.*	*Lbs.*		*Lbs.*	*Lbs.*		*Lbs.*	*Lbs.*	
1	200	Cotton seed meal	1328	584	$ 7.18	568	240	$ 1.83	544	—96	$—.41	880	172	$ .77
2	240	Acid phosphate	1136	392	4.59	536	208	1.73	456	8	—1.38	768	160	1.00
3	00	No fertilizer	744	.....	.....	328	.....	.....	448	.....	.....	608	.....	.....
4	200	Kainit	992	249	2.49	496	205	1.80	488	40	—.76	744	169	1.25
5	200	otton seed meal	1040	299	1.25	848	594	5 84	768	320	1.58	768	227	.13
	240	Acid phosphate												
6	200	Cotton seed meal	1228	489	4.33	944	727	8.02	712	264	.82	792	285	1.15
	200	Kainit												
7	240	Acid phosphate	1360	622	6.79	848	568	5.95	536	88	1.51	776	302	1.81
	200	Kainit												
8	00	No fertilizer	736	.....	.....	143	....	.....	448	....	.....	440	.....	.....
9	200	Cotton seed meal	1472	736	6.67	1072	929	9.67	832	384	1.16	808	468	2.61
	240	Acid phosphate												
	200	Kainit												
10	200	Cotton seed meal	1374	638	6.95	1048	905	9.99	952	504	3.76	776	336	1.14
	240	Acid phosphate												
	100	Kainit												

GROUP IV. POTASH MORE IMPORTANT THAN PHOSPHORIC ACID; LATTER OF SECONDARY IMPORTANCE, BUT NEEDED.

EXPERIMENT MADE BY J. R. MCLENDON, 2 MILES EAST OF NAFTEL, MONTGOMERY COUNTY, ALA.

Light sandy soil 12 inches deep; red clay subsoil.

The field had been in cultivation more than forty years.

The original forest growth was short leaf pine, red oak and hickory.

Cotton was the crop in 1896 and in 1897.

Mr. McLendon reports that there was no rust and that the rainfall was sufficient.

Through an oversight the fertilizers were applied upon tenth-acre instead of eighth-acre plots, making the rate of application, and consequently the cost of fertilizers, twenty-five per cent. greater than in any as the other experiments.

(See Table p. 64.)

Increase of seed cotton per acre when cotton seed meal was added:

To unfertilized plot	90 lbs.
To acid phosphate plot	208 "
To kainit plot	168 "
To acid phosphate and kainit plot	274 "
Average increase with cotton seed meal	**185** "

Increase of seed cotton per acre when acid phosphate was added:

To unfertilized plot	90 lbs.
To cotton seed meal plot	208 "
To kainit plot	2 "
To cotton seed meal and kainit plot	108 "
Average increase with acid phosphate	**102** "

Increase of seed cotton per acre when kainit was added:

To unfertilized plot.....184 lbs.
To cotton seed meal plot.....262 "
To acid phosphate plot..... 96 "
To cotton seed meal and phosphate plot..162 "

Average increase with kainit.....176 "

Naftel experiment with cotton.

Plot No.	Fertilizers. Amount per acre.	Fertilizers. Kind.	Naftel. Yield seed cotton per acre.	Naftel. Increase over unfertilized plots.	Naftel. Profit from fertilizers.
	Lbs		*Lbs.*	*Lbs.*	
1	250	Cotton seed meal	250	90	$-.97
2	300	Acid phosphate	250	90	-.47
3	00	No fertilizer	160	.....	.....
4	250	Kainit	350	184	1.13
5	250	Cotton seed meal	470	298	.38
	300	Acid phosphate			
6	250	Cotton seed meal	530	352	1.37
	250	Kainit			
7	300	Acid phosphate	370	186	-.74
	250	Kainit			
8	00	No fertilizer	190	.....	.....
9	250	Cotton seed meal	650	460	.18
	300	Acid phosphate			
	250	Kainit			
10	250	Cotton seed meal	590	400	.12
	300	Acid phosphate			
	100	Kainit			

Each of the fertilizers, whether applied singly or in combination increased the yield to a considerable extent.

A complete fertilizer afforded the largest yield. As in 1897, kainit was somewhat more important than either of the other materials. In 1897 when rust prevailed, the favorable effect of kainit was attributed to its rust restrain-

ing tendency, but the results obtained in 1898, when there was no rust, indicate plainly that this soil is notably deficient in potash.

No single fertilizer or combination afforded any considerable profit, although each increased the yield.

EXPERIMENT MADE BY T. M. BORLAND, ½ MILE SOUTHWEST OF DOTHAN, HENRY COUNTY.

Dark gray upland; subsoil yellow clay.

This field had been in cultivation for about ten years. The original growth was long leaf pine.

The crop of 1897 was corn, whether with or without peas is not stated.

Cotton was planted April 6. There was no rain until June 2, on which date the experimenter noticed that the plants fertilized with kainit, alone or in combination, had resisted drought better than other plants.

(See Table p. 67.)

Increase of seed cotton per acre where cotton seed meal was added:

To unfertilized plot	32 lbs.
To acid phosphate plot	22 "
To kainit plot	32 "
To acid phosphate and kainit plot	228 "
Average increase with cotton seed meal	**78**

Increase of seed cotton per acre where acid phosphate was added:

To unfertilized plot	40 lbs.
To cotton seed meal plot	30 "
To kainit plot	20 "
To cotton seed meal and kainit plot	216 "
Average increase with acid phosphate	**76**

Increase of seed cotton per acre when kainit was added:

To unfertilized plot	136 lbs.
To cotton seed meal plot	136 "
To acid phosphate plot	116 "
To cotton seed meal and acid phos. plot	322 "
Average increase with kainit	**127**

All fertilizers were needed, kainit giving slightly the best results. No fertilizer afforded much profit, which was doubtless due to the unfavorable season. Mr. Borland writes that 1898 was "the most unfavorable year for cotton that we have had in this country in twenty years. I did not gather more than half the cotton made as the bolls cracked and the cotton rotted." For this reason the experiment is not conclusive.

Dothan experiment with cotton.

Plot No.	Fertilizers. Amount per acre.	Fertilizers. Kind.	Dothan. Yield seed cotton per acre.	Dothan. Increase over unfertilized plots.	Dothan. Profit from fertilizers.
	Lbs.		*Lbs.*	*Lbs.*	$
1	250	Cotton seed meal	320	32	—1.41
2	300	Acid phosphate	328	40	— .88
3	00	No fertilizer	288	.....	.....
4	250	Kainit	416	136	.73
5	250	Cotton seed meal	344	62	—2.43
	300	Acid phosphate			
6	250	Cotton seed meal	432	168	— .67
	250	Kainit			
7	300	Acid phosphate	408	156	.46
	250	Kainit			
8	00	No fertilizer	248	.....	.....
9	250	Cotton seed meal	632	384	1.19
	300	Acid phosphate			
	250	Kainit			
10	250	Cotton seed meal	616	368	1.64
	300	Acid phosphate			
	100	Kainit			

GROUP V. POTASH MUCH MORE IMPORTANT THAN PHOSPHORIC ACID; LATTER NOT NEEDED OR USED AT FINANCIAL LOSS.

EXPERIMENT MADE BY D. K. COLLINS, 1½ MILES SOUTHEAST OF COOSA VALLEY, ST. CLAIR COUNTY.

Dark sandy second bottom soil; subsoil yellowish clay at depth of five inches.

This river bottom had been in cultivation about twenty years and was considered good cotton land, but with a tendency to rust. The preceding crop was corn; in earlier years corn and cotton alternated.

The original growth was oak, hickory and gum.

Rust appeared and on some plots did great damage, especially on the plot receiving acid phosphate alone, and to a less extent on plot 5.

Increase of seed cotton per acre when cotton seed meal was added:

To unfertilized plot	64 lbs.
To acid phosphate plot	454 "
To kainit plot	19 "
To acid phosphate and kainit plot	31 "
Average increase with cotton seed meal	**142**

Increase of seed cotton per acre when acid phosphate was added:

To unfertilized plot	—116 lbs.
To cotton seed meal plot	274 "
To kainit plot	—162 "
To cotton seed meal and kainit plot	—150 "
Average decrease with acid phosphate	**38**

Increase of seed cotton per acre when kainit was added:

To unfertilized plot ....442 lbs.
To cotton seed meal plot.....398 "
To acid phosphate plot.....397 "
To cotton seed meal and phosphate plot.— 26 "

Average increase with kainit.....302

All results of this experiment seem to be governed by the amount of damage from rust, hence kainit, which restrained the rust, was the most effective fertilizer, the other two materials exerting slight effect. There was less rust with the complete fertilizer containing 200 pounds of kainit than with the one containing only 100 pounds of kainit.

The largest profit, $5.51 per acre, was afforded by kainit used alone.

Coosa Valley experiment with cotton.

	FERTILIZERS.		COOSA VALLEY.		
Plot No.	Amount per acre.	KIND.	Yield seed cotton per acre.	Increase over unfertilized plots.	Profit from fertilizers.....
	Lbs.		*Lbs.*	*Lbs.*	
1	200	Cotton seed meal	1568	64	$ .91
2	240	Acid phosphate	1488	—16	—3.30
3	00	No fertilizer	1504	.....	.....
4	200	Kainit	1928	443	5.51
5	200	Cotton seed meal	1704	338	1.85
	240	Acid phosphate			
6	200	Cotton seed meal	1808	462	3.90
	200	Kainit			
7	240	Acid phosphate	1608	281	1.49
	200	Kainit			
8	00	No fertilizer	1408	.....	.....
9	200	Cotton seed meal	1720	312	.07
	240	Acid phosphate			
	200	Kainit			
10	200	Cotton seed meal	1584	176	—1.34
	240	Acid phosphate			
	100	Kainit			

GROUP VI. ONLY NITROGEN VERY IMPORTANT; PHOSPHORIC ACID AND POTASH OF SLIGHT OR NO BENEFIT.

EXPERIMENT MADE BY T. K. JONES, 2 MILES SOUTH OF GREENSBORO, HALE COUNTY.

Mulatto, or yellowish, sandy soil.

This land has been in cultivation, chiefly in cotton, for more than forty years. The original growth is reported as hickory, oak and other hard woods. The number of stalks per eighth acre plot was as follows: 681 on plot 1; 941 on plot 2; 1,050 on plot 3; 666 on plot 4; 1,000 on plot 5; 883 on plot 6; 986 on plot 7; 868 on plot 8; 735 on plot 9.

In the following table no corrections have been made for a defective stand, for, judging by the fact that the unfertilized plot with 868 plants yielded more than the unfertilized plot with 1,050 plants, the plots planted thickly had no advantage over other plots. The land was level and apparently very uniform. There was practically no rust on any plot, but on all plots there was heavy loss from shedding of "forms" in June and July.

For at least three years preceding this experiment, the field had grown cotton.

(See Table p. 75.)

Increase of seed cotton per acre when cotton seed meal was added:

To unfertilized plot	304 lbs.
To acid phosphate plot	74 "
To kainit plot	49 "
To acid phosphate and kainit plot	19 "
Average increase with cotton seed meal	**112 "**

Increase of seed cotton per acre when acid phosphate was added:

To unfertilized plot	48 lbs.
To cotton seed meal plot	—182 "
To kainit plot	— 82 "
To cotton seed meal and kainit plot...	—110 "
Average decrease with acid phosphate....	**81** "

Increase of seed cotton per acre when kainit was added:

To unfertilized plot	29 lbs.
To cotton seed meal plot	—226 "
To acid phosphate plot.....	—111 "
To cotton seed meal and acid phos. plot.	—110 "
Average decrease with kainit.....	**105** "

Cotton seed meal used by itself afforded the largest yield and the greatest profit. All other fertilizers afforded a financial loss. It is difficult to understand why cotton seed meal gave such poor results when used in combination with other fertilizers, unless we assume that phosphate and kainit, when used with cotton seed meal, exerted a distinctly harmful effect under the rather unusual conditions of this experiment, viz: (1) late planting (May 3), (2) unusually early frost; (3) continued wet weather in July and August, causing great loss from shedding of fruit.

The experiment, though not conclusive, is suggestive of the special need of this soil for nitrogen; in 1897 the experiment on the same farm indicated unmistakably that the main need was for nitrogen.

EXPERIMENT MADE BY J. P. ANDERSON ON FARM OF DR. THOMAS, THOMASTON, MARENGO COUNTY.

Gray, sandy soil, 4 inches deep, with red clay subsoil.

This field had been in cultivation for thirty or forty years. All recent crops consisted of cotton. The original growth was oak, hickory, gum and short leaf pine. There was some rust, chiefly on Plots 5 and 7.

(See Table p. 75.)

Increase of seed cotton per acre when cotton seed meal was added:

To unfertilized plot	426 lbs.
To acid phosphate plot	146 "
To kainit plot	119 "
To acid phosphate and kainit plot	539 "
Average increase with cotton seed meal	**308** "

Increase of seed cotton per acre when acid phosphate was added:

To unfertilized plot	104 lbs.
To cotton seed meal plot	—176 "
To kainit plot	—142 "
To cotton seed meal and kainit plot	278 "
Average increase with acid phosphate	**16** "

Increase of seed cotton per acre when kainit was added:

To unfertilized plot	— 9 lbs.
To cotton seed meal plot	—316 "
To acid phosphate plot	—255 "
To cotton seed meal and acid phos. plot	138 "
Average decrease with kainit	**85** "

The chief need of this soil was for nitrogen. Neither phosphate nor kainit was effective except when combined with cotton seed meal. The largest profit, $4.72 per acre, resulted from the use of cotton seed meal alone.

The experiment seems to have been conducted on the same plots as the test made in 1897. In 1897 kainit was most effective, phosphate fairly effective. The main reason why kainit was decidedly beneficial in 1897, was probably the excessive amount of rust during that year on the plots without kainit. There was less rust in 1898. The appearance of the plants in 1896 suggested the need for a complete fertilizer and seemed to show, as in 1898, the special importance of cotton seed meal.

EXPERIMENT MADE BY J. W. DYKES, 3½ MILES WEST OF UNION SPRINGS, BULLOCK COUNTY.

Dark sandy soil just above overflow; subsoil yellow clay.

This field, which had a soil about eight inches deep and inclined to be wet, was cleared about 13 years ago. The original growth was short leaf pine, dogwood, gum, hickory and oak.

The preceding crop was corn.

(See Table p. 75.)

Increase of seed cotton per acre when cottonseed meal was added:

To unfertilized plot	336 lbs.
To acid phosphate plot	189 "
To kainit plot	169 "
To acid phosphate and kainit plot	170 "
Average increase with cotton seed meal	**216** "

Increase of cotton seed per acre when acid phosphate was added:

To unfertilized plot .....160 lbs.
To cotton seed meal plot ..... 64 "
To kainit plot ..... 12 "
To cotton seed meal and kainit plot .....113 "

Average increase with acid phosphate ..... 87 "

Increase of seed cotton per acre when kainit was added:

To unfertilized plot .....118 lbs.
To cotton seed meal plot..... —49 "
To acid phosphate plot..... —30 "
To cotton seed meal and acid phosphate plot 51 "

Average increase with kainit..... 22 "

The largest yield and the greatest profit, $3.88 per acre, was afforded by a complete fertilizer containing 100 pounds of kainit.

In most combinations cotton seed meal was more affective than acid phosphate.

Greensboro, Thomaston, and Union Springs experiments with cotton.

Plot No.	Fertilizers.		Greensboro.			Thomaston.			Union Springs.		
	Amount per acre	Kind.	Yield seed cotton per acre.	Increase over unfertilized plots.	Profit from fertilizers.	Yield seed cotton per acre.	Increase over unfertilized plots.	Profit from fertilizers.	Yield seed cotton per acre.	Increase over unfertilized plots.	Profit from fertilizers.
	Lbs.		*Lbs.*	*Lbs.*		*Lbs.*	*Lbs.*		*Lbs.*	*Lbs.*	
1	200	Cotton seed meal	760	304	$ 2 83	1466	426	$ 4.72	856	336	$ 3.33
2	240	Acid phosphate	504	48	—.76	1144	104	.11	680	160	.99
3	00	No fertilizer	456			1040			520		
4	200	Kainit	504	29	—.91	1064	—9	—1.52	640	118	.45
5	200	Cotton seed meal	616	122	—1.51	1356	250	.48	872	349	2.03
	240	Acid phosphate									
6	200	Cotton seed meal	592	78	—2 07	1248	110	1.57	712	287	1.19
	200	Kainit									
7	240	Acid phosphate	480	—53	—3.70	1020	—151	— .53	656	130	— .86
	200	Kainit									
8	00	No fertilizer	552			1204			528		
9	200	Cotton seed meal	520	—32	—5.27	1592	388	1.25	928	400	1.44
	240	Acid phosphate									
	200	Kainit									
10	200	Cotton seed meal				1560	356	1.46	1040	512	3 88
	240	Acid phosphate									
	100	Kainit									

GROUP VII. NO FERTILIZER VERY EFFECTIVE.

EXPERIMENT MADE BY E. HAYS, ONE MILE WEST OF CULLMAN, CULLMAN COUNTY, ALA.

Sandy upland; recently cleared.

The original growth was oak and pine. Apparently the land had been in cultivation only one year before the test was begun.

On this "new ground" no fertilizers were decidedly beneficial.

(See Table, p. 78.)

Increase of seed cotton per acre when cotton seed meal was added:

To unfertilized plot	152 lbs.
To acid phosphate plot	—86 "
To kainit plot	—31 "
To acid phosphate and kainit plot	213 "
Average increase with cotton seed meal	**62 "**

Increase of seed cotton per acre when acid phosphate was added:

To unfertilized plot	112 lbs.
To cotton seed meal plot	—126 "
To kainit plot	—170 "
To cotton seed meal and kainit plot	74 "
Average decrease with acid phosphate	**27 "**

Increase of seed cotton per acre when kainit was added:

To unfertilized plot	45 lbs.
To cotton seed meal plot	—138 "
To acid phosphate plot	—237 "
To cotton seed meal and acid phosphate plot	62 "
Average decrease with kainit	**67 "**

EXPERIMENT MADE BY D. T. FULTON, HARTFORD, GENEVA COUNTY.

Gray sandy loam; subsoil yellow sandy clay.

The field had been cleared only three years and had produced but two crops, one of cowpeas and one of corn. The forest growth was long leaf pine with a few oaks.

No fertilizer increased the yield to any great extent, a result ascribed chiefly to the unfavorable year. "Much of the cotton rotted in the field."

Increase of seed cotton per acre when cotton seed meal was added:

To unfertilized plot	128 lbs.
To acid phosphate plot	32 "
To kainit plot	32 "
To acid phosphate and kainit plot	40 "
Average increase with cotton seed meal	**58** "

Increase of seed cotton per acre when acid phosphate was added:

To unfertilized plot	112 lbs.
To cotton seed meal plot	16 "
To kainit plot	48 "
To cotton seed meal and kainit plot	56 "
Average increase with acid phosphate	**58** "

Increase of seed cotton per acre when kainit was added:

To unfertilized plot	152 lbs.
To cotton seed meal plot	56 "
To acid phosphate plot	88 "
To cotton seed meal and acid phosphate plot	56 "
Average increase with kainit	**88** "

Hartford and Cullman experiment with cotton.

Plot No	FERTILIZERS. Amount per acre.	FERTILIZERS. Kind.	Hartford. Yield seed cotton per acre.	Hartford. Increase over unfertilized plots	Hartford. Profit from fertilizers.	Cullman. Yield seed cotton per acre	Cullman. Increase over unfertilized plots	Cullman. Profit from fertilizers
	Lbs.		*Lbs.*	*Lbs.*		*Lbs.*	*Lbs.*	
1	200	Cotton seed meal	352	128	$ 0 09	880	152	$0.46
2	240	Acid phosphate	336	112	.24	840	112	.24
3	00	No fertilizer	224	....	.....	728	....	.....
4	200	Kainit	376	155	1 03	800	45	—68
5	200 240	Cotton seed meal Acid phosphate	368	150	—1.07	808	26	—3.00
6	200 200	Cotton seed meal Kainit	408	194	— .27	824	14	—3.07
7	240 200	Acid phosphate Kainit	424	213	.43	712	–125	—4.82
8	00	No fertilizer	208	....	.....	864	....	.....
9	200 240 200	Cotton seed meal Acid phosphate Kainit	464	256	— 80	952	88	—3.41
10	200 240 100	Cotton seed meal Acid phosphate Kainit	480	272	.15	912	48	—3.33

DO FERTILIZERS PAY AT PRESENT PRICES OF COTTON?

We may in part answer this question by showing the average amount of increase in yield of seed cotton attributable to the different fertilizers. The following table gives the *average* results for 22 co-operative tests in 1897, and for 30 in 1898. The price assumed for a pound of seed cotton, 1 5-9 cents, is the *net* price of increase, or value of the seed cotton after paying 33 cents per 100 pounds for picking, and is equivalent to 5 cents per pound for lint and $6.67 per ton for seed.

Average increase over unfertilized plots in 1897 and 1898.

Plot No.	FERTILIZERS. Amount per acre.	FERTILIZERS. KIND.	Cost of fertilizers.	Average 22 tests in 1897. Increase over unfertilized plots.	Average 22 tests in 1897. Profit from fertilizers.	Average 30 tests in 1898. Increase over unfertilized plots.	Average 30 tests in 1898. Profit from fertilizers.
	Lbs.			*Lbs.*		*Lbs.*	
1	200	Cotton seed meal	$ 1.90	**113**	$—.15	**205**	$ 1.29
2	240	Acid phosphate	1.50	**194**	1.51	**230**	2.08
3	00	No fertilizer					
4	200	Kainit	1.38	**144**	.86	**97**	.13
5	200	Cotton seed meal	3.40	**339**	1.87	**375**	2.43
	240	Acid phosphate					
6	200	Cotton seed meal	3.28	**282**	1.10	**258**	.73
	240	Kainit					
7	200	Acid phosphate	2.88	**287**	1.58	**283**	.88
	200	Kainit					
8	00	No fertilizer					
9	200	Cotton seed meal	4.78	**419**	1.73	**392**	1.32
	240	Acid phosphate					
	200	Kainit					
10	200	Cotton seed meal	4.08	**372**	1.70	**435**	2.84
	240	Acid phosphate					
	100	Kainit					

This table shows that fertilizers, even when used indiscriminately, or without any attempt to suit the fertilizer to the soil, were, as judged by *average* results, moderately profitable.

Averages however do not do full justice to the amount of increase which fertilizers afford when selected with special reference to their suitability for the soil on which they are to be applied. The several tables on preceding pages which give the yield and profits in each locality show that in a number of localities, the complete fertilizer, the meal and phospate mixture, or even the phosphate applied by itself afford profits of more than $5 per acre after paying for cost of picking the increased yield due to the fertilizer.

The absolute necessity for using fertilizers in the regions where they are now in general use can also be inferred from the small yields obtained in most tests on the plots that received no fertilizer. In our conclusive tests in 1897 and 1898, the average yields *without fertilizers* were respectively 474 and 506 pounds of seed cotton per acre. Excluding all tests where the unfertilized plots produced 500 pounds or more of seed cotton per acre, we find that 11 soils in 1897 averaged without fertilizers only 281 pounds, and 17 soils in 1898 averaged, when unfertilized, only 299 pounds of seed cotton per acre, the entire product, including seed, being worth less than $6 per acre.

General Suggestions about Suiting the Fertilizer to the Soil.

There are no positive indications or signs by which the farmer can tell whether his soil needs chiefly phosphate or potash. He can often decide whether nitrogenous fertilizers are needed. As a rule on soils with the proper supply of moisture, and properly cultivated, a very small cotton stalk suggests a need of nitrogenous fertilizers. A very large cotton stalk, too much "run to weed," indicates that an ample supply of nitrogen is present, and if such a large plant is poorly fruited, and late in maturing, a need for phosphate is suggested, (except possibly in the Central Prairie Region). A light shade of green on the leaves, instead dark, deep luxuriant green, may indicate a need of either of

phosphate or nitrogen, or both. But color of foliage is not to be relied on, for few have an accurate eye for color, the subject has not been sufficiently studied, and the supply of moisture or the presence of leaf disease is apt to determine or obscure the color of the foliage.

A black or dark soil usually contains an abundance of vegetable matter and hence of nitrogen, but lime soils may be dark colored and still need additional nitrogen. Next to size of stalks, the history of the field affords the best indication as to whether or not the soil needs nitrogen. For example, recently cleared land contains much vegetable matter and cotton on "new ground" seldom responds profitably to nitrogenous fertilizers. The ashes left in burning the brush, especially if the growth is hardwood, usually make potash fertilizers unnecessary on recently cleared land. When "new ground" needs any fertilizer at all it is usually acid phosphate alone.

Cotton following cow peas, needs little if any cotton seed or cotton seed meal if the peas the preceding year occupied all the space. If the peas were grown between the corn rows and made but slight growth of vines, a small amount of nitrogenous fertilizer may be needed.

We are able to give no indication by which to determine the need for potash. Where black rust is prevalent kainit is often needed.

The best solution of the fertilizer question is for the farmer to obtain the necessary supplies of high priced nitrogen from the air instead of from fertilizers. This can be done by practicing such a rotation as will require a large area of cow peas (and of vetch and *crimson* clover, when the farmer has learned from the bulletins of this Station how to "inoculate" them and thus to grow successfully these two soil-improving plants. Inoculation consists in sowing with the clover seed some of the soil from a field where clover has been successfully grown; or in sowing with vetch seed soil from an old vetch field, and so on.

For example, the following three-year rotation will furnish to the soil sufficient nitrogen trapped from the air by the restorative plants to dispense almost or quite entirely with purchased nitrogen, which now in ammoniated guanos or cotton seed meal costs 12 to 15 cents per pound:

First year corn, with cow peas between.
Second year fall oats, followed by cow peas.
Third year cotton as usual, or followed by a "catch crop" of crimson clover or vetch.

If half instead of one-third of the farm is needed for cotton, the above rotation is easily changed to a four-year rotation by causing another cotton crop to follow the cotton crop of the third year, thus allowing cotton to occupy one-half the cultivated land.

The growth of the renovating plants does not diminish the necessity for buying phosphate, and, where needed, potash, both of which, however, cost per pound only about half as much as nitrogen. Moreover, the adoption of a rotation embracing a large proportion of leguminous or soil-improving crops would not at once, but only after several years, render the purchase of nitrogenous fertilizers unnecessary.

This plan, especially if further perfected by growing a larger amount of livestock, will greatly decrease the farmer's expenditure for fertilizers, without reducing the amount of his sales.

Means of Determining the Needs of a Soil.

While the size of stalks, history of land, color of soil, and even color of foliage are helpful in making an intelligent guess as to the needs of a soil, the only certain means of learning the best fertilizer for a given soil is by an actual test of fertilizers.

This Station is able to furnish material for only 30 to 40 such tests each year. A much larger number of tests is needed if we are speedily to arrive at a knowledge of the

fertilizer needs of the numerous varieties of soil in Alabama. It will pay farmers to make similar experiments or simpler tests at their own expense.

If a farmer is willing to take sufficient pains to make a complete test on 10 eighth-acre plots, it would be well for him to follow exactly the plan of the tests described in this bulletin.

However, a simpler test on three plots will throw some light on the needs of his soil. Thus on 3 plots he can determine whether his soil needs potash, and how much increase or profit he gets from a complete fertilizer and from a mixture of acid phosphate and cotton seed meal. The three plots should be either one-eighth or one-fourth acre in area. The middle plot should have no fertilizer; one plot should receive per acre 80 pounds of cotton seed meal and 160 pounds of kainit; the third plot should receive 80 pounds of cotton seed meal, 160 pounds of acid phosphate and 80 pounds of kainit. Any parties agreeing to make this test at their own expense will, on application, be furnished with a detailed plan suggesting dimensions of plots, forms for keeping records, etc.

This simple test can scarcely fail to be profitable to the party making it, and if reports are sent to Auburn and edited, these supplementary tests may serve to confirm or modify the fertilizer formulas suggested in this bulletin for the different soils of the State, and the tests may thus be made useful to many farmers.

This is an opportunity for farmers to help each other, and surely sufficient public spirit will not be wanting to make these simpler tests, involving as they do no unusual expense and only a very small amount of extra labor and pains.

The names of parties volunteering to give information about local soils, forest growth, and fertilizers in most general use in their neighborhoods, will be gladly enrolled. In time we shall probably be able to furnish such observers with blank forms on which to record information of this kind.

Wherever, in the following pages, a formula is recommended which contains cotton seed meal, cotton seed may be substituted, using at least two and one-half times as much seed as the amount of meal recommended.

The suggestions in the next few pages are based on experiments extending over a number of years but are in no sense intended as final nor as universally applicable.

Fertilizers for Red Lime Soils of the Tennessee Valley Region.

Although commercial fertilizers are not generally used in this region the soil responds freely to fertilizers containing nitrogen and phosphoric acid. There is ample data to sustain this conclusion. Experiments made at Town Creek, Athens, Trinity and for several years at Madison show that acid phosphate greatly increases the yield of cotton and that the use of potash is not profitable. As in all other parts of the State, nitrogen, preferably in cotton seed or cotton seed meal, is advantageous on the upland fields that have been cultivated continuously in cotton for many years. To obtain best results, cotton seed meal or cotton seed on these soils should be applied, not alone, but in combination with acid phosphate.

The remarks above are not intended to apply to overflowed land.

Doubtless the following formula will give profitable results on cotton on these soils :

Acid phosphate, 160 to 240 pounds per acre.
Cotton seed meal, 80 to 120 pounds per acre.

Total, 240 to 360 pounds per acre.

This formula contains 2.2 per cent. nitrogen, about 8 to 10 per cent. available phosphoric acid and a little over ½ per cent. of potash.

Where the cotton stalks grow large enough the cotton seed meal may be reduced or even omitted. If much cotton seed meal is used, the rows should probably be wider than is usual on the uplands in this region. In a region so well adapted to cow peas, clover, etc., these crops should enter the rotation so often as to make it unnecessary to purchase nitrogenous fertilizers.

Fertilizers for Calcareous Valley Soils of Northeast Alabama.

The above designation is here tentatively used to include the valley soils, rich in lime, such as occur at Blountsville, Blount County, and Larimore, DeKalb County. In both localities in 1898 phosphate was greatly needed, as was also nitrogen, (in cotton seed meal) when combined with phosphates. Potash was apparently not needed.

It is notable that numerous other experiments on reddish land in Northeast Alabama give similar results. For example, on mulatto land *with red clay subsoil*, apparently calcareous, at Creswell Station, Shelby County, a test extending over two years indicated a decided need for acid phosphate and no necessity for kainit. The same was true in a two-year test at Remlap, Blount County, on soil described as red sandy land, with clay subsoil. At Attalla, Etowah County, on red loam, with red clay subsoil, results for three years indicated that little or no potash was needed, but that the need for phosphoric acid was imperative.

For the soils of this class the writer would suggest the use of the formula mentioned as suitable for the Tennessee Valley Region.

Fertilizers for Oak and Hickory Uplands with Short Leaf Pine.

Following the agricultural map of Alabama published by Dr. E. A. Smith, State Geologist, this designation is applied to an area in the northwestern part of Alabama lying between the Central Prairie Region on one side and the Table Lands and Coal Fields on the other, and extending northward from Tuscaloosa and Pickens counties.

For this region we have no large amount of data. The experiment at Sulligent, Lamar county, in 1898, on gray valley land shows plainly that phosphate was important and potash unnecessary. The same was true at Gordo, on "dark ashy second bottom."

At Dillburgh, Pickens county, in 1898, on high grayish table land, with red clay subsoil, and at Davis Creek, Fayette county, in 1891, on "whitish" soil, phosphate was highly important, and potash was beneficial, but to a less extent.

Doubtless on most of the better upland soils of this region where fertilizers are needed at all, a combination of two parts acid phosphate and one part cotton seed meal will be sufficient. (See formula for Tennessee Valley soils.) The thinner, sandier upland soils may be benefitted by the addition to the above of 80 pounds of kainit per acre, especially if cotton on these soils inclines to rust.

Fertilizers for Gravelly Hills Region with Long Leaf Pine.

The term used above is not intended to convey an idea that the soils embraced in this region are uniform. They vary widely. This region, as laid down in Dr. Smith's map, embraces the larger part of Tuscaloosa county, a small part of Pickens, the northern parts of Hale, Perry, Montgomery, Macon and Russell, most of Bibb, Chilton and Autauga and the southern parts of Elmore and Lee.

Numerous tests has been made in this region. The great majority of them agree in showing a decided need for phos-

phates. This is particularly true in the experiments several times repeated at Tuscaloosa, Clanton, (Chilton County), and Randolph, (Bibb County), and also in tests made at Robinson Springs, (Elmore County), Marvyn, (Russell County), and between Tuskegee and Notasulga, (Macon County.) In a few tests in other localities in this region nitrogen has been most effective, but in no case has potash been the principal material needed.

Most of these tests have indicated that potash fertilizers were unprofitable in the rather large amounts employed in these experiments. In other tests potash has been useful, but always less important than acid phosphate. In nearly all these tests nitrogenous fertilizers have been beneficial, but in most of these counties of less importance than phosphates. The following fertilizer formula is tentatively suggested for those soils in this region where cotton does not usually suffer severely from black rust and where the stalks are not notably undersized:

80 to 120 pounds cotton seed meal per acre.
160 to 240 " acid phosphate.

240 to 360 " total per acre.

On soils inclined to rust it will probably pay to add to the above 80 pounds of kainit per acre.

Fertilizers for Gray Isinglass and Red Clay Lands of East Alabama.

This triangular area extends along the Georgia line from Russell into Cleburne county. Its eastern angle or apex is near Verbena, in Chilton county, on the Louisville and Nashville Railroad.

The soils vary from deep red clay to light gray sand of considerable depth. At Cusseta, on red land, a test continued for two years indicated that phosphate was chiefly in demand, that nitrogen was necessary but less effective, and that potash was not profitable. At Kaylor, Randolph County,

on lighter soil, the results on the whole have been but little more favorable to kainit. Experiments repeated for several years on gray sandy soil at Dadeville agree with those just cited in showing the pre-eminent need for phosphates and afford a somewhat more favorable showing for potash fertilizers, which, however, are, as in all the co-operative tests in this region, less effective than either cotton seed meal or acid phosphate.

At Roanoke, Randolph County, on sandy loam soil, phosphate was the chief need of the soil, nitrogen of secondary importance, and kainit of still less advantage, although somewhat beneficial.

Without attempting a complete analysis of the numerous experiments at Auburn, which lies in the southern edge of this district, it may be said briefly that on the Experiment Station farm potash fertilizers have been less essential than phosphate and nitrogenous fertilizers on the stiffer, reddish soil, but that potash has been beneficial when combined with the other materials and applied to the lighter soils of this farm. In at least one instance potash was also decidedly beneficial on stiffer, reddish loam, this favorable result occurring in a season when black rust was very destructive.

It appears to the writer that the farmers of this region can dispense with kainit or other potash fertilizer on red land not very subject to rust. A mixture of two-thirds acid phosphate and one-third cotton seed meal is probably the correct proportion for most of the red lands of this region.

For example I would suggest

Cotton seed meal per acre...	80 to 120 pounds
Acid phosphate per acre....	160 to 240 "
Total.....	240 to 360 " per acre.

This proportion should be modified according to the size of cotton stalks usually produced, according to recent cropping of the land, etc., increasing the proportion of cotton seed meal where the cotton stalks are usually too small and

decreasing the proportion of meal on fields on which a thrifty crop of cowpeas has recently grown, and omitting the meal entirely on fresh land.

On the gray soils of this region where the sand is deep or where rust frequently occurs, 80 pounds of kainit per acre will often prove profitable.

The formula given above and containing no kainit, would analyze about 2.2 per cent. nitrogen, or 2.6 per cent. ammonia, about 8 or 10 per cent. of available phosphoric acid, and about ½ per cent. of potash. If kainit constituted one-fourth of the fertilizer analysis would show about 1.7 per cent. of nitrogen, 6 to 7½ per cent. of available phosphoric acid and 3.5 per cent. of potash.

Fertilizers for Southern Long Leaf Pine Region.

As here used, this term is applied to the long leaf pine lands of the southern third of the State, or to the greater part of the land region south of the Central Prairie Region.

It is usually sub-divided, and embraces a variety of soils. While many fertilizer tests have been made in this portion of the State, many of the results cannot be considered in detail here because of uncertainty as to the kind of soil and vegetation of the localities where many of the tests were made.

Deferring a detailed analysis of the results in the southern part of the State until further data is available and until more is learned about the localities in which the earlier tests were made, it may be said that there is a general need for phosphoric acid in these soils and that nitrogen is also important, especially when combined with acid phosphate.

As to potash, the results vary widely. There seems to be a more general need for potash than in the cotton-growing regions north of the Central Prairie Region.

In most localities potash, while decidedly useful, is not equally as important as phosphoric acid, and should doubtless constitute a smaller portion of the fertilizer than

should phosphoric acid. In some tests potash was not needed, especially where a red clay subsoil was present.

The following formula is tentatively suggested for the soils of this region:

60	to 120	lbs.	cotton seed meal	per acre.
120	to 240	"	acid phosphate	" "
60	to 120	"	kainit	" "
240	to 480	"	Total per acre.	

On fresh land the cotton seed meal and kainit may be omitted; on the stiffer soils, especially where the forest growth is largely hard woods, it is probable that the potash in the above formula may be omitted if rust is not feared.

The formula given above contains about 1.7 per cent. of nitogen, 6 to 7.5 per cent. of available phosphoric acid, and 3.5 per cent. of potash.

Fertilizers for the Central Prairie Region.

In this region there is considerable variation in soils. Leaving out of consideration all the soils within this belt that contain any considerable percentage of sand, we have to deal with soils all rich in lime. These lime soils represent every gradation in color and fertility between white or bald prairie and deep black soils, rich in vegetable matter, and indeed in all elements of plant food.

There is a widely accepted opinion that commercial fertilizers do not pay on these lime lands. However the majority of these lime soils are greatly improved by the addition of vegetable matter. The better class of soils need drainage and vegetable matter in order that the physical condition may be improved. The poorer grades all need vegetable matter rich in nitrogen. Cotton seed is here generally preferable to cotton seed meal, by reason of the greater effect of

the former in lightening the soil, but on some of the thin uplands small quantities of cotton seed meal can be used to advantage.

However, the fertilizer most effective on the lime soils of the Central Prairie Region is a crop of melilotus, or tall sweet white clover. After a field has been occupied for two years by this plant and again put in cultivation, the yield is often nearly double what it was before this restorative crop was grown. This benefit to the soil accrues even though the melilotus may have been almost continuously grazed or frequently mowed during its second year of growth.

Fertilizers for Other Regions..

The data at hand are not sufficient to permit a discussion of the needs of the soils of the Table Lands and Coal Fields in North Alabama. For the numerous narrow soil belts in the northeastern part of the State, lying between the Coal Fields and the Gray Gneissic (Isinglass) and Red Clay lands we have considerable data, which however is unavailable for lack of accurate information as to the soil and vegetation of the localities in which the tests were made.

Another region not discussed in this bulletin is a region of short leaf pines and hard woods fringing the central prairies. Information regarding the boundaries and soils of this region, and indeed of any soil, is invited from readers of this bulletin.

In this discussion no reference has been made to soils needing lime, although tests of lime have been made for this Station in several localities. Soils which when moistened and brought into contact with blue litmus paper, cause the paper to turn red, need lime. Paper for this test will be supplied free to parties applying to the writer and promising to report the results of their tests.

INCONCLUSIVE EXPERIMENTS.

The experiment near Abbeville, Henry county, was started on the farm of the Southeast Alabama Agricultural School, by Prof. S. T. Slaton, and concluded by Prof. P. M. McIntyre.

The soil was a brown loam.

The land had been in cultivation about fifty years. The original forest growth was oak and hickory.

The experiment near Newton, Dale county, was made by Mr. D. Carmichael, Jr.

The land had been in cultivation about ten years and consisted of a light, gray surface soil, with a red clay subsoil. The original forest growth was long leaf pine.

The experiment at Wetumpka, Elmore county, was made upon the farm of the Fifth District Agricultural School, by Prof. B. A. Taylor.

The land was dark gray in color, with a yellowish red subsoil.

The original forest growth was pine, both long and short leaf, the short leaf however predominating.

The land was infested with nut grass, which obscured the effect of the fertilizers on cotton.

The experiment near Brundidge, Pike county, was made by Mr. G. Conner, on land that had been in cultivation about sixty years and which was apparently not uniform, the yields of the two unfertilized plots varying widely.

The surface soil was gray with a yellow subsoil.

The original forest growth was oak, hickory, gum and short leaf pine.

The experiment at Boligee, Greene county, was made by Mr. J. P. McAlpine, on land that had been cleared about fifty years.

The soil was dark yellow, with a yellow subsoil.

The original forest growth was short and long leaf pine, chestnut, oak, hickory, mulberry and persimmon.

The experiment at Tuscumbia, Colbert county, was made by Mr. F. Funkey upon land that had been cleared and cultivated about forty years.

The land was red with a red clay subsoil.

Inconclusive experiments with cotton.

Plot No.	FERTILIZERS. Amount per acre	Kind.	Abbeville. Yield of seed cotton per acre.	Abbeville. Increase over unfertilized plots	Newton. Yield of seed cotton per acre.	Newton. Increase over unfertilized plots	Wetumpka. Yield of seed cotton per acre.	Wetumpka. Increase over unfertilized plots	Brundidge. Yield of seed cotton per acre.	Brundidge. Increase over unfertilized plots	Boligee. Yield of seed cotton per acre.	Boligee. Increase over unfertilized plots	Tuscumbia. Yield of seed cotton per acre.	Tuscumbia. Increase over unfertilized plots
			Lbs.	*Lbs.*	*Lbs.*	*Lbs.*	*Lbs.*	*Lbs.*	*Lbs.*	*Lbs.*	*Lbs.*	*Lbs.*	*Lbs.*	*Lbs.*
1	200	Cotton seed meal	720	208	400	—32	624	216	512	136	720	152	1220	532
2	240	Acid phosphate	440	—72	416	—16	648	240	480	104	560	—8	976	288
3	00	No fertilizer	512	.....	432	.....	408	.....	376	....	568	.....	688	.....
4	200	Kainit	640	146	400	—10	416	.....	520	114	642	95	888	206
5	200 240	Cotton seed meal Acid phosphate	600	123	576	189	616	192	696	259	976	450	1192	517
6	200 200	Cotton seed meal Kainit	440	—19	464	99	456	24	736	269	632	126	872	203
7	240 200	Acid phosphate Kainit	648	206	408	66	416	—24	576	78	440	—45	744	82
8	00	No fertilizer	.....	.....	320	.....	448	.....	528	.....	464	.....	656	.....
9	200 240 200	Cotton seed meal Acid phosphate Kainit	424	.....	424	104	584	136	760	232	408	—.56	832	176
10	200 240 100	Cotton seed meal Acid phosphate Kainit	.....	.....	392	70	704	256	808	280	440	—24	720	64