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CORN CULTURE.

By

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CORN CULTURE.

By J. F. Duggar.

SUMMARY.

During the last five years thirty-six varieties of corn have been tested from one to five years. In no two of these five years did the same variety stand at the head of the list.

Of the varieties tested five years, Mosby made the highest average yield; among those tested four years, Shaw led; of the varieties tested three years Cocke was most productive; at the head of the list of those tested two years, stand Renfro and Higgins.

Mexican June corn did not afford a satisfactory yield of grain.

In five years tests seed corn from Illinois afforded yields averaging .45 of a bushel more than seed from the Gulf States region. Satisfactory yields were obtained with seed from both the South and the North. Late varieties from the North made good yields at Auburn, but the smallest yields obtained were from early varieties of northern origin.

Seed corn from Virginia gave an average yield of 4 bushels per acre higher than seed corn of the same varieties from the Gulf States and Georgia.

No material difference was found as the result of planting kernels from the middle, butt, or tip portion of the ear.

In the wet season of 1900 planting corn in the water furrow decreased the yield.

Corn planted late or after small grain failed to make a satisfactory yield.

Relatively thick planting was most advantageous with an early, small-stalked variety.

Frequent rains obscured the results of cultivation experiments made in 1900 with late corn, but the slight differences in yields were in favor of

(1) Making first cultivation deep.

(2) Continuation of cultivation late into the season.

(3) Frequent cultivation.

There was a reduction in the yield of corn in 1900 as the result of either stripping the blades, or cutting the tops, or cutting and shocking the entire plant. This loss was greater when topping or cutting was done than when the blades were stripped. The total value of grain and harvested forage was greatest when the stalks were cut and shocked.

Lime was useless on sandy upland poor in humus; it was apparently slightly effective, but not profitably so, on soil where there was considerable vegetable matter.

The stubble alone of velvet beans proved an affective fertilizer for corn. Still more effective was the plowing under of the entire growth of velvet bean vines, the corn crop following the vines yielding 11.9 bushels per acre more than the corn on the plot where only the roots and stubble of velvet beans were used as a fertilizer for corn.

Beggar weed, used as fertilizer, increased the yield of corn, but in this respect proved decidedly inferior to velvet beans.

Cowpea vines, from which the peas had been picked, increased the yield of corn by 17 per cent. in spite of the fact that nitrate of soda was applied to the corn.

The fertilizing effect of cowpea vines and velvet bean vines was more permanent than was the fertilizing effect of the stubble of these two plants. The average increase in the yield of the corn crop of 1900, grown two years after these legumes, was 3.2 bushels per acre on the plots where the vines had been plowed in and only .9 of a bushel on the plots where only the roots and stubble of cowpeas and velvet beans had been left on the land in 1898.

In a second experiment the residual fertilizing effect of velvet beans, grown in 1898, was represented by an increase of 7.5 bushels of corn in the crop of 1900. In this test the residual effect of velvet bean stubble was considerable, but less than that of the entire growth of the same plant.

Hairy vetch, hairy vetch stubble, rye, and rye stubble were compared as green manures for corn. Corn planted June 16, which was more than a month after harvesting the vetch and rye hay, yielded 8.4 bushels per acre where the entire rye plant was plowed under and 17.5 bushels where vetch had been used as a green manure. This is an increase of 98 per cent. attributable to vetch. When the fertilizing effects of the stubbles of these two plants are compared the differences are somewhat less, but decidedly in favor of vetch stubble.

Vetch vines and stubble were nearly on an equality as fertilizers if measured by the yield of corn following these crops in the same year; however, the benfit from plowing in the vines was more permanent, as indicated by the increase in the second corn crop on the same land.

It was more profitable to harvest vetch for hay and utilize only the stubble as fertilizer.

Two hundred pounds of cotton seed meal and 434 pounds of cotton seed produced practically equal increases in the yield of corn, that is, a pound of nitrogen was of equal value in cotton seed and in cotton seed meal.

Unfavorable weather rendered inconclusive the results of experiments with nitrate of soda and cotton seed meal applied to corn at different dates.

Cowpea stubble afforded sufficient nitrogen for corn planted late in the season.

On exceedingly poor, gray sandy soil at Auburn fertilizer tests, or soil tests, with corn were repeated for three years. Phosphate gave no increase, kainit an inconsiderable one, and cotton seed meal an increase of only 2.3 bushels per acre, or not enough to be profitable.

On a slightly better sandy soil at Auburn the average results of an experiment repeated for two years show no gains from the use of phosphate or kainit and only a moderate increase with cotton seed meal.

On "mulatto" land in Big Wills Valley, DeKalb County cotton seed meal was highly effective and profitable, increasing the yield 7.9 bushels of corn per acre; phosphate and kainit were useless.

Commercial fertilizers are not so well adapted to corn as to cotton. If used for corn the amounts should not be large. A formula for corn should contain a smaller portion of phosphoric acid and potash and a much larger percentage of nitrogen than a formula for cotton growing on the same land. That is, it should be made up largely, if not entirely, of some nitrogenous material, like cotton seed meal. Cowpeas, velvet beans, vetch and other leguminous plants and coarse home-made manures are safer and better for corn than are commercial fertilizers.

TESTS OF VARIETIES OF CORN.

Results of variety tests of corn made by the writer in 1896 and 1897 were published in Bulletins Nos. 75 and 88 of this Station. The results for 1898, 1899, and 1900 are presented in the tables below. The figures are the actual yields of shelled corn. There was an equal number of plants on all plots, except in 1900, when on a few plots there was a slight deficiency in the stand. The varieties are arranged in order of yield.

Yields of varieties of corn in 1898.

Variety.	Yield per acre. Bushels.
Higgins	20.0
Shaw	17.5
Baden	16.9
Mosby Prolific	16.3
St. Charles (from Ill.)	15.5
Experiment Station Yellow	14.9
Farmer's Pride	14.0
Golden Beauty	13.3
Cocke Prolific (from Ga.)	12.9
Cuban Giant	11.8
Hickory King (from Ga.)	11.4
Blount Prolific (from Ga.)	11.0
Hickory King (Av. Ill. and Ga. seed)	10.9
Blount Prolific (Av. Ill. & Ga. seed)	10.8
Blount Prolific (from Ill.)	10.5
Hickory King (from Ill.)	10.4

Yields of varieties of corn in 1899.

Variety.	Yield per acre. Bushels.
Experiment Station Yellow	19.5
Jones Pearl Prolific	18.2
Mosby	18.0
Golden Dent	17.9
Blount Prolific (Ga.)	17.1
Evans	16.7
Blount Prolific (Av. Ill. and Ga.)	16.2
St. Charles (from Ills.)	16.1
Red Cob (from Jones)	16.0
Shaw	15.8
St. Charles (Av. Ala. and Ill.)	15.7
St. Charles (from Ala.)	15.3
Blount (from Ill.)	15.2
Hickory King (from Ga.)	14.9
Champion White Pearl	14.5
Hickory King (Av. Ga. & Ill.)	14.2
Hickory King (Ill.)	13.5

Yields of varieties of corn in 1900.

Variety.	Yield per acre. Bushels.
Cocke Prolific (from Va.)	41.7
Mosby	40.1
Arnold	39.6
Bradberry	39.1
Cocke Prolific (from N. Ga.)	38.6
Cocke Prolific (from S. Ga.)	38.4
Cocke Prolific (av. 4 plots)	37.8
Blount Prolific (from Va.)	36.8
Sanders	36.5
Expt. Sta. Yellow (av. 4 plots)	35.0
Red Cob	34.8
Blount Prolific (av. 3 plots)	34.3
Cary Klondyke	34.0
Farmer's Pride	33.7
St. Charles (av. 3 plots)	33.7

Shaw	33.2
St. Charles (from Ill.)	33.1
Giant Broad Grain	32.9
Cocke Prolific (from S. Ga. [J.])	32.6
Blount Prolific (from S. Ga.)	32.2
Early Mastodon	31.9
Poor Man	31.3
Hickory King (from Del.)	30.4
Hickory King (from Va.)	29.8
Golden Beauty	28.9
Evans	28.4
Hickory King (av. 3 plots)	28.2
White Sheep Tooth	26.2
Creole	25.9
Hickory King (from Ill.)	24.5
Champion White Pearl	24.4
Leaming	19.9

RELATIVE PRODUCTIVENESS OF VARIETIES.

Since all five of the variety tests of corn made during the last five years have been on a uniform plan and continuously under the same management and since fertilization and culture have been substantially the same each year, we are able to use these data in determining the relative productiveness of varieties.

However, available land and other considerations have made it impracticable to test the same list of varieties each year. Instead, we have in all tests used the variety Experiment Station Yellow as a standard with which the yields of all other varieties may be compared.

First let us ascertain how this variety, our standard, compares in productiveness with the other four varieties, that have entered into all of our recent tests.

Yield of varieties of corn tested for 5 years at Auburn.

	Yield of shelled corn per acre.					
	1896	1897	1898	1899	1900	Average 5 years.
Mosby..........................	15.5	25.4	16.3	18.0	40.1	23.1
St. Charles (av of seed from S. & N)	25.1	18.1	15.5	15 7	33.7	21.6
Experiment Station Yellow	16.9	18.4	14.9	19.5	35.0	20.9
Blount (av. of seed from (S. & N.)	22.3	19.0	10.8	16.2	34.3	20.5
Hickory King (av. of seed from S. & N.)	20.7	13.2	10 9	14 2	28 2	17.4

From this table we see that Experiment Station Yellow, though a safe variety, has not given the highest average yield for the five-year period. It has been surpassed by Mosby, averaging 23.1 bushels, and even by Saint Charles, which gives 21.6 bushels, against 20.9 bushels for Experiment Station Yellow. Blount closely follows with a record of 20.5 bushels, while Hickory King falls considerably below the other varieties, averaging only 17.4 bushels per acre for the five-year period.

Since it is not permissible to compare even the average yield of one variety with that made by another variety in different years, we are led to adopt some means of comparison which will eliminate the influence of varying seasons and place all varieties on the same basis, whatever may be the years in which they were tested. This can be done by representing the yield in any year of our standard, Experiment Station Yellow, by the member 100. The yield of any other variety can then be calculated in percentages of this number.

By this means the figures in the following table are obtained; the figures are percentages, and if greater than 100 show that the variety opposite the figure afforded a larger yield for a given year than did the Experiment Station Yellow. A figure smaller than 100 indicates a yield less than that of the standard variety just referred to.

Relative yields of varieties of corn at Auburn, taking the yield of Experiment Station Yellow as 100.

	1896	1897	1898	1899	1900	Average.
Tested 5 years.						
Mosby	91	138	109	92	115	109
St Charles	148	98	104	81	96	105
Experiment Stat on Yellow	100	100	100	100	100	100
Blount	132	103	72	83	98	98
Hickory King	122	72	73	73	80	84
Tested 4 years.						
Shaw	....	99	117	81	95	98
Champion White Pearl	126	79	....	74	70	87
Tested 3 years.						
Cocke	....	129	87	....	108	108
Farmers' Pride	....	101	94	....	96	97
Jones' Pearl Prolific	99	97	....	93	....	96
EarlyMastodon	134	60	....	....	91	95
Tested 2 years.						
Renfro	86	128	....	....	....	107
Higgins	72	....	134	....	....	103
Red Cob	....	....	....	82	99	91
Golden Beauty	....	....	89	....	83	86
Evans	....	....	....	86	81	84
Tested 1 year.						
Golden Giant	125	....	....	....	....	125
Cade Prolific	....	124	....	....	....	124
Yellow Dent	117	....	....	....	....	117
Arnold	....	....	....	....	113	113
Baden	....	....	113	....	....	113
Bradbury	....	....	....	....	112	112
Peabody	108	....	....	....	....	108
Sanders	....	....	....	....	104	104
Cary Klondike	....	....	....	....	97	97
Strawberry	....	97	....	....	....	97
Giant Broad Grain	....	....	....	....	94	94
Chester Co. Mammoth	93	....	....	....	....	93
Golden Dent	....	....	....	92	....	92
Poor Man	....	....	....	....	89	89
Welborn	....	87	....	....	....	87
Cuban Giant	....	....	79	....	....	79
Sheep Tooth	....	....	....	....	75	75
Creole	....	....	....	....	74	74
Leaming	....	....	....	....	57	57
SilverMine	....	48	....	....	....	48

Among the varieties tested for 3 or more years in this series of experiments, Mosby and Cocke take first rank, their yields exceeding those of the standard by 9 and 8 per cent. respectively. Both are prolific varieties, having usually two or more small ears per plant. They are desirable varieties for bottom lands or for rich unlands provided the supply of moisture is abundant. They are not to be recommended for rather poor or dry upland, where there is a tendency to make nubbins instead of ears. Varieties with larger ears and a smaller number, as Experiment Station Yellow, Farmer's Pride, Shaw, Higgins, etc., are probably safer, or less likely to make an occasional failure on such lands, and the three last named are also suitable for bottom land.

No early variety has averaged well here, though a medium early kind has sometimes given a large yield. The late varieties contain less weevil eaten corn when harvested. The late date at which frost occurs in the Gulf States makes earliness a consideration of no special importance for corn planted at the usual time.

THE RELATION OF THE RAINFALL TO THE YIELD OF VARIETIES.

It will be noticed that the relative rank of varieties differs greatly in each year. Weather conditions, and especially rainfall, may be one year in favor of one class of varieties, and the next in favor of another type.

For example, in 1896 the early varieties as a rule surpassed the late varieties. In 1897 the opposite condition occurred, the late varieties leading. In 1898 and 1899 the influence of season was less marked. In 1900 weather conditions were decidedly favorable to the late varieties.

The chart of the rainfall (see opposite p. 108), during the past five years was prepared to throw light on the relation between the distribution of the rainfall and the yields of the early and of the late varieties.

The dates of planting of all varieties were as follows:

March 28, 1896; April 8, 1897; April 1, 1898; April 3, 1899, and April 6, 1900.

This makes the period between planting time and the beginning of the relatively abundant rains of midsummer 100, 74, 96, 107, and 112 days respectively.

Those interested in such problems and with sufficient leisure for such investigations may, by the use of the chart, trace other important relations between the rainfall and the yield of each variety.

Here we need only observe that the distribution of the rainfall is the most important climatic factor in determining the yield of corn in the Gulf States. Since this is beyond control we must depend for uniformly satisfactory yields of corn on frequent, well timed and judicious shallow cultivation of corn and on so preparing the soil and supplying it with decaying organic matter by rotations embracing cowpeas and other humus-forming crops, that the soil will be enabled to retain a sufficiency of moisture during periods of drought.

The rainfall chart was prepared under the writer's direction by T. Bragg, a student of the agricultural course, from the weather records at Auburn kept by Dr. J. T. Anderson.

This chart shows the rainfall for the six months from April to September inclusive.

The rainfall in the other six months has less influence on the yield of corn. However it is given below.

Rainfall in inches.

	1896	1897	1898	1899	1900
January	....	3.47	1.60	7.17	2.20
February	....	6.34	1.25	....	**11.09**
March	....	**10.68**	3.88	3.69	4.45
April	1.74	5.82	5.06	**2.5[illegible]**	5.48
May	2.55	**1.09**	**.26**	3.06	**1.62**
June	**1.77**	3.46	**1.18**	**1.92**	**8.95**
July	**9.29**	5.01	**6.79**	**8.74**	3.22
August	2.26	6.37	**10.13**	4.78	6.69
September	5.78	**.44**	1.93	**.14**	3.50
October	1.54	2.31	**11.73**	3.42	4.87
November	7.37	2.09	6.74	2.39	5.17
December	2.38	1.91	6.08	4.75	4.73

MEXICAN JUNE CORN.

This variety has been highly recommended for very late planting, especially for occupying a field after a crop of small grain is cut. We have grown it for several years, but the late date of planting has made it impracticable to compare the yields with those of other varieties. It may be said, however, that the average yield of Mexican June corn planted late has been less at Auburn than that of the most other varieties planted earlier. For example in 1899 it was grown on soil that would easily have produced 20 to 25 bushels of the standard varieties planted early. The yield of the Mexican June was only 9 bushels per acre and it was scarcely dry enough for harvesting October 19, although planted April 21. In 1900, it was planted July 3 and yielded far less than other varieties planted early.

It makes an immense growth of stalks and leaves. On poor or medium land there is a tendency to produce only nubbins, though the shucks are of full length. It is probably valuable for forage, if fed green. We have not found much use for it.

WHERE TO GET SEED.

The Alabama Experiment Station has no seed for sale or distribution. With many varieties growing near together we could not keep varieties pure.

We refer inquirers wishing any of these varieties to the parties from whom we obtained seed, as follows:

Curry-Arrington Seed Co., Rome. Ga.: Shaw, Cade, Hickory King, Farmer's Pride, Golden Dent, Cocke, Higgins.

Alexander Seed Co., Augusta, Ga.: Cocke, Bradberry, Poor Man's, Mexican June.

H. P. Jones, Herndon, Ga.: Jones Pearl, Red Cob, Cocke, Blount, Welborn.

E. G. Packard, Dover, Del.: Chester, Hickory King, Early Mastodon ,White Sheep, Tooth.

J. C. Suffern, Woorhees, Ill.: Champion, White Pearl, St. Charles, Hickory King, Blount, Golden Beauty, Leaming, Cuban Giant, Silver Mine.

T. W. Wood & Sons, Richmond, Va.: Cocke, Hickory King, Blount, Giant Broadgrain, Klondyke.

W. H. Arnold, Thompson Station, Tenn.: Arnold, Red Cob.

Mississippi A. & M. College., Starkville, Miss.: Mosby and Evans.

Louisiana Experiment Station, Andubon Park, La.: Creole.

W. S. Sanders, Danielsville, Ga.: Sanders.

Dr. J. O. Boykin, Talladega, Ala.: Baden.

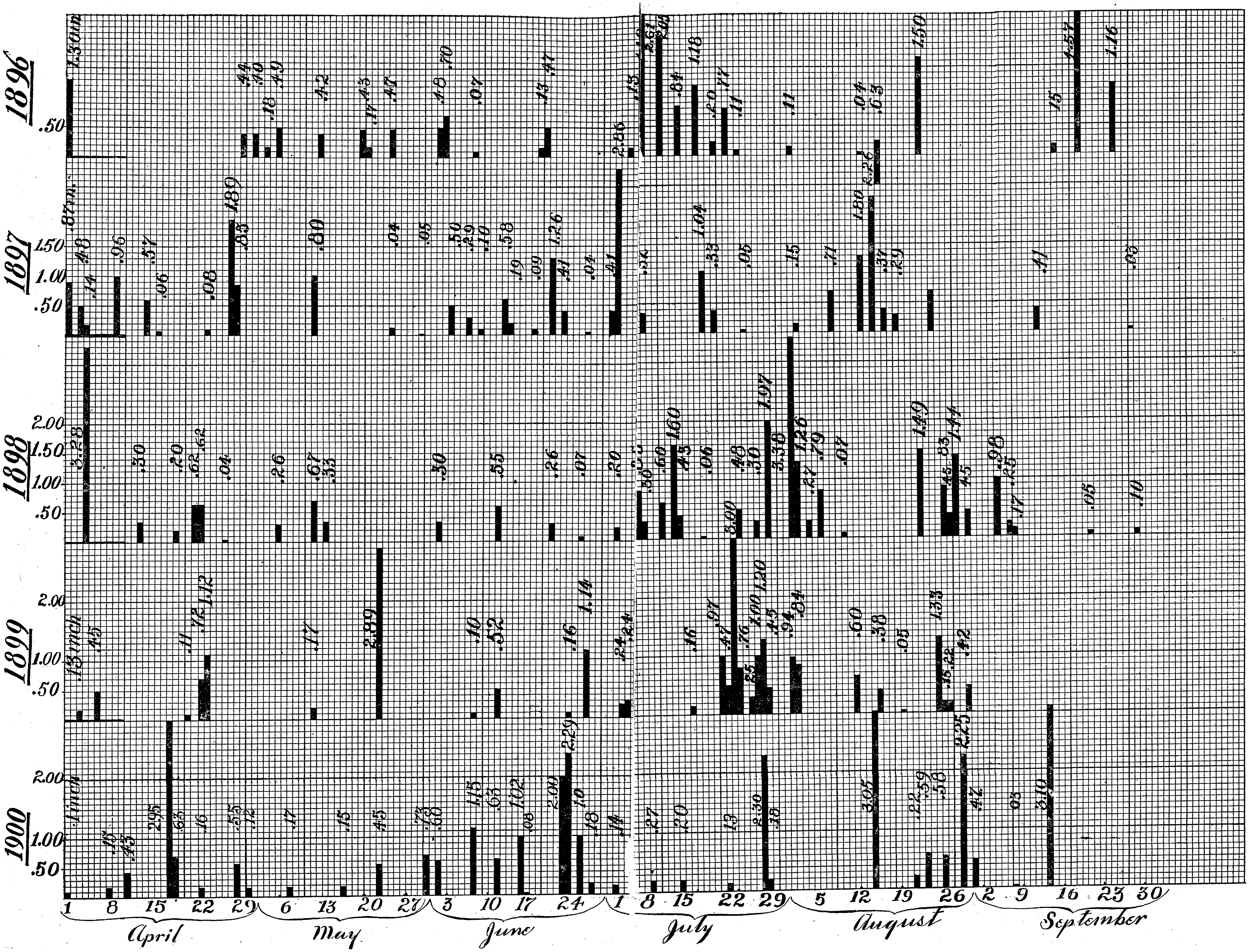
SEED CORN FROM DIFFERENT LATITUDES.

The following table gives the yields obtained in five years experiments in planting at Auburn seed corn from different latitudes.

The Georgia seed were from Curry-Arrington Seed Co., at Rome, in North Georgia and from Alexander Seed Co., Augusta, and P. H. Jones, Herndon, Ga., seed from both the latter sources being designated as from South Georgia.

Seed corn from different latitudes.

Year.	Variety.	Seed from	Yield per acre.			Increase per acre from	
			Seed from Ill.	Seed from Gulf Region.	Seed from Del. & Va.	Gulf Reg'n over Ill. seed	Va. & Del over Ill. seed.
						Bus.	*Bus.*
1896	Hickory King	Alabama...	....	16 5	....	—2.8	......
do	do	Illinois....	19.3	....	....	......	......
do	....	Delaware..	....	.....	15 6		—3 7
1896	Blount Prolif	Ga. (South)	....	13.1	....	—1.1	......
	do	Illinois ..	14 2	......			
1897	Hickory King	Alabama ...	.....	12.1	....	—2.2	......
do	do	Illinois. ..	14 3		....		......
1897	Blount Prolif.	Ga. (South)	....	18 9	....	— .2	.....
do	do	Illinois.....	19.1	....	....	.....	.....
1898	Hickory King	Ga. (North)	.....	11.4	....	1 0	......
do	do	Illinois ...	10 4	.....	..	..	.....
1898	Blount Prolif.	Ga. (North)	....	11.0	....	.5	......
do	do	Illinois...	10 5	....	....	....	.....
1899	Blount Prolif.	Georgia....	....	17.1	....	1 9	......
do	do	Illinois....	15.2	....	....	......	......
1899	St. Charles...	Alabama...	...	15.3	....	.8	.....
do	do	Illinois. ..	16.1	....	....	....	.....
1900	St. Charles..	Ala. (1 year)	....	34.2	....	1.1	......
do	do	Illinois....	33 1	....	....	....	......
1900	Blount Prolif.	Ga. (South)	....	32.2	....	—1.9	......
do	do	Illinois.....	34.1	....	......	.....	......
do	do	Virginia....	....	....	36 8	..	2.7
1900	Cocke Prolif..	Ga. (South; J.)	....	32.6 } Av 36.5	....	....	......
do	do	Ga. (South; A.)	....	38.4 }	....	.....	......
do	do	Ga. (North)	....	38.6 }	....	.....	......
do	do	Virginia....	.....	....	41.7	....	5.2
1900	King Hickory	Virginia....	.....	....	29.8	.....	5.4
do	do	Delaware...	..	....	30 4	....	5.9
do	do	Illinois....	24 5	....	.....	......	...


1896
1897
1898
1899
1900
1.30in.
.87in.
.13 inch
1 inch
.50
1.00
1.50
2.00
1 8 15 22 29
6 13 20 27
3 10 17 24
1 8 15 22 29
5 12 19 26
2 9 16 23 30
April
May
June
July
August
September

In six separate tests seed from Illinois afforded a slightly larger crop than seed corn from the latitude of the Gulf States; the average excess in these tests in favor of Northern seed was 1.5 bushels pr acre. In four tests seed from the far South proved superior to Illinois seed, the average excess being 1.1 bushels.

Averaging the ten comparable tcsts in which Illinois corn was compared with the same varieties from Alabama and Georgia, we have an average difference of only .45 of a bushel per acre in favor of Northern seed, thus placing them practically on an equality with Southern seed.

The data in the preceding table enable us to compare Illinois and Delaware seed in two instances, the variety being Hickory King. Illinois seed in 1896 gave an excess of 3.7 bushels per acre, but in 1900, a much more valuable season for corn on the Station farm, seed of the same variety from Delaware proved superior to Illinois seed to the extent of 5.9 bushels per acre, making the average for the two tests 1.1 bushels in favor of Delaware seed.

In a comparison of Illinois seed corn with that from Virginia, the latter afforded larger yields with both varieties, averaging 4 bushels per acre in excess of Illinois seed under the favorable conditions of 1900.

Seed from Alabama and Georgia has been compared with seed from Virginia several times and in the case of both varieties, Cocke Prolific and Hickory King, there has been a large advantage with the seed from Virginia; its average superiority was 4 bushels per acre. There is further confirmation of the apparent superiority of Virginia seed of these varieties in the fact that in none of the four instances where comparison was possible did the Georgia or Alabama seed closely approach the seed from Virginia in the yield afforded.

On the whole our experiments relative to the effect of climate on corn seem to favor seed from Virginia as more productive here in the case of Cocke, Blount and Hickory King than seed from any other source. However, numerous repetitions will be necessary before this tentative conclusion can be accepted as positive. Meantime the results suggest that, with suitable varieties, seed from any latitude, from Illinois southward, can be made to afford satisfactory crops in Alabama. Doubtless purity of seed is even more important than climate and it is quite possible that some of the rather poor showings made by Alabama and Georgia seed may be due to impurity of variety, the result of the seed having been grown in fields adjacent to fields of common corn, where mixing or cross fertilization would naturally occur.

BUTT, MIDDLE AND TIP KERNELS FOR SEED.

In 1898, kernels from the middle of the ear of the variety Experiment Station Yellow, from a space of about one inch at the butt end, and from an equal space at the tip end of the ear were planted, April 1, on six plots. The yields follow:

Yield obtained from planting middle, butt and tip kernels.

Kind of seed.	Yield of shelled corn per acre.
	Bus.
From middle kernels, (average of two plots)............	16.3
From butt kernels, (average of two plots).............	15.4
From tip kernels, (average of two plots).............	16.8

The differences in yield are too slight to indicate any real superiority of seed from any particular portion of the ear. The same thing was true in our test of this matter in 1896. We feel justified in repeating the conclusion reached in Bulletins Nos. 75 and 88, as the result of a careful study of the experiments made on this point, both in Alabama and in other States.

"Taken as a whole, the experiments thus far made in several widely separated States fail to show any decided advantage in planting kernels from any special portion of the cob. This has been true even when the tip, butt and middle kernels planted had been propagated for several generations from tip, butt and middle kernels respectively."

In these experiments the tip kernels used were all sound. In the tip of the ear there is often a larger percentage of weevil eaten or defective kernels than elsewhere and in such cases the tip kernels should be rejected.

PLANTING CORN IN WATER FURROW VERSUS ON A LEVEL.

Only two plots were used, lying adjacent, on a deep sandy soil, where sorghum had grown in 1899. April 5, 1900, on one plot beds five feet wide were formed by using a one-horse turn plow. On the same date the other plot was flushed, or plowed level with the same plow. On the same day, April 5, Evans corn, a rather early variety, was planted in rows 5 feet apart, the complete fertilizer having first been applied in the drills where corn was to be planted and mixed with soil by means of a scooter plow. On the plot which had been bedded fertilizers and corn were placed in the water-furrow. On the other plot planting was done by opening a furrow in the level, flushed ground.

The plots were so thinned as to leave an equal number of plants on each. The yield of shelled corn per acre was 19 bushels when planting was done in the water furrow and 22.2 bushels when on a level.

Planting in the water furrow is common in this locality and it is thought to increase the ease of cultivation and to enable the plants to better resist drought. There was so much rain in April and June, 1900, that this method was at a disadvantage and the result under these abnormal conditions cannot be accepted as conclusive. Planting corn in the water furrow lengthens the period during which cultivation with the harrow is possible. It is practicable to plant corn in the water furrow only in well drained, light soil.

TIME FOR PLANTING CORN.

No direct experiments have been made here to determine this point. Our first planting is usually about the middle of March and extending up to the middle of April, most of it being done about the first of the last named month. A smaller amount of injury from the bud worm that preys on the root is noticed when planting is very early or very late than when done in midseason.

Our experimental work here has been almost entirely on poor upland. On such soils very late planting, after the removal of wheat or oats, has resulted in almost entire failure of the crop except in 1898, when St. Charles planted June 16, a month after plowing in vetch vines or stubble, afforded a satisfactory yield.

In 1900, Experiment Station Yellow corn planted May 1 on ordinary upland averaged nearly 30 bushels of corn per acre, but this is apparently an unusual result, arising from the peculiar distribution of the rainfall in 1900.

Overflows late in June in 1900 made it necessary to plant considerable corn in July in numerous localities in Alabama. Such reports as we have received of these plantings have been chiefly from the bottom lands of the western part of the State. As a rule failure seems to have attended these efforts, whether the common late kind or one of the early varieties from the North has been employed.

To ascertain whether any variety would succeed when planted very late, we planted the following list of varieties July 13, 1900, on good branch-bottom soil: St. Charles, Evans, Mosby, Hickory King, Blount, Golden Dent, Champion White Pearl, Cocke & Experiment Station Yellow.

All proved to be absolute failures, making low, slender stalks, no large ears, and few and poorly filled nubbins. Smut was unusually abundant and this excessive injury from smut we have every year observed in most of our late planted corn. Corn planted after small grain has generally proved a failure, except, perhaps, on very fertile land, and even on rich soil cowpeas or sorghum grown as forage usually pays better than corn planted very late.

DISTANCE FOR UPLAND CORN.

In 1898 on a sandy loam soil, containing numerous rather small flint stones, three varieties of corn were used in a test of thick planting as compared with ordinary distances. All rows were 4 feet 8 inches apart. In the plots where the corn was "rather thick," the intervals between single plants in the row was 2.5 feet, giving 11.6 square feet per plant, which is really considerably closer than farmers usually plant corn on thin upland of this character, with a productive capacity of 12 to 20 bushels per acre. The corn designated as "thick planting" was left in thinning at average intervals of 18 inches along the row, or practically 50 per cent. thicker than in the other case. Planting was done April 1.

Experiment Station Yellow is a rather large southern variety. St. Charles seed for this test was obtained from

Illinois; the stalks are rather small, but considerably larger than those of Golden Beauty, and the variety is intermediate in earliness between the other two varieties. Golden Beauty is well known as a very early yellow variety, with very small stalks. The seed was from Illinois. The following table gives the results:

Medium versus thick planting of corn.

	Yield of shelled corn per acre.		
	Medium thickness	Thick planting.	Increase with thick planting.
	Bus.	*Bus*	*Bus*
Experiment Station Yellow . . .	21.2	22 8	1 6
St. Charles	16 4	17 7	1.3
Golden Beauty	10 5	12 8	2.3
Average, 3 varieties	16.1	17 8	1 7

With all varieties there was an advantage in close spacing. This benefit was naturally most marked in the case of Golden Beauty, the variety having the smallest plants, best able to bear crowding. No cowpeas were grown between the corn rows, though this double cropping is generally advisable on thin land where wide rows are a necessity.

The following quotation from Alabama Experiment Station Bulletin No. 88 gives the results of our earlier work relative to the best thickness for corn; the experiments of 1896 and 1897 were made on sandy, poorer land than was the test detailed above, and in that sandy land there were no stones.

"Yield of corn when plants stood at different distances apart.

DISTANCE		Number of plants per acre.	YIELD PER ACRE		
Between rows.	Between plants.		1896	1897	Average 2 years.
			Bus.	*Bus.*	*Bus.*
5 feet	4 feet	2,178	12.4	15 3	13.9
5 seet	3 feet	2,904	12.9	15 7	14 3
5 feet	2 feet	4,356	9.8	16.7	13.3
6 feet	2 feet 6 in.	2,904	13.1	15 5	14.3
4 feet 10 in.	3 feet 1½ in.	2 904	15 6	16.7	16.7
4 feet	3 feet 9 in.	2,904	16.9	17.8	17.4

In both seasons the yield was largest when the constant area devoted to each plant approached a perfect square in shape. In other words, a plant having 15 square feet of space was most productive when so planted that the distance in the drill nearly equaled the distance between rows.

This distance of 4 feet by 3 feet 9 inches affords the largest average yield for two years, but for cheapness of cultivation rows 5 feet wide, with plants about 3 feet apart, are to be preferred to narrower rows on such soil as that used for this test. On poor land a row of cow peas should usually be planted between the corn rows, which was not done in this experiment. With a row of cow peas between the corn rows the distance should be at least 5 feet on such lands as this."

In none of these seasons was there a sufficiency of rain. Doubtless if cultivation had been somewhat neglected, or delayed long after a rain, the corn that was planted close together would have made a less favorable showing. Thin planting of corn is safest, so far as making a medium yield, but somewhat thicker planting than usual seems advisable where a maximum yield is desired and where cultivation is prompt and thorough.

CULTIVATION EXPERIMENTS.

Two series of experiments with cultivation were conducted in 1900, one with corn planted early, the other with corn planted late. The results of the test with early corn were rendered worthless by want of uniformity in the soil, and are omitted here.

The experiment here reported was made with Experiment Station Yellow corn planted May 1, on a field where cowpea roots and stubble had been plowed in a few weeks before this date. The fertilizer per acre consisted of 209 pounds of acid phosphate and 24 pounds of muriate of potash. The same number of plants, in rows 4 feet 3 inches apart, was left on all plots.

Deep versus shallow first cultivation. Three plots (Nos. 37, 40, 41) were cultivated deep May 17, which required 5 trips per row,—2 with a scooter running near the plants and 3 with a straight shovel, breaking the middles to a depth of about 4 inches. All subsequent cultivations, given at the same time as in the other plots mentioned in this paragraph, were shallow.

Plots 42 and 48 received shallow cultivation throughout, using, as in all shallow culture plots, the heel scrape. The dates of cultivation of both series were May 17, 3 furrows (5 for deep culture plots); June 2, 2 furrows; June 6, 2 furrows; June 15, 2 furrows; June 20, 2 furrows; June 30, 2 furrows; July 11, 2 furrows.

There were 15 cultivation furrows for the shallow culture plots and 17 for the deep. The unusually frequent cultivation was due to the frequent rains, the aim in this series of plots being to stir the soil whenever a crust should begin to form. Rain fell immediately after the cultivation of June 2 and June 6, and almost immediately after that of June 15, thus requiring their repetition, in other words causing us to give several cultivations in excess of what is necessary in ordinary seasons.

The following table gives the yields in bushels of corn per acre:

First cultivation deep, others shallow.	Bus.	All cultivation shallow.	Bus.
Plot 37	27.4	Plot 42	30.7
" 40	30.1	" 48	27.3
" 41	31.8		
Average	**29.8**	Average	**29.0**

The average difference is .8 bushel per acre in favor of making the first cultivation deep. This is no greater than the error which may arise from slight variations in the fertility of the plots.. We must conclude that in a season of frequent rains deep cultivation when confined to the first working of corn was not notably injurious. It should be said, however, that on the Station farm, both on light gray and stiffer reddish soils, we cultivate shallow from the first, and think that in so doing we get better results than by the deep "running around" with a scooter, which is so customary.

Effects of late cultivation.—Plots 39 and 43 were cultivated in the same manner and at the same dates as plots 42 and 48 in the preceding section, except that they were "laid by" June 30, while the latter received one additional cultivation, July 11.

The following table gives the yields of corn in bushels per acre:

Last cultivation, June 30.		Last cultivation, July 11.	
	Bus.		*Bus.*
Plot 39	27.5	Plot 42	30.7
Plot 43	27.4	Plot 48	27.3
Averave	**27.5**	Average	**29.0**

Here is a gain of 1.5 bushels per acre apparently attributable to the last cultivation of 2 furrows per row. This is the more noteworthy in view of the absence of any considerable rain after the early "laying by" and before the late "laying by."

Observation suggests that corn is frequently laid by too early. We doubt that the appearance of tassels is an indication that cultivation, in all cases, should cease. We do not hesitate to cultivate tasseled corn if a crust is forming. Of course late cultivation is only advisable when the work is very shallow.

Frequency of cultivation.—This experiment embraced four series of plots, all cultivated shallow from the beginning, the heel scrape being the only implement used. The plan, from which rains, and the writer's occasional absence, made some deviation necessary, was as follows:

Plots.	To be cultivated	Actually cultivated.
42 & 48	When crusting	M. 17; J'e. 2, 6, 15, 20, 30; J'y 11
45 & 50	Every 7 days	M. 17, 23, 30; J'e 6, 15, 20, 30; J'y 11
44 & 49	Every 14 days	M. 17 & 30; J'e 20; J'y 4
46, 47, & 51	Every 14 days, in alternate middles only.	M. 17 & 30; J'e 6 & 15; J'y 11

On all plots the cultivation of May 17 required 3 furrows, and each subsequent cultivation 2 furrows per row. The total number of furrows per row during the entire season was as follows:

15 furrows for cultivation when crusting; 17 for weekly cultivation; 9 for cultivation every 2 weeks; and 6 for working of alternate middles every 2 weeks.

Effects of frequency of cultivation of corn.

Plots.	When cultivated (approximately.)	No trips per row.	Separate yields. respectively.	Average yield per acre.
			Bus	*Bus.*
42 & 48....	When crusting..	15	30.7—27 3	**29.0**
45 & 50 ..	Weekly	17	31 0—29.5	**30.3**
44 & 49	Every 14 days ...	9	30 4—27.0	**28.7**
46, 47 & 51.	Every 14 days in alternate middles	6	26.0—25.9—29.1	**27.3**

The best yield was made with the greatest number of furrows, that is with weekly cultivation. Working only when a crust was forming saved 2 furrows and apparently lost 1.3 bushels of corn. Cultivation at intervals of about two weeks lacked 1.6 bushels of affording the same yield as weekly working. The loss when only alternate middles were stirred infrequently was 3 bushels as compared with the stirring of entire soil areas at the same dates.

No experiments in methods of cultivation can be expected to be conclusive in a wet year like 1900, for the effect of frequent rains is to equalize all plots, effecting for both poorly and well tilled plots just what judicious cultivation ordinarily does, viz. providing an adequate supply of moisture.

While awaiting the results of a repetition of these experiments we may infer that since the effects of good cultivation were apparent in a wet year that they would be much more marked in a dry or even in an ordinary season.

NUMBER OF FURROWS PER ROW FOR CORN.

Lest some should misunderstand the preceding experiment and assume that we ordinarily give as much cultivation to corn as 15 furrows, we give the number of furrows per row in other fields of corn, planted at the usual time. Let it be remembered that the several yields given do not represent differences due to the frequency of cultivation, because soils, fertilizers, dates of planting, etc., vary.

Seven furrows per row during the entire season, in 4 cultivation, 1 rolling and 1 harrowing before planting, 1 harrowing after corn came up, and 1 hoeing and thinning, constitute the work of cultivating the corn in the "methods of harvesting" experiment of 1900, where the yield averaged 45.3 bushels per acre on upland.

The number of furrows in some other experiments was,—7 (in 4 cultivations) in the variety test in 1900, where the yields ranged between 19.9 and 41.7 bushels per acre; 7 in the test of cowpeas as fertilizers for corn, where the yields ranged from 18 to 28.9 bushels of corn; and 9 (in 4 cultivations) for the corn grown in the rotation experiment in 1900. In all these cases the harrow was used for the first cultivation, thereby decreasing the number of furrows with one-horse implements.

In 1899, with a very different season, the number of furrows per row required by corn averaged higher. For example the corn in the variety test that year had 12 furrows (distributed through 6 cultivations), besides 1 harrowing.

It is false economy to omit a cultivation when the ground is crusting; it pays to be liberal in the number of cultivations, even though six be required. But it pays to be sparing in the number of trips per row at each separate cultivation. Never, except possibly at the first cultivation, use an 18-inch scrape where a 24-inch or larger one will do equally effective work. As for the use of the scooter and narrow straight shovel as cultivating implements, they are time killers and profit consumers, even if the injury to the roots is repaired by seasonable rains. With the heel scrape for mellow land, shallow working wing shovels for hard soils, and among more expensive implements a vast array of cultivators, we fail to find the reason for employing the scooter and its kind in cultivation.

METHODS OF HARVESTING CORN.

The experiment described below had two ends in view, (1) to ascertain the productive capacity of sandy, stony upland for corn when the corn was highly fertilized and the crop worked in the best possible manner, and (2) to compare the yields of grain and forage resulting from stripping the blades, topping the stalks, cutting and shocking the entire growth, and leaving all the forage in the field, harvesting only the ears.

Let us first consider the productive capacity under favorable conditions of this grade of land, the average yield of which in this vicinity is usually less than 12 bushels per acre. In the years immediately preceding this test it had been used for various experiments, as follows:

In 1896 it was quite poor, having been in constant cultivation for many years. At that time it was overrun with Bermuda grass. The chief aim in the treatment of this land during the next few years was to destroy Bermuda grass, and incidentally to use the land for experiments with small grain and cotton. The improvement of the soil was kept in view, but was subordinated to the aims just mentioned.

In January, 1896, this field was sown to oats, which, with the aid of 240 pounds of commercial fertilizer, yielded only 10.4 bushels per acre, which may serve as a measure of the productiveness of the land at that time. Cowpeas were sown broadcast after the oats, making but a poor growth. The peas were picked and the vines plowed under, and rye sown in November, 1896. The rye was cut and threshed and in the summer of 1897 broadcast cowpeas were again grown, this time making a luxuriant growth. After the peas were picked, cattle grazed on the vines.

Twice in the early months of 1898 the land was plowed, using scooters both times in preference to turn plows so as to leave the Bermuda roots exposed on the surface of the ground.

In 1898 cotton was the crop, and there was used a mixture of acid phosphate, cotton seed meal, and kainit, the mixture being employed at the rate of 480 pounds per acre, applied by various methods. The average yield of seed cotton was 1,270 pounds per acre, the best plot making 1,454 pounds. In 1899 cotton was again grown and the cultivation of these two cotton crops, with the winter treatment adopted, exterminated the Bermuda grass. The fertilizers used under this piece of cotton in 1899 averaged per acre 212 pounds of phosphate and 1,792 pounds of stable manure. The average yield was 1,329 pounds, or nearly a bale, of seed cotton per acre.

The preparation of the land for corn in 1900 and the fertilization of the corn, which was several times heavier than is our custom, were as follows: March 22 the land was plowed with a one-horse turn plow to a depth of 4 inches. A Chattanooga subsoil plow, drawn by two mules, followed in this furrow, loosening the soil to an additional depth of 6 inches. The subsoil plow left undisturbed strips of hard soil between each pair of subsoil furrows. Cotton seed, which had been killed, was scattered broadcast at the rate of 732 pounds per acre, and after the first rain was cultivated in. Just after the land was subsoiled it was rolled and harrowed and the harrowing was repeated after every rain to hold the moisture. Just before planting there was applied in the drill and thoroughly mixed with the soil 256 pounds of acid phosphate per acre, an equal quantity of cotton seed meal, and 64 pounds of muriate of potash. April 9 Mosby corn was planted about 2½ feet apart in rows 4 feet 4½ inches apart. Before covering the corn nitrate of soda was dropped about 8 inches from the hill of corn, using it at the rate of 100 pounds per acre.

Cultivation consisted of one harrowing across the rows, April 26, of 4 cultivations with a heel scrape, the total number of furrows per row being 7, and of one hoeing, which also served for thinning.

The cultivation was so timed as to come soon after a rain, thus preventing the long continuance of a surface crust, which would have wasted the moisture. The average yield of shelled corn was 45.3 bushels per acre. The corn was grown under field conditions,—that is solid, or without any spaces between plots or any outside rows.

This yield of 45.3 bushels of corn per acre on high sandy, rocky soil was obtained only by exceptionally favorable weather conditions, thorough preparation, timely and judicious shallow cultivation, and what would generally be excessive fertilization.

On every fourth row the corn plants were stripped of their blades August 8, when in the late "fodder-pulling" stage.

August 16 the tops just above the ear were cut from every fourth row, the lower leaves (then badly "fired") being undisturbed, and the corn was pulled September 22.

August 18, on every fourth row the entire plants were cut and immediately shocked. The shocks were left in the field until September 22, when the ears were pulled. The stalks, which showed some dampness towards the lower end which had been in contact with the ground, weighed 1,759 pounds per acre.

September 22 the ears were pulled from another set of rows on which neither leaves nor top nor stalk had been harvested, and also on the same date the ears were pulled from the topped stalks standing in the field and from the shocked corn.

Let us consider first the yield of forage obtained by the different methods of harvesting.

The blades, or "fodder," pulled August 8 were cured in fair weather in the usual way, the green blades being immediately tied into "hands," and these tied into bundles and weighed on August 10, the actual number of hours of sunshine required in curing being 12. The yield of this *cured* "fodder," weighed in its fresh condition, or just after being bundled, was 615 pounds per acre.

The tops, cut August 16, were weighed immediately after curing, which consisted in leaving them exposed in small loose piles or "hands" to 15 hours of actual sunshine. Their weight was 711.4 pounds per acre. As stated above the yield of cured stover (entire plant after the ear is removed) was 1,759 pounds per acre.

Negro laborers, not in any way pushed, "pulled fodder" at the rate of one acre in 19.8 hours, or practically half an acre a day. With thinner, smaller, less leafy corn, and more active laborers about twice this area can be stripped in a day.

One of these same hands, entirely unaccustomed to handling shocked corn, pulled the ears, about 45 bushels, from the shocked corn at the rate of one acre in 10 hours and 8 minutes. It is probable that with practice this speed could be considerably increased.

The time required in topping,—much less than in stripping,—in cutting corn, in "tieing fodder," in pulling the ears in the field and in hauling was not recorded. Apparently the labor of cutting corn required no more time than topping, and less than fodder pulling.

The following table gives the yields of corn in 1900 accompanying the several treatments of the corn forage.

Yield per acre of corn and forage from different methods of harvesting in 1900.

METHOD OF HARVESTING.	Corn per acre.	Forage per acre.
	Bus.	*Lbs.*
Only ears harvested	46.9	00
Tops cut and ears harvested	44.2	711 (tops)
Entire stalks cut and ears afterwards harvested	44.3	1759 (stalks)
Blades stripped and ears harvested	45.9	615 (blades)

In 1900, with a luxuriant growth and an abundance of moisture, there was a reduction of only one bushel per acre in the yield of corn as the apparent result of stripping the blades. Contrary to the results of previous experiments here and elsewhere the yield of grain was slightly less when the plants were topped or cut and shocked than when stripping was practiced. The apparent effect of all these methods of utilizing corn forage was to slightly reduce the yield of grain, stripping by 1 bushel, cutting by 2.6 bushels, and topping by 2.7 bushels per acre.

The following table gives the yield per acre both of grain and forage for 3 years on the plots differently treated:

Yield per acre of corn and forage from different methods of harvesting.

METHOD OF HARVESTING.	Corn per acre.				
	1896	1897	1900	Average. 3 yrs.	Average. Loss
	Bus.	*Bus.*	*Bus.*	*Bus.*	*Bus.*
Only ears harvested	34.4	31.0	46.9	37.6	.....
Tops cut and ears harvested	30.2	29.2	44.3	34.6	3.0
Entire stalks cut and ears afterwards harvested	29.2	29.5	44.3	34.3	3.3
Blades stripped and ears harvested	......	. .	45 9	....	.....

Our average results for three years show a loss of 3.3 bushels per acre when corn is cut and shocked, and 3 bushels per acre when it is topped, taking as a standard the yield of corn where no forage is harvested.

The yields of forage are given in the following table:

Yields of cured corn tops, stover, and blades.

	Yield per acre.				Assumed value of forage per 100 lbs.	Value forage per acre.	Value forage and corn.*
	1896	1897	1900	Aver'ge 3 yeas.			
	Lbs	*Lbs*	*Lbs*	*Lbs.*	*Cents.*	$	$
Tops	312	509	711	511	40	2.04	19.34
Stover	2103	1355	1759	1739	30	5.22	23.22
Blades, or fodder	....	...	615	....	60	......	....
No forage harvested	...	....	....	....	....	......	18 80

* Corn estimated at 50 cents per bushel.

The average yield for three years is 511 pounds of cured corn tops per acre against 1,739 pounds of cured stalks or stover. Assuming—in the absence of exact experiments in feeding tops and stalks,—that tops are worth 40 cents, stalks 30 cents per 100, and corn 50 cents per bushel, we find that the topped acre gives a combined value of tops and corn only 54 cents above the value of the corn alone on the acre from which no forage was harvested. This makes topping unprofitable under these conditions, for the labor of topping would cost more than 54 cents per acre and the tops if left uncut would have some slight value when eaten by cattle turned into the corn fields after corn is harvested.

Comparing cutting and shocking with harvesting only the ears, we find the value of the cut stalks and ears borne by them give a total value of $23.22 per acre, against $18.80 when only the ears are pulled. The difference in favor of cutting the stalks is therefore $4.42 per acre. This is sufficient, after defraying the cost of cutting, shocking, and hauling the stalks and the extra expense of pulling the ears from shocked corn, (which we find to be a slower operation than pulling ears from the standing stalks),—to leave a balance in favor of cutting the stalks.

Where a shredding machine capable of removing the ear by machinery is available, there is a decided advantage in cutting the stalks over any other method of handling corn. It should also be borne in mind, in any comparison of cutting corn with the more usual methods of harvesting the crop, that there is a decided advantage in the matter of convenience in cutting corn. This can be done before cotton picking begins, a merit that will be generally recognized. Moreover the cutting of the stalks leaves the land in better condition for plowing, and enables the farmer to begin the plowing for small grain at an earlier date than is practicable when the ears are allowed to cure slowly on the living plants. The removal of the stalks is somewhat more exhaustive to the land than is burying them with the plow, but this is on most soils more than counterbalanced by the greater convenience of preparing and cultivating land that is free from stalks.

The single experiment made here in 1900 relative to the effect of stripping the blades from the corn plant is not sufficient to show the usual effect of that process. In this case the yield was reduced by only one bushel per acre when the blades were stripped off, while the average of many experiments made in the South gives an average loss of nearly three bushels per acre when "fodder" is pulled.

LIME AS A FERTILIZER FOR CORN.

March 11, 1898, on plowed land 2,000 pounds of lime per acre was applied broadcast and harrowed in. The above figure refers to the weight of the quicklime, which was water-slacked before being applied, so that the actual amount of slacked lime employed was much greater. An adjacent plot was not limed. Both received the same fertilizer, viz.: 231 pounds of acid phosphate and 78 pounds of cotton seed meal per acre. The land had grown up in broom sedge and bore also a rather light growth of Japan clover or *Lespedeza striata* in 1897.

Corn was planted March 21, 1898, and at the next to the last cultivation Wonderful cowpeas without fertilizers were drilled in the "middles" between the corn rows.

The yields per acre were as follows:

Corn on limed plot........................10.8 bushels.
Corn on plot not limed...................11.8 bushels.

With cowpeas growing between the corn rows the results were even more unfavorable to the application of lime, the yield of peas without lime being 11.1 bushels and with lime only 8.7 bushels per acre.

The soil on which the above experiment was conducted was a sandy loam, containing many small flint stones.

This field was selected for the experiment with lime because it was thought that the presence of the vegetable matter in the broom sedge and lespedeza would allow the lime to exert its maximum effect. However, it might be claimed that the application of this amount of lime was made too late and that the apparent injury was the result of caustic action which would have been avoided if the lime had been applied some months before planting.

In a second experiment with lime the application was made to very sandy gray soil 17 months before the corn was planted and the amount used was only 1,200 pounds per acre of air slacked lime. This was spread broadcast on plowed ground in November, 1898, and harrowed in. The ground remained practically bare all winter and the following summer was planted with beggar weed and drilled velvet beans, fertilized with acid phosphate and muriate of potash. On some plots the entire growth of velvet beans was used as a fertilizer, on others only the light second growth of bean vines, and on others only the stubble.

March 31, 1900, all plots were plowed and on April 5 Mosby corn was planted and fertilized with 240 pounds of acid phosphate and 40 pounds of muriate of potash per acre. The soil is very sandy, free from stone, and naturally poor and thirsty. It occupies an elevated hilltop. The following table is arranged in such a way as to show the effect of lime (applied 17 months before planting corn) in connection with the different amounts of vegetable matter that had accumulated in the soil after the application of the lime and before the planting of corn.

Effects of lime on corn, with various amounts of vegetable matter in the soil.

Amount and kind of vegetable matter plowed under in March, 1900.	Yield of corn per acre.		
	Not limed.	Limed 17 mos. before	Increase on limed plots.
	Bus.	*Bus.*	*Bus.*
Very little; stubble of velvet beans	15.5	15.7	0.2
Little; 2nd growth of velvet beans.	16 8	15.7	1.1
Medium amount; beggar weeds..........	20 2	17.2	3.0
Large amount; velvet bean vines, entire....	28.9	26.1	2.8

The results show that where only small amounts of vegetable matter were present the effects of lime were very slight. When there was present a considerable amount of vegetable matter there was an average increase of 2.9 bushels of corn per acre on the limed plots.

The benefit derived by corn from lime, applied nearly two years before, may have been due to the fact that lime favored the growth of velvet beans, (as the record for 1899 plainly shows), thus leaving for the corn plants a larger amount of vegetable matter on the limed plots. Or it may have been due to more rapid and complete decay and nitrification of the vegetable matter effected by the lime that remained in the soil.

On the whole these experiments suggest that corn is not especially a lime-loving plant and that only when large amounts of vegetable matter are present is it a desirable fertilizer for corn on our sandy upland soils, which are not sour.

Stubble versus vines of velvet beans as fertilizers for corn.—The first experiment mentioned below is the same as one of the tests discussed under the head of liming. (See p. 129). On a very sandy soil there was planted in the late spring and early summer of 1899 velvet beans in drills on certain plots and beggar weed, sown broadcast, on others. The beggar weed and a portion of the velvet beans was used exclusively for fertilizer. On other plots velvet beans were cut once, the light second growth being left for fertilizer. On still other plots two cuttings of velvet beans were made, thus leaving only the stubble as fertilizer for corn. These various fertilizing materials were all plowed under March 31, 1900, and Mosby corn planted April 5, using per acre 240 pounds of acid phosphate and 40 pounds of muriate of potash. As stated elsewhere, half the plots had been lightly limed 17 months before the corn was planted.

Vines versus stubble of velvet beans as fertilizer for corn in 1900.

Plots	Material used for green manuring.	Yield of corn per acre.	Increase over stubble plot.
		Bus.	*Bus.*
4 & 9	Stubble of velvet beans..................	15.6	....
5 & 10	Second growth of velvet beans	16.8	1.2
3 & 8	Entire growth of velvet beans.............	27.5	11.9
2 & 7	Entire growth of beggar weeds	18.7	3.1

The entire growth of velvet beans afforded a yield of corn greater by 11.9 bushels per acre than the yield where only the stubble was employed as fertilizer. In this case it was more profitable to use velvet bean vines for fertilizers than to harvest them for hay, for the average yield of hay in 1899 was only 2,800 pounds per acre, and this was cured with great difficulty and considerable cost, and the hay was not of good quality in this particular instance.

Unfortunately there was not room for a plot entirely without green manure, that might serve as a basis for ascertaining the extent of the fertilizing effect of both the stubble and vines. However the yield of a plot similarly fertilized and on similar soil, about 100 yards away, was less than 5 bushels per acre, and though the varieties were different (but of nearly equal productiveness in the variety test of 1900) we are able to conclude that even the stubble of velvet beans greatly increased the yield, probably about 8 bushels per acre and that the vines of velvet beans enormously increased the yield, probably by about 20 bushels.

COWPEAS AS A FERTILIZER FOR CORN.

In 1897, on reddish loam soil, a test was made of the Wonderful or Unknown, Clay and Whippoorwill varieties of cowpeas, planted in drills and cultivated. On one plot soja, or soy, beans were planted, but as no stand of soy beans was obtained this plot was cultivated without a crop, that is, kept clean or fallow.

The varieties of cowpeas occupied five comparable plots lying on both sides of the fallow plot. The peas were picked at the usual time and in April, 1898, the vines were plowed in as fertilizer for corn.

The yields of corn on the five plots where pea vines had been plowed in did not vary widely and the average yield of these plots was 20.1 bushels per acre. The corn having no cowpeas preceding it,—the plot having been cultivated but kept bare in the summer of 1897,—yielded 17.1 bushels. This is an increase of 3 bushels per acre, or 17 per cent., attributable to the use of peavines as fertilizer. The increase would doubtless have been still greater but for the fact that nitrate of soda at the rate of 67.5 pounds per acre was used on corn on all plots.

RESIDUAL FERTILIZING EFFECTS OF VELVET BEAN AND COWPEA STUBBLE AND VINES.

We are concerned not only with the fertilizing effect exerted by cowpeas and velvet beans on the crop of corn which immediately succeeds them, but also with learning whether this beneficial effect extends to a crop grown the second year after these soil-improving plants. Naturally the permanency of the improvement effected by plowing under leguminous plants varies with the kind of soil, the most lasting effect being obtained on stiff soils and the least permanent benefit occurring where the soil is sandy.

The soil on which the following experiment was made belongs at neither extreme. It is a sandy loam, containing many small flint stones, and is a little stiffer than the soil on which the first-year effects of velvet beans as a fertilizer for corn were tested in 1900. (See p. 130).

In 1898 eight uniform plots, separated by alleys 3½ feet wide, were planted, 2 plots with velvet beans, 5 with Wonderful cowpeas (most plots broadcast), and 1 with drilled Orange sorghum. The growth of the several plots was either cured for hay or used as a fertilizer, as indicated in the next table.

March 9, 1899, all plots were plowed and in due time sorghum was planted in drills on all plots, and this crop at the proper season was cured for hay.

March 17, 1900, the sorghum stubble was turned with a one-horse plow and March 29 corn was planted on all plots. The fertilizer for corn consisted of 240 pounds of acid phosphate and 32 pounds of muriate of potash per acre. No nitrogenous fertilizer had been used here on any plot during 1890, 1899, or 1898, except on one plot in 1898, where 125 pounds of cotton seed meal per acre was used as a part of the fertilizer for sorghum.

With this exception the fertilization of each of the plots has been uniform during all of the last four years, consisting of phosphate and potash, as mentioned above.

Fertilizing effects in 1900 of stubble and vines of cowpeas and velvet beans grown in 1898.

Plot.	Crop in 1898.	Portion used for fertilizer.	Corn per acre in 1900.		
			Yield.	Increase over sorghum plot of 1898.	Increase, vines over stubble.
			Bus.	*Bus.*	*Bus.*
8	Sorghum.....	Stubble..........	24.1	....	....
4 & 7	Cowpeas.	Stubble............	25.7	1.6	....
3 & 6	Cowpeas.	Vines, after picking.	27.7	3.6	2.0
2	Velvet beans.	Stubble............	23.9	0.2	....
1	Velvet beans.	Entire growth	26 8	2.6	2.4

Let it be noted that the heavy growth of sorghum in 1899 did not utilize all of the fertility derived from the preceding crop of legumes. Although sorghum is a plant that is especially exhaustive to soil fertility, there still remained for the corn crop of 1900 a residue of nitrogen from the cowpea and velvet bean vines of 1898 sufficient to increase the yield of corn to the extent of 3.6 bushels per acre where cowpeas had grown two years before, and 2.6 bushels where velvet beans had grown. This is an average of 3.2 bushels per acre as the residual fertilizing effect of these legumes.

The fertilizing effects, of the stubble and roots of these two plants was far more transitory, the first succeeding crop, sorghum, practically exhausting them, leaving sufficient in the soil to increase the corn crop of 1900 by only an inconsiderable amount, viz.: 1.6 bushels and .2 bushel, an average of .9 bushel per acre. This accords with other experiments which we have made, in showing that on our sandy soils the fertilizing effects of the stubble and roots of leguminous plants, while highly favorable to the immediately succeeding crop, do not extend in any considerable degree to subsequent crops. This fact has an important bearing on the question of rotation.

RESIDUAL EFFECTS OF VELVET BEAN STUBBLE AND VINES AS FERTILIZERS FOR CORN; SECOND EXPERIMENT.

An experiment similar to the preceding was made by growing velvet beans in 1898 on soil similar to, but somewhat poorer than that on which the last-mentioned test was made, and planting adjacent and similar plots in cotton in 1898.

In 1899 cotton, fertilized uniformly, was grown on both sets of plots and the average yield following velvet beans was 1,578 pounds of seed cotton per acre against only 918 pounds where cotton followed cotton. Here was a gain of 660 pounds of seed cotton per acre as the immediate, or first-year, result of using velvet bean vines as a fertilizer.

The residual, or second-year, effects were tested on corn planted March 29, 1900, without any nitrogenous fertilizer.

Where cotton had grown in 1898 the yield of corn in 1900 was 18 bushels per acre; on the next plot, where velvet beans had been grown for fertilizer in 1898, the yield of corn in 1900 was 25.5 bushels. This gain of 7.5 bushels per acre represents the residual or second year effect of using the entire growth of velvet beans as a fertilizer.

As a fertilizer the entire growth of velvet beans of the crop of 1898 proved superior to the stubble and vines to the extent of 112 pounds of seed cotton per acre in 1899 and to the extent of 2.2 bushels of corn per acre in 1900.

Vetch versus small grains as green manure for corn.

In the fall of 1898 on gray sandy soil, a number of plots, each one-twelfth acre, were sown with hairy vetch, rye, oats, and a mixture of vetch and oats. In April and May, 1898, certain of these plots were cut so as to compare the yield of forage made by these different plants. We are concerned here not especially with the yields of hay, but rather with the fertilizing effect of the vetch vines, vetch stubble, rye, rye stubble, etc.

The following table gives the data for the crops sown November 4, 1897, as fertilizers for the corn crop of the following summer, and also the yields of hay on plots harvested, and of the two succeeding corn crops on each plot, both in 1898 and in 1899. A clearer presentation of the fertilizing effects of the several crops is afforded in a shorter table following the one below.

No nitrogenous fertilizer was used on any plot in the fall of 1897, but all plots except the two vacant ones and except Nos. 15 and 16, received at that time 240 pounds of acid phosphate and 40 pounds of muriate of potash per acre.

In 1898 St. Charles corn from Illinois was planted June 16 and fertilized, on all plots, with 240 pounds of acid phosphate and 40 pounds of muriate of potash per acre. The corn that was planted March 20, 1900 (variety St. Charles) was fertilized with 200 acid phosphate and 100 pounds of cotton seed meal per acre.

Yields of corn following vetch, vetch stubble, rye, rye stubble, etc.

Plot	Seed sown Nov. 4, 1897. Am't per acre.	Seed sown Nov. 4, 1897. Kind.	Portion used as fertilizer.	Yield of hay in April & May, 1898.	Yield of corn per acre. In 1898	Yield of corn per acre. In 1899
	Qts.			*Lbs.*	*Bus.*	*Bus.*
1	36	Rye	Stubble	1980	11.4	18.8
2	36	Rye	Whole plant	....	8.4	21.0
3	30	Hairy vetch	Whole plant.	....	16.6	22.9
4	......	Left bare, & fall plowed.	Weeds	....	15.0	18.2
5	21 30	Hairy vetch Turf oats	Stubble	3000	11.1	19.9
6	30	Hairy vetch	Stubble	2784	16.8	21.7
7	60	Turf oats	Stubble	1920	6.1	18.7
8	30	Hairy vetch, not inoculated	Whole plant (failure.)	....	14.2	19.6
9	30	Hairy vetch	Whole plant.	....	15.8	21.7
10	30	Hairy vetch	Stubble	3180	14.5	19.2
11	30	Hairy vetch, not inoculated	Stubble (failure.)	564	18.0	19.7
12	30	Hairy vetch	Stubble	3360	19.1	22.6
13	30	Hairy vetch	Whole plant.	....	17.2	24.1
14	......	Left bare, & fall plowed.	Weeds	....	15.4	18.6
15	30	H. vetch; ½ fertilizer.	Stubble	2604	16.2	18.6
16	30	H. vetch; no fertilizer	Stubble	2244	15.9	19.6

In the following table the preceding one is summarized so far as concerns the fertilizing effects of the several plants used as green manures, as determined by the yield of corn in 1898, that is, by the corn crop immediately following the green manuring plants.

Average results from use of vetch, etc., as green manure for corn.

Plots.	Green manuring plant. April and May, 1898.	Corn per acre, in 1898. Yield.	Corn per acre, in 1898. Increase over P. 2, rye.	per cent. Increase
		Bus.	*Bus.*	
1	Rye stubble	11.4	3 0	36
2	Rye, entire plant	8.4	....	....
7	Oat stubble	6 1	2.3	27
5	Oats and vetch stubble mixture	11.0	2.6	31
4 & 14	Left vacant & fall plowed, weeds	15.2	6.8	81
6, 10, 12	Hairy vetch stubble	17.5	9.1	108
3, 9, 13	Hairy vetch, entire plant.	16.6	8.2	98

The above table shows that vetch was superior to rye as fertilizer to the extent of 8.2 bushels of corn per acre, an increase of 98 per cent.; that vetch stubble afforded a still larger yield of corn the first season, or 9.1 bushels more than was obtained on the rye plot. If it be asked why the stubble of both vetch and rye was more favorable to the succeeding corn crop than was the entire growth, the answer would seem to be found in the statement that the stubble of the vetch afforded sufficient nitrogen for the corn and that the plowing in of large masses of vegetable matter in May into a sandy soil may have made the ground too loose and dry, interfering with the capillary movement of moisture in the soil.

Notice, in this connection, that there was a smaller yield of corn after oat stubble and after rye than after rye stubble. There is every reason for assuming that these smaller yields were due to dryer soil, resulting from the fact that the oats and uncut rye continued to exhaust the moisture of the soil up to the time when the land was plowed, May 10, while the rye on the "rye stubble plot" was removed a month earlier, thus checking the loss of moisture from this latter plot by removing the plants which would have exhausted it in transpiration.

If we take as a basis the yield of corn in 1898 on the plot where rye stubble was plowed in, we have this yield increased by 54 per cent on the "vetch stubble plots" and by 46 per cent on the plots where the entire growth of *vetch* was used as green manure. On page 206 of Bulletin No. 96 is a statement of the amounts of nitrogen in the green manuring material on an acre in this experiment, viz: 26 pounds in the entire growth of rye, 105.5 pounds in the entire growth of vetch, and 19.9 pounds in the roots and stubble of vetch.

Residual, or second-year, fertilizing effects of vetch and rye.—It was desired to ascertain whether the various plants (vetch, rye, etc.) used as green manures had exhausted their fertilizing effect the first year, or whether the second corn crop would also be helped by any unused fertilizing material which they might leave in the soil. To ascertain the full amount of this residual effect no nitrogenous fertilizer should have been used on the second corn crop, planted March 20, 1899. However, we were dependent on that field for part of the corn needed to feed the farm teams and could not well afford the low yield of corn which would undoubtedly have been obtained on some plots if nitrogenous fertilizers had been withheld. Hence, in 1899 there was used on all plots 100 pounds per acre of cotton meal as well as 200 pounds of acid phosphate per acre.

The yields of the second crop of corn after vetch, etc., that is of corn in 1900, averaged as follows:

After rye stubble .. ..18.8 bushels per acre.
After rye plowed in, May, '98....21.0 bushels per acre.
After vetch stubble..............21.2 bushels per acre.
After vetch, plowed in, May, '98...22.9 bushels per acre.

The use of cotton seed meal on the corn obscures the results, making the superiority of vetch as a fertilizer less than it would otherwise have been. However, even at this disadvantage, the plots on which the entire growth of vetch had been plowed in yielded 1.9 bushels of corn more than did the plot where at the same time the entire rye plant had been used as green manure.

All plants, whether vetch or rye, that supplied much vegetable matter in 1898, were advantageous to the corn crop of 1899, after the rotting of this organic matter. The residual effect of vetch was superior to that of rye, in spite of the fact that the use of cotton seed meal on the corn crop doubtless made the difference in yield considerably smaller than it would have been had none of the corn plots received nitrogenous fertilizer. The residual fertilizing effect of the entire vetch plant was greater than that of vetch stubble.

COTTON SEED VERSUS COTTON SEED MEAL AS FERTILIZER FOR CORN.

On poor sandy soil, abounding in small stones, cotton seed and cotton seed meal were compared as fertilizers for corn in 1900. Preceding crops were cotton in both 1899 and 1898, and in 1897 oats, followed by broadcast cowpeas, of which only a thin stand was obtained; the peas were cut for hay. In 1896 corn, (with drilled cowpeas between the rows), occupied these plots.

On all plots in 1900 a mixture of 240 pounds of acid phosphate and 32 pounds of muriate of potash per acre was applied. On plots 1 and 4 cotton seed meal at the rate of 200 pounds per acre was employed. On Plot 2 cotton seed at the rate of 434 pounds or 13 bushels per acre were used, first taking the precaution to kill the germs without loss of fertilizing material.

All fertilizers were applied in the drill immediately before planting corn—that is in the planting furrow, and mixed with the adjacent soil by the use of a scooter plow. The date of plant ing and fertilizing was March 29, 1900, and the variety used was Experiment Station Yellow, of which 3,168 plants per acre were allowed to reach maturity, there being the same number of plants on every plot.

The 200 pounds of cotton seed meal and the 434 pounds of cotton seed contained equivalent amounts of nitrogen. Plot 3 received no nitrogen.

The results follow:

Cotton seed and cotton seed meal as fertilizers for corn in 1900.

Fertilizer (plus minerals.)	Yield of corn per acre.	Increase per acre.
	Bus.	Bus.
No nitrogenous fertilizer	15.4	....
434 lbs. cotton seed (killed) per acre........	18.3	2.9
200 lbs. cotton seed meal per acre...........	18.5	3.1

The differences in yield are so slight that we may say that in this test a pound of nitrogen in cotton seed was just as valuable as in a pound of cotton seed meal. The average increase with these fertilizers was 3 bushels per acre, which is not quite sufficient to balance the cost of the fertilizer. It does not follow that nitrogen was not needed, but the results suggest that too much nitrogen was used for profit.

Cotton seed meal versus nitrate of soda; intercultural fertilization.

It was on this same portion of this same field that the special nitrogen experiment referred to on page 34 of Bulletin 75, for 1896, was conducted, the crop being ruined by drouth.

In 1896, the soil, the variety, the date of planting and the mineral portion of the fertilizer were practically the same as in 1900. The great difference in the yields is due almost entirely to the difference in the rainfall of the two years.

Cotton seed versus nitrate of soda; and intercultural application of each. (1896.)

Plots.	Fertilizer per acre, (plus minerals.)	Yield corn per acre.
		Bus.
2 & 6	180 lbs. c. s. meal at planting	7.9
4 & 8	80 lbs. nitrate of soda at planting	8.4
3 & 7	90 lbs. c. s. meal at planting; 40 lbs. of nitrate of soda at planting	8.7
1 & 5	90 lbs. c. s. meal at planting; 90 lbs. c. s. meal at 3d plowing, June 20	6.9

The failure of the crop due to drought prevents the drawing of conclusions.

DOES COWPEA STUBBLE FURNISH SUFFICIENT NITROGEN FOR CORN?

The corn for this experiment was not planted until May 1, 1900. The variety was Experiment Station Yellow. The preceding crop drilled cowpeas, cut for hay. It was known that a very small quantity of nitrate of soda, 20 to 40 pounds per acre, gives early corn a prompt start and rapid growth, thus serving to shorten the time during which the bud worm can injure the root of the young plant and destroy the stand.

We desired to ascertain whether this undoubted advantage of nitrate of soda would hold good with corn planted very late and also whether the cowpea roots and stubble had furnished enough nitrogen for the needs of the corn plant. Hence after drilling and mixing the phosphate and muriate of potash and after dropping the corn, a little nitrate of soda was dropped in the open furrow about five or six inches away from the seed corn, the nitrate being used at the rate of 36 pounds per acre.

The average yield on the two plots receiving no nitrogen in the fertilizer was 29 bushels per acre; on the other two plots it was 29.1 bushels.

This practical equality in yield indicates that nitrate of soda was not needed with corn where the preceding pea crop had left in the soil the nitrogen that was contained in its roots and stubble. Nitrate of soda was at a further disadvantage here by reason of the excessive rainfall in June, which doubtless leached out much of the nitrogen of this fertilizer. On silage corn and on all of the small grains we have had a considerable increase from the use of nitrate of soda.

Its value when employed at the rate of about twenty pounds per acre for the purpose of causing early planted corn to grow off promptly and rapidly has been demonstrated elsewhere. The pea stubble, under these conditions, furnished sufficient nitrogen.

FERTILIZER EXPERIMENTS WITH CORN.

The fertilizer experiments, or soil tests, with corn presented below have been made on three farms: (1) On the Experiment Station Farm at Auburn on a hilltop where the soil consists of a deep bed of gray sand nearly free from stones and pebbles.

(2) On the farm of J. D. Foster, just south of his house and on a sandy soil not quite so poor or coarse as the preceding; the Foster Experiment at Auburn is distant about one mile from the fertilizer experiment on the Station Farm.

(3) On "mulatto" soil, with deep red subsoil, on the farm of W. F. Fulton, Larimore, DeKalb County, Ala.

Fertilizer experiments with corn on Experiment Station Farm in 1898, 1899, 1900.

During all the three years the experiments were conducted on the same character of soil, a deep gray sand, selected on account of its extreme poverty. Each year (except 1898) the fertilizer applied on any plot was exactly the same as that applied to the same plot (but to a different crop), the preceding year. Hence the experiments, except that of 1898, are really a test, not only of the immediate or first-year effects of each fertilizer, but also of the cumulative effect, (if any on this porous soil), of similar applications in 1898 and 1899.

Every year the same variety of corn, Experiment Station Yellow, was employed.

The dates of planting were March 25, March 27, and April 7 respectively for the several years. In 1898 and 1899 the stand was uniform and perfect, 2790 plants per acre on each plot. In 1900 the stand was uniform on most plots, but slightly defective on Plots 7, 10, and 5. The percentages of missing plants on these plots are too small to materially affect the results or to make any corrections necessary.

All fertilizers were applied in the drill and mixed with the soil by means of a scooter plow. No cowpeas were planted between rows of corn.

This field had borne no leguminous or nitrogen-collecting plants since 1895, when it was used for a variety test of cowpeas, the vines of which were plowed under. In 1896 and 1897 the crops were small grains fertilized with a moderate amount of a complete commercial fertilizer.

Corn in 1898 followed oats; in 1899 and 1900 it was preceded by cotton, which had received the same fertilizers as were applied to corn on the corresponding plots.

Fertilizer experiments with corn on Experiment Station farm, in 1898, 1899 and 1900.

Plot No.	Am't per acre	Kind of Fertilizers.	Yield of corn per acre.			Increase per acre, over unfertilized plots.			
			1898	1899	1900	1898	1899	1900	Average.
	Lbs.		*Bus.*	*Bus*	*Bus*	*Bus*	*Bus.*	*Bus*	*Bus.*
1	200	Cotton seed meal.....	15.2	14.1	13 4	.9	—.8	6.4	2.2
2	240	Acid phosphate.......	12.5	15.8	6.2	—.8	.9	—.8	—.2
3	00	No fertilizer.........	14.3	14.9	7.0		....	...	....
4	200	Kainit............	16.6	12.9	5.6	2.9	3.3	-1.2	1.7
5	200 240	Cotton seed meal..... Acid phosphate.......	16 2	18.4	12.7	3.0	.9	6.2	3.4
6	200 240	Cotton seed meal..... Kainit....	16.0	19.2	10.3	3.4	.4	4.0	2.6
7	240 200	Acid phosphate....... Kainit............	12.7	19.4	4 3	.6	—.5	-1.7	—.5
8	00	No fertilizer..........	11.5	21.5	5.8	....	....	....	....
9	200 240 200	Cotton seed meal..... Acid phosphate....... Kainit..........	15.2	24.1	11.5	2.7	2.6	5.7	3.7
10	200 240 100	Cotton seed meal .... Acid phosphate....... Kainit...............	....	....	12.0	....	....	6.2	....

The following figures give an analysis of the average results for 3 years:

Increase of shelled corn per acre when cotton seed meal was added.

To unfertilized plot....... ....2.2 bushels.
To acid phosphate plot ....1.9 bushels.
To kainit plot .... .9 bushels.
To acid phosphate and kainit plot..........4.2 bushels.

Average increase with cotton seed meal, . 2.3 bushels.

Increase of shelled corn per acre when acid phosphate was added.

To unfertilized plot ....— .2 bushels.
To cotton seed meal plot..................1.2 bushels.
To kainit plot ....—2.2 bushels.
To cotton seed meal and kainit plot ....1.1 bushels.

Average increase with acid phosphate, . . 0. 0 bushels.

Increase of shelled corn per acre when kainit was added.
To unfertilized plot .. ..1.7 bushels.
To cotton seed meal plot .... .4 bushels.
To acid phosphate plot ....— .3 bushels.
To cotton seed meal and acid phosphate plot. .3 bushels.

Average increase with kainit, ... 0.5 bushels.

In 1898 with an excedingly dry May and June there was very little increase with any fertilizer, the average increase for each fertilizer applied under four different conditions being as follows:

Cotton seed meal, 1.8 bushels;
Acid phosphate, *decrease,* .5 bushel.
Kainit, 1.6 bushels.

In 1898 none of the fertilizers, in the amounts used, were profitable.

In 1899 there was a greater yield on all plots (except Plot 4) than the preceding year, but the increase from commercial fertilizers was no greater than before, averaging under four different conditions as below:

Increased yield with cotton seed meal, 1.9 bushels.
Increased yield with acid phosphate, 1.8 bushels.
Decreased yield with kainit, .5 bushel.

In 1900 there was almost a complete failure of the corn crop on deep sandy land, every plot falling below its yield in previous years. And yet the increase attributable to cotton seed meal in 1900 is far greater than in any previous year, this fertilizer reclaiming the plots to which it was applied from absolute failure. The average increase in 1900, with four different combinations for each fertilizer, is stated below:

Increase with cotton seed meal, 6.5 bushels.
Increase with acid phosphate, .1 bushel.
Decrease with kainit, 1.2 bushels.

In 1900 cotton seed meal at the rate of 200 pounds per acre paid a profit. This favorable result occurred in a year when the rainfall in the first half of the growing season was excessive, and when doubtless much of the nitrogen was leached out and lost to the crop. It is an open and interesting question whether the very low yields of the plots receiving no cotton seed meal were due to the peculiar season and consequent exhaustion through leaching of the small supply of nitrogen of the soil, or whether the absolute failure on these plots was attributable to the nitrogen removed in the two preceding crops, viz: cotton in 1899 and a light crop of spring oats in 1898. The experiments on these same plots, with corn, cotton and oats, which have already been under way for three years, will be continued and future results will doubtless throw light on this question.

The main practical conclusion to which we wish now to direct attention is the unprofitableness of large applications of *commercial* fertilizers to corn on land deficient in humus and hence unable to resist extremes of drought and leaching. Note, in contrast the very large increased yield of corn where rotting velvet beans furnished the humus and nitrogen (see p. 130) and recall that the two experiments were on the same hilltop, a few yards apart, and that weather condition did not ruin the crop fortified by an abundance of humus.

Fertilizer experiments on Foster farm at Auburn, in 1899 *and* 1900. Both experiments were made in the same field, which has a soil that is apparently uniform. The soil is sandy but somewhat less so and somewhat richer than the Station soil on which similar tests were conducted. In both these Foster experiments there is no test of the cumulative effect of fertilizers, since no fertilizer experiment on this soil had preceded the test of 1899 or 1900.

The tests were made by J. D. Foster in accordance with detailed written directions from the Agriculturist of the Experiment Station. The weighing of fertilizers, the harvesting of the crop, and the shelling of the corn were performed by T. U. Culver, of this department of the Station.

Common corn of the usual type in this locality was used. The dates of planting were March 27, 1899, and March 31, 1900. The stand was good and practically uniform. It was noted that the corn on Plots 5, 9, and 10 was later in tasseling and maturing than on the other plots.

In 1898 the crop on this field was corn, very lightly fertilized, with drilled cowpeas between the corn rows; the peas were picked, and the vines grazed. In 1899 cotton was the crop on the entire field, and fertilization was then uniform and moderate on the portion of the field which the following year was used for the fertilizer experiment with corn.

Results of fertilizer experiments with corn on Foster farm, Auburn, in 1899 *and* 1900.

Plot No.	Am't per acre	Kind of fertilizers.	1899 Yield.	1899 Increase.	1900 Yield.	1900 Increase.	Av. Increase.
	Lbs.		*Bus.*	*Bus.*	*Bus.*	*Bus.*	*Bus.*
1	200	Cotton seed meal	13 6	2.2	15.4	9 6	5.9
2	240	Acid phosphate	I1.6	.2	6.4	.6	.4
3	00	No fertilizer	11.4	......	5.8	......	.....
4	200	Kainit	10.8	.0	7.2	1.5	8.
5	200 240	Cotton seed meal Acid phosphate	16.0	5.8	8.0	2.4	4.1
6	200 200	Cotton seed meal Kainit	12.0	2.4	10.0	4.5	3.5
7	240 200	Acid phosphate Kainit	9.6	.6	4.2	.8	.7
8	00	No fertilizer	8.4	......	5.3	.....	.....
9	200 240 200	Cotton seed meal Acid phosphate Kainit	8.8	4.	7.1	1.8	1.1
10	200 240 100	Cotton seed meal Acid phosphate Kainit	11.0	2.6	9.0	3.7	3.2

In 1899 this soil, though poor, failed to respond to acid phosphate or kainit when these fertilizers were applied to corn. The yield was somewhat increased, but not to a profitable extent, by cotton seed meal, the true value of which, however, was doubtless obscured by the cowpeas grown between the corn rows in 1898.

In 1899 the average increase for fertilizers, each applied in four different combinations, was as follows:

Increase with cotton seed meal, 2.5 bushels.

Increase with acid phosphate, .6 bushel.

Decrease with kainit, 1.2 bushels.

In 1900 the results are similar, a complete failure of corn to respond to acid phosphate and kainit, and a slight, though usually unprofitable, increase with cotton seed meal.

In 1900 the average results for each fertilizer were as follows:

Increase with cotton seed meal, 3.8 bushels per acre.
Decrease with acid phosphate, 2.5 bushels per acre.
Decrease with kainit, 1.0 bushel per acre.

An analysis of the average increase for both years is given below:

Increase of shelled corn per acre when cotton seed meal was added.

To unfertilized plot .. ..5.9 bushels.
To acid phosphate plot ....3.7 bushels.
To kainit plot .. ..2.7 bushels.
To acid phosphate and kainit plot .... .4 bushels.

Average increase with cotton seed meal, . . 3.2 bushels.

Increase of shelled corn per acre when acid phosphate was added.

To unfertilized plot .. .. .4 bushels.
To cotton seed meal plot...............—1.8 bushels.
To kainit plot .. ..— .1 bushel.
To cotton seed meal and kainit plot ......—2.4 bushels.

Average decrease with acid phosphate, . . 1.0 bushels.

Increase of shelled corn per acre when kainit was added.

To unfertilized plot .... .8 bushels.
To cotton seed meal plot ....—2.4 bushels.
To acid phosphate plot .... .3 bushels.
To cotton seed meal and acid phosphate plot .. ..—3.0 bushels.

Average *decrease* with kainit, ... 1.1 bushels.

Fertilizer experiment in DeKalb County. This experiment was made in a most careful manner by W. F. Fulton, at Larimore, near Collinsville, with fertilizer materials furnished by this Station. The composition and amount of fertilizer was the same as in both of the Auburn experiments.

The soil was reddish, or mulatto, with a deep red subsoil. It was the characteristic stiff red soil of Big Wills Valley, and was deficient in vegetable matter, and doubtless amply supplied with lime. The original forest growth was poplar, oak, hickory, and mulberry. Cotton in 1898 and corn in 1899, both without fertilizers, constituted the preceding crops.

Corn was planted April 5, the fertilizers having been drilled in and mixed as usual with the soil a few days before planting time.

The very full notes recorded by the experimenter indicate that between July 2 and 17 the lower blades "fired," or dried up, on all plots receiving acid phosphate. August 10, the corn on Plot 1 was green "from top to bottom, and on Plot 6 nearly so," while on the other fertilized plots all blades up to 3 or 4 feet were then dead. "The season was the wettest ever known, frequent and heavy rains falling in April and from May 8 to the middle of July. It was impossible to do justice to crops and yet the corn flourished and pushed on ahead of grass and weeds."

The blades were stripped from the plants at the usual time and the yields in lbs. per acre of cured blades or fodder, are given below, beginning with Plot 1: 296, 448, 440, 376, 440, 520, 408, 448, 544 and 592.

The table gives the yields and the increase attributable to fertilizers.

Fertilizer experiment with corn in 1900 at Larimore, DeKalb County.

Plot No.	Am't per acre	Kind of fertilizers.	Yield of shelled corn per acre.	Increase over unfer-tilized plots.
	Lbs.		*Bus*	*Bus.*
1	200	Cotton seed meal	29.4	11.8
2	240	Acid phosphate	18.2	0.6
3	00	No fertilizer	17.6	....
4	200	Kainit	18.6	0.4
5	200 240	Cotton seed meal Acid phosphate	27.0	8.2
6	200 200	Cotton seed meal Kainit	26.7	7.3
7	240 200	Acid phosphate Kainit	22.8	2.8
8	00	No fertilizer	20.7	....
9	200 240 200	Cotton seed meal Acid phosphate Kainit	26.7	6.0
10	200 240 100	Cotton seed meal Acid phosphate Kainit	30.8	10.1

The lessons of the preceding table are made plainer below:

Increase of shelled corn per acre when cotton seed meal was added

To unfertilized plot ....11.8 bushels.
To acid phosphate plot .. .. 7.9 bushels.
To kainit plot .. .. 6.9 bushels.
To acid phosphate and kainit plot........ 5.4 bushels.

Average increase with cotton seed meal, . . 7.9 bushels.

Increase of shelled corn per acre when acid phosphate was added.

To unfertilized plot ....0.6 bushels.
To cotton seed meal plot ....3.6 bushels.
To kainit plot .. ..2.4 bushels.
To cotton seed meal and kainit plot ......—1.3 bushels.

Average decrease with acid phosphate, . . 0.5 bushels.

Increase of shelled corn per acre when kainit was added.

To unfertilized plot ....0.4 bushels.
To cotton seed meal plot .. ..—4.5 bushels.
To acid phosphate plot ....2.2 bushels.
To cotton seed meal and acid phosphate plot .. ..2.2 bushels.

Average decrease with kainit, ... 1.0 bushels.

In whatever combination cotton seed meal was applied it greatly increased the yield, the average increase with this fertilizer being 7.9 bushels, which affords a fair profit. Apparently leaching did not to any great extent occur on this stiff soil, notwithstanding the phenomenal rainfall of April, May and June.

Neither acid phosphate nor kainit was needed by corn on this red calcareous soil.

Conclusions from fertilizer experiments on three farms.

(1) Heavy applications of acid phosphate or kainit were useless.

(2) Cotton seed meal was the only commercial fertilizer tested that ever paid a profit when applied to

corn, and in the large amount used, 200 pounds per acre, this was not always profitable.

(3) A fertilizer for corn should contain much more nitrogen, and much less phosphoric acid and potash than a fertilizer for cotton on the same land.

(4) Leguminous plants, whether only the roots and stubble or the entire growth of vines are plowed under, constitute a safer and more profitable fertilizer for corn than do commercial fertilizers, or even cotton seed meal. A similar superiority of stable manure for corn may be reasonably expected.