W. M. Shepardson.

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Agricultural Experiment Station,

OF THE

AGRICULTURAL AND MECHANICAL COLLEGE,

AUBURN, ALA., JUNE, 1890.

CORN, COTTON, RYE, CHUFAS.

Conclusions from Six Years of Experiment.

☞ The Bulletins of this Station will be sent Free to any citizen of the State, on application to the Director.

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SOME CONCLUSIONS FROM EXPERIMENTS WITH FERTILIZERS.

[J. S. NEWMAN, AGRICULTURIST.]

Inquiries as to the needs of the soils of this station and the choice of plants as to sources of their food supplies were commenced in 1884.

A retrospective view of results during five years develops some interesting facts.

The most prominent of these is the effect of phosphoric acid, not consumed by the plants to which it is applied, upon subsequent crops, as shown by the failure of later applications to produce perceptible effects. An application of acid phosphate to corn in 1884 upon land to which none had been previously applied increased the yield seven bushels per acre upon land with clay subsoil. This land, when first taken in charge, produced only 3.7 bushels of corn per acre without manure. Four years later, after continuous cultivation in different crops, all except one of which were fertilized with phosphatic manures, the yield without manure was 13.02 bushels while the application of phosphates gave no increase. The reserve force from previous applications furnished all that the plant needed, or all that it could utilize without additional supply of other elements of plant food.

These and many other facts indicate that, on soil having clay subsoil, the phosphoric acid does not leach to an injurious extent, but remains in an available form in reach of cultivated plants.

On another class of soil having no clay within four feet of the surface different results appear. Here there seems to have been a serious loss of phosphoric acid and a decided response to new applications after seasons in which the rainfall was excessive, causing a rapid descent of the water through the porous subsoil. The last season was exempt from such leaching rains and the corn seems to have received the full benefit of the residue from the application of the previous year as well as that of the current season.

The complaint is often heard, that the phosphates do not produce the effects upon crops that were realized from their early use, and the conclusion that the phosphatic manures have degenerated in quality, is drawn from this assumption of facts. The facts are:

(*a*) That the phosphatic compounds are of higher grade than those sold fifteen years ago.

(*b*) That their effect is equally marked upon lands to which none has been previously applied.

(*c*) Lands, to which repeated liberal applications have been made, contain enough of the unappropriated previous applications to supply the needs of the crops.

This last is true of soils which contain enough clay to prevent injurious leaching.

We infer then that phosphates applied to clay soils, or sandy soils with good clay subsoils, are held until used by plants, or at least the larger part of them. On such soils, therefore, heavy annual applications are not wasteful.

On sandy soils, without clay foundation, however, heavy applications are not advisable, since that not appropriated by the crops to which it is applied may leach beyond the reach of the roots of cultivated plants.

THE THREE FORMS OF PHOSPHORIC ACID.

The results of experiment indicate no difference in the agricultural value of water soluble and citrate soluble phosphoric acid. Repeated, careful comparisons, under identical circumstances have shown no greater variations than would occur either without the use of manure or with equal quantities of the same fertilizer.

Indeed this question of the comparative agricultural value of these two forms may be regarded as definitely settled. Again, the plant seems perfectly indifferent to the source from which *available* phosphoric acid is derived. Formerly a preference was given to animal bone as a source but repeated comparisons indicate that the same quantity of available phosphoric acid from rock is as valuable as its equal weight from bone.

ACID SOLUBLE.

The finely pulverized phosphate rock, known as "Floats," has been subjected to experiment for six years. While the results from its use have not equaled those from the acidulated phosphates when applied alone, when applied with nitrogen, and especially with cotton seed meal, the difference in yield has rarely been sufficient to justify the additional outlay for the acidulated goods. This is especially apparent when we consider the fact that we get nearly twice as much phosphoric acid in a ton of floats as in one of acid phosphate.

The active fermentation which the cotton seed meal undergoes in the soil possibly renders a portion of the phosphoric acid in the floats available.

THOMAS SCORIA OR SLAG.

This is a by-product in the preparation of steel by the "basic process." It has been used in comparison with floats with results closely approximating those from the latter. Its action, like that of floats, is stimulated by association with cotton seed meal.

ALABAMA RAW PHOSPHATES.

Some enterprising parties at Aberdeen Miss., and Selma Ala., have prepared some of the native phosphates, samples of which have been experimented with, but their low grade necessitates the use of such heavy applications as to render the economy of their employment, as substitutes for more costly goods, doubtful.

SOME PRACTICAL SUGGESTIONS ON THE USE OF PHOSPHATES.

Vast sums have been wasted in the cotton states by the injudicious purchase and use of commercial manures. This has resulted,

(*a*) From the absence of a knowledge of the needs of soils, which could be acquired only by experiment.

(*b*) By following the advice and practice of ignorant teachers.

Within the last twenty years the farmers and planters have learned much about the use of fertilizers, but their tuition has involved a severe tax upon their income. Commercial compounds have been purchased and applied without a knowledge either of the composition of the fertilizer or the needs of the soil or the plants. They paid twenty cents per pound for nitrogen while the cotton seed and animal manures were largely robbed of this valuable ingredient by wasteful handling before being applied to the soil.

Phosphates were applied to land already rich in phosphoric acid as are the black prairie lands of Alabama.

Mr. David Dickson made extravagant application of a low grade phosphate to his sixteen acre lot, previously enriched by animal manures, and harvested large crops; others followed his example upon impoverished fields and harvested poor crops and disappointment. This continued until experiment demonstrated that smaller application of concentrated manures gave more profitable results.

Mr. Furman caused a wasteful expenditure for kainit, to be applied to lands already abundantly supplied with potash. Except as a conservator of moisture, during severe drouth, very little benefit has been derived from the use of kainit or other sources of potash. Under a judicious rotation of crops, including those which are humus-supplying little else than phosphates need be purchased by the corn and cotton grower. The lands of this station have been rapidly improved by the following rotation:

Commencing 1st year with cotton.
2nd " corn with peas between rows.
3rd " oats followed by peas same year.
4th " cotton again.

All of these crops except the peas are fertilized. Under this system the soil soon becomes sufficiently supplied with humus to furnish the nitrogen needed for the cotton plant in the cheapest, best possible form, so that an application of acid phosphate is sufficient to secure profitable crops.

Cotton seed and stable manure, supplemented with acid phosphate, furnishing the cheapest and best manure for corn, so that the purchase of nitrogen may be entirely dispensed with, pea vines furnishing it for cotton and cotton seed and stable manure for corn. If lands have been so denuded of vegetable matter as to require the purchase of nitrogen, cotton seed meal affords the cheapest source. This and acid phosphate mixed in equal parts, 100 lbs of each per acre, on sandy and red lands, supply the needs of plants as well as the more costly commercial compounds. They may be easily, thoroughly and cheaply mixed on the farm.

The black prairie lands should be excepted from all rules of treatment of other soils. They respond to sotton seed, stable manure and cotton seed meal but not satisfactorily to phosphates.

If cotton seed, stable manure and phosphates are composted for corn, the following formula, used for many years, has given most satisfactory results; to make one ton of the dry materials use.

500 lbs Acid phosphate.
750 " Stable manure.
750 " Cotton seed.

2000 lbs.

The cotton seed should be protected from fermentation until used in the compost. The stable manure should remain in the stalls until needed. When the stalls are cleaned out in January, the time for making the compost, a liberal supply of litter should be spread in the stall to furnish a bed for the mules and serve as an absorbent for the first droppings. A small quantity of litter is used during the year, as found necessary, to keep the stall dry. An occasional dusting with land plaster or gypsum will also contribute to this end and prevent loss of ammonia. To those not familiar with this practice it seems at first view untidy, but on the contrary, since the manure is packed down by the tread of the mule from day to day—siloed as it were—no fermentation takes place and no disagreeable odor is emitted, while the animal has a clean, elastic bed throughout the year.

Again, the liquid manure, which contains most of the nitrogen, is absorbed by the solid excrement and no loss of nitrogen takes place. If the manure is removed daily it is almost impossible, in this climate, to prevent injurious fermentation or "fire fanging," while much of the liquid manure is lost.

MANNER OF COMPOSTING.

Take such quantity of the cotton seed and stable manure as can be conveniently mixed with forks and shovels: stir them until thoroughly commingled, wetting them as they are stirred, using enough water to wet them thoroughly without leaching. Spread this mixture, to a depth of about six inches, and pour over it the phosphate, which should be free from lumps, and stir until the particles of phosphate adhere to the manure and seed and the three ingredients are intimately mingled. This process is repeated until all of the material is consumed, each mixed lot being shoveled into the common heap as the mingling is completed. Of course the proper relative proportions must be preserved in these several mixings.

It is important to wet the material of the compost thoroughly to retard the fermentation and prevent fire fanging.

IS AMMONIA LOST DURING FERMENTATION?

It is commonly supposed that when vapor passes off rapidly from the compost heap—when it "smokes"—that a loss of ammonia takes place. Litmus paper placed immediately upon the freshly stirred compost, in the midst of the rising fumes, did not detect the presence of an Alkali, indicating that no free ammonia was present. On the contrary it discovered the presence of acid sufficient to neutralize ammonia should volatilization take place. The acid phosphate prevents loss of ammonia.

WHY IS THIS?

Nearly half of every acid phosphate or super phosphate, as it is sometimes called, is gypsum, or sulphate of lime, which results from treating the pulverized phosphate rock with sulphuric acid. The presence of this sulphate of lime furnishes a safeguard against any loss of ammonia by being volatilized.

If stable manure or stable manure and cotton seed are fermented without the phosphate, or without gypsum added, a perceptible loss of ammonia takes place.

If the compost is to be applied to cotton, we use the following formula, mixing as before.

700 lbs acid phosphate.
650 " Stable manure.
650 " Cotton seed.

2000 lbs.

Experiments in the use of kainit in the compost heap indicated that the cotton seed and stable manure supplied enough potash.

If the compost is made for miscellaneous use, 600 lbs of phosphate per ton is used. The compost has proved during twenty years of practical experience and experiment the cheapest manure for the corn and cotton planter.

In making the first experiments with it in 1869 the materials were put up in layers, but this practice has long since been abandoned as unsatisfactory on account of the phosphate hardening into lumps.

COMPOSTING IN THE FURROW.

Some apply the cotton seed in the furrow, over which cotton is to be planted, and sprinkle the phosphate over them early in the season and, covering them with earth, allow the seed to ferment there. If the seasons are favorable in early spring this practice gives good results, but some serious objections stand against it.

(*a*) In order that the seed may not vegetate they must be applied before the soil has been warmed sufficiently to supply the conditions necessary for germination. If heavy, baking rains occur, the soil where the plant is to grow becomes hard. It cannot be rebroken without disturbing the manure, and hence there is difficulty in securing a mellow seed bed.

(*b*) It involves extra labor in distributing the seed and phosphate as they must be distributed separately.

COTTON SEED MEAL IN COMPOST.

Since cotton seed meal is cheaper at twenty dollars per ton, or even at twenty-two dollars per ton, than cotton seed at twelve, the meal has been substituted for the seed in the compost heap with perfectly satisfactory results. The following formula was used:

500	lbs.	cotton seed meal.
500	"	acid phosphate.
1000	"	stable manure.
2000	lbs.	

The stable manure is thoroughly pulverized and moistened and the meal and phosphate stirred into it until they adhere to the moist manure. The fermentation of this compost proceeds much more rapidly than that in which the seed are used and hence must be closely watched to avoid excessive heating. If this occurs, open vertical holes with a crowbar and pour in water, or turn the heap, adding water as it is turned. The plant food in the meal-compost is more promptly available than in that in which the seed are used.

POTASH.

So far as furnishing plant food is concerned, there seems to be little need of applying potash to these soils.

As conservators of moisture in dry seasons the potash salts are useful. During seasons in which there is sufficient rainfall, their influence is not appreciable. Plants seem indifferent as to the source from which they derive their potash. The sulphate, (in Kainit) muriate, and carbonate (in cotton seed hull ashes) have been applied under identical circumstances, using the same number of pounds of potash from each source. Cotton, corn, turnips and potatoes express indifference as to the source from which it is derived. During dry fall seasons cotton to which potash has been applied retains its leaves later than that to which none was applied. This however, is not usually accompanied by increased production, due to the potash.

NITROGEN.

The following sources of nitrogen have been employed alone and in various combinations, viz: Nitrate of soda, sulphate of ammonia, dried blood, cotton seed meal, cotton seed, stable manure and pea vines.

Of the four commercial sources, cotton seed meal is not only the best suited to this latitude, but is the cheapest source of supply—best, because its nitrogen is not so promptly available as in the others and hence resists the leaching influence of our heavy spring rains better than the others. Nitrate of soda and sulphate of ammonia when applied before or with the seed of spring crops are often leached beyond the reach of the roots of the young plants, on sandy soils, before the seed vegetate. If applied during the growth of the crop, either as a top-dress to small grain, or interculturally, to corn, cotton or vegetables, when the soil is occupied by root-hairs ready to appropriate the nitrates, the effect is very marked.

As remarked of phosphoric acid and potash, plants are indifferent as to the source of supply of their nitrogon, *per se*, but some of the sources carry with them conditions, inseparable from themselves, which render more certain, reliable and continuous their supply of this important factor in plant growth. We need, in our long growing season, a source which will not exhaust itself in the early growth of the plant, but give out a sufficiency for an early and vigorous growth and gradually yield up its supplies, as the season advances, and the demands of the growing plant increase. For this reason, experience and results of experiment point to the vegetable sources as the most desirable in our climate.

The cost of the commercial sources of nitrogen, and the limited supply of the domestic souces—cotton seed and animal manures—render it necessary for us to look for a cheaper and more universally available means through which to permanently improve our wasted soils. This we find in pea vines and other leguminous plants. When lands become exhausted of phosphoric acid, it must be resupplied by purchase; not so with nitrogen. This need not be purchased at all. Peas, clover, melilotus, vetches etc., may be used as factories for its production upon the very soil that needs it. On the stiff clay and calcarious prairie soils, clover, peas or melilotus may be used—on sandy soils, resort must be had to the peas. These furnish the cheapest and most permanent manure available to the cultivator of sandy soils. A crop of pea vines following oat stubble and left to protect, and rot upon the soil, until prepared for corn the following February, proved more than the equivalent of the residue of half a ton of compost and two hundred pounds of cotton seed meal and acid phosphate per acre, applied to cotton the previous year. A rotation of crops for three years, including two crops of pea vines, one cut for hay and the other left to rot upon the land, compared with clean culture in cotton for the same number of years, made a difference of *one hundred and five* per cent. in the yield of rye, following, in favor of the rotation including the peas.

HOW TO USE THE PEA VINES.

In more northern latitudes the practice of summer fallowing prevails as a preparation for winter grain and hence clover is turned in, *while green*, to be followed in August by wheat or barley: Fall plowing is also practiced in climates in which the winter is sufficiently severe to freeze the surface to the depth to which the land is plowed and thus pulverize the soil and prevent decomposition. There are no deleterious effects from thus plowing sod or clover lands, in cold climates, since the low temperature, prevailing through the winter, prevents the decompostion of the vegetable matter, turned into the soil, and consequently there is very little waste possible before the planting season in early spring. The crops therefore in such climate profit both by the meliorating effects of the vegetable matter upon the physical condition of the soil and the supply of plant food resulting from its decomposition.

On the lime lands of Alabama fall plowing is admissible, and even desirable, as a preparation for spring crops, on account of the difficulty of preparing such soils in spring, and the superior physical condition resulting from the fall plowing.

Even on the prairie, lime lands, however, turning in pea vines green, has proved wasteful as demonstrated by experiment, since cutting the vines for hay has left the soil in better condition than turning them green, as shown by subsequent production, while leaving them to rot upon the land gave better results than either.

Many writers have misled farmers by recommending an imitation of northern practice on southern farms, under conditions entirely different. Under no circumstances should the soil be fallowed in this climate during summer unless it is to be covered by another crop immediately. Exposure to our summer suns is injurious even if no green matter is turned in.

If large quanities of green vegetation is turned in, during our warm and long summer, injuriously rapid fermentation takes place and, on sandy soils, every vestige of organized matter soon disappears in consequence of the rapid decomposition.

The soil is benefited in three ways by growing upon it leguminous plants for its improvement.

(*a*). The shade afforded by the growth while it remains upon the surface and the prevention of evaporation and consequent crusting of the surface is important. Land will improve if merely covered with plank but will deteriorate if constantly exposed with a bare surface. During the severest drouth, land covered with pea vines remains porous and friable. The covering of vines also prevents surface washing which has been the most potent agent in the impoverishment of the soils of the cotton states.

(*b*). The presence of the decaying vegetable matter in the soil improves its physical condition and increases its power of absorbing and retaining moisture. In our warm climate, subject to long-continued drouths, this is a most important function.

(*c*). The decomposition of the vegetable matter upon and in the soil improves its chemical properties, directly, by addition of the chemical plant food which the decaying vegetation contains, and indirectly, by the action of the acids and alkalies, generated during and by the decomposition, upon insoluble substances already in the soil. If not turned in too long before planting, it especially supplies nitrogen in a most desirable form and doles it out gradually as the season advances and the growing plant demands it. It also darkens the soil and thus increases its capacity for absorbing heat and thereby hastens the arrival of seed time in spring.

THE TIME TO PLOW IN PEA VINES.

Experiments instituted for the purpose of making this inquiry have invariably indicated that the proper time is in the preparation of the land for the next crop.

If a crop of small grain or grass is to be sown in the early fall, the vines may be turned in some weeks before sowing the seed. If the land is not to be planted until the next spring, then, except with stiff soils, which require fall and winter fallowing, the land should not be broken until a short time before planting. If plowed in green during the summer and the land left bare, as remarked before, injury will result from this exposure and the vegetable matter will have decomposed, and the results of such decomposition leached through the soil, before the spring crop is planted.

Decomposition progresses throughout our mild winters and, unless the land is occupied by some growing crop, loss must ensue.

No one would think of applying manure in August or September for the crop to be planted the following April. The results of experiments have only served to corroborate the current testimony of practical men whose observation and experience have taught them that pea vines *pay best* when left upon the surface until the land is needed for another crop.

CONCLUSIONS FROM SIX YEARS OF EXPERIMENT.

1. Phosphoric acid leaches but little, if any, upon clay soil or those having clay sub-soil, but does leach through sandy soils with sandy subsoils.

2. Citrate soluble phosphoric acid possesses equal agricultural value with water soluble.

3. The phosphoric acid from floats, or phosphate rock ground to an impalpable powder, gradually becomes available in the soil, but produces very little effect upon the first crop.

4. The availability of the phosphoric acid in floats is hastened by use with cotton seed meal.

5. Plants are indifferent as to the sources from which available phosphoric acid is derived.

6. Nitrogen leaches rapidly through sandy soil unless occupied by feeding roots or underlaid by clay subsoil.

7. Plants are indifferent as to the sources from which their supply of nitrogen is derived, but those sources which yield a supply gradually, as needed by the plant, are best suited to our long seasons of growth.

8. Of the commercial sources of nitrogen, cotton seed meal is cheapest and most reliable. It yields its plant food more gradually than either the mineral or animal sources.

9. Pea vines, grown upon the land, and left to protect the surface until preparation is made for the next crop, furnish the cheapest source of nitrogen in the most desirable condition.

10. Pea vines, thus grown and treated, furnish the most reliable and practicable means of improving worn lands.

11. Pea vines cut for hay, leaving the stubble and roots

on and in the land, benefit the soil more than turning them in green during the summer.

12. Potash applied to the soil of this station has not been profitable except during drouth. Its principal benefit seems to result from its affinity for moisture.

13. Plants seem indifferent as to the source of supply from which they derive the potash needed.

14. Following thorough preparation of the soil, shallow cultivation produces larger crops at less cost than deep cultivation.

15. Impoverished soils may be rapidly restored to productiveness by terracing accompanied by a judicious rotation of crops involving a restoration of humus.

16. The best way to utilize the animal manures saved on the farm, and the surplus cotton seed, is in compost with acid phosphate.

17. Contrary to the general opinion, ammonia is not volatilized and lost from such compost during the fermentation.

FRUIT AND STOCK.

18. Grapes, peaches, plums, raspberries, strawberries and the oriental type of pears can be grown profitably under intelligent culture.

19. Growing wool and mutton, intelligently pursued, is more profitable than growing cotton—a profit of fifty per cent upon the value of the sheep and the cost of keeping them can be realized.

20. Pork can be grown here as cheaply as in any state in the union by cultivating our peculiar crops especially for swine.

21. Green crops for soiling cattle may be had in abundant supply, during the entire year, from the cereals, lucerne, corn, sorghum and peas. By means of these and ensilage pasturage may be dispensed with.

SOME FIELD EXPERIMENTS IN 1889.

CORN.

The land upon which this experiment was conducted was embraced in the ten acres planted in cotton in 1888, by order of the Board, to determine the profit of improved cultivation and fertilization, the results of which were reported in Bulletin No. 5, New Series. The liberal application of manure to the cotton the previous season and the absence of the usual leaching rains during the winter of 1888–9 prevented the usual contrast between the fertilized and unfertilized plots, the residue nearly supplying the needs of the corn plant, as shown in the accompanying tabulated statement of results. Attention is invited to the comparison of cotton seed crushed and uncrushed with each other and with an equivalent supply of nitrogen from cotton seed meal. Attention is also directed to the comparison of raw phosphate—a cheap article of Alabama phosphate—with acid phosphate, indicating either that enough phosphoric acid was obtained from the residue of the previous application, or that the raw phosphate possesses valuable fertilizing properties.* The small increased production over the unfertilized plot leaves the question in doubt.

After the crop was gathered, during a protracted drouth in the fall, chemical examination of the soil and subsoil was made, the results of which appear in the accompanying report of the chemist, Dr. N. T. Lupton:

	NITROGEN.	PHOS. ACID.	POTASH.
1. Soil to depth of 6 inches	0 093	0.06	0.02
2. Subsoil from 6 to 12 inches	0 093	0 07	0.02
3. " " 12 " 18 "	0 074	....	....
4. " " 18 " 24 "	0 046	....	....
5. " " 24 " 30 "	0.065	....	....
6. " " 30 " 36 "	0 031	....	....
7. " " 36 " 42 "	0.056	....	....
8. " " 42 " 48 "	0 035	....	....

The uniformity in the contents of the soil and subsoil down to twelve inches is worthy of note.

Attention is invited to the fact that the relation between the different parts of the plant seems not to be materially affected by the different manures.

*Possibly part of the effect is due to carbonate of lime in this phosphate.

	Fertilizers per Acre.	Cost of Fertilizers per Acre.	Results. Yield. Shelled Corn in Bushels.	Fodder in Pounds	Relations of different parts of the plant to the whole. % of Stalk.	% of Shuck.	% of Shelled Corn.	% of Cob.	% of Fodder.
1	105 lbs. Sulphate Ammonia.	$3 86	12 85	300	....	....	......	....	....
2	131¼ lbs. Nitrate Soda.....	3.57	13.39	280	....	....	......	....	....
3	378 lbs. Dried Blood..	4.91	18 39	350	23.7	13.2	40 03	9.03	13.6
4	252 lbs. Cotton Seed Meal..	2.36	17 67	394	26	14	36	9	15
5	105 lbs. Acid Phosphate....	1.00	13 48	370	27	11	35	9	17
6	105 lbs. Acid Phosphate ... 52½ lbs. Muriate of Potash..	2.18	14.28	380	30.9	9 8	34.5	8 4	16.4
7	52½ lbs. Muriate of Potash..	1.18	13 39	340	29.8	10	35	9.1	15.8
8	Without Manure............	....	13.92	340	30.3	10.6	34.3	10.1	15
9	105 lbs. Sulphate Ammonia 105 lbs. Acid Phosphate.... 52½ lbs. Muriate Potash ..	6.04	22.32	405	28.2	8.8	38.4	12.1	12.4
10	131¼ lbs. Nitrate of Soda... 105 lbs. Acid Phosphate..... 52½ lbs. Muriate Potash....	5.75	20 08	510	27.2	10.5	36.5	9 8	16.9
11	378 lbs. Dried Blood .... 105 lbs. Acid Phosphate.... 52½ lbs. Muriate Potash ...	6.91	22.25	420	26.1	11.2	39 9	9.3	13.4
12	252 lbs Cotton Seed Meal... 105 lbs. Acid Phosphate. ... 52½ lbs. Muriate Potash ..	4.36	22.25	390	26	10.4	41	9.6	13.8
13	670 lbs. Crushed Cotton Seed	3.20	15.89	330	27	9 9	39.2	9 5	14.5
14	670 lbs. Green Cotton Seed .	2 88	16.43	345	26.6	11.2	38.5	9.6	14.4
15	105 lbs. Acid Phosphate... 52½ lbs. Muriate Potash 670 lbs. Crushed Cotton Seed	5.20	18 75	355	26.1	9 9	40	10.3	13 5
16	Without Manure.	....	17.32	325	26.1	10.1	40.8	9.2	13.7
17	105 lbs. Acid Phosphate. .. 52½ lbs. Muriate Potash 670 lbs. Green Cotton Seed	4 88	20 62	410	26.8	9	38.3	14.7	13.6
18	210 lbs. Raw Phosphate ... 52½ lbs. Muriate Potash. 252 lbs. Cotton Seed Meal..	5.54	23.21	425	25.2	9.3	41.8	9.9	13.5
19	210 lbs. Raw Phosphate.... 52½ lbs. Muriate Potash ... 670 lbs. Crushed Cotton Seed	6.33	24.46	455	27.5	9 1	39.2	11.3	12.8
20	210 lbs. Raw Phosphate... 52½ lbs. Muriate Potash .. 670 lbs. Green Cotton Seed .	6 33	22.85	410	26 1	9	41	9.6	13.1
21	500 lbs. Compost of Stable Manure, Cotton Seed & Acid Phos. mixed and fermented..	2.50	24 10	.....	....	....	......	....	....
	Average %	....	.....	.....	27	10 4	39 41	9 8	14 2

EXPERIMENTS WITH VARIETIES OF CORN.

PLANTED APRIL 8; GATHERED SEPT. 26.

Names of Varieties.	From whom Received.	Time Edible.		Time from plant'g to edible in days.	Habit of Growth.	Productiveness.	Stalks—lbs. Yield of 12
Ea. Southern Sweet	Ferry	June	24	76	Very Small Stalk	Prolific	....
Livingston's Evergreen	Livingston.	July	8	90	Small Stalk	Medium	....
Livingston's Golden Coin	"	"	1	83	" "	"	....
Old Col'ny (early sweet or sug'r	Ferry	June	26	78	" "	"	....
Clayton's Prolific	Clayton	July	11	93	Medium	Very Prolific	12¾
Flour Corn	"	"	20	102	Small Stalk	Medium	6
Little's Early	"	"	8	90	Medium	Very Prolific	12¾
Mosby's Prolific	Dept. of Ag	"	16	98	"	Prolific	10⅞
Naylor's Eight Row	" "	"	1	83	Small	Medium	8 9-16
Rice's Early	Clayton	"	6	88	Medium	"	9¼
Thornton's Prolific	"	"	16	98	Large	"	10 5-16
Webb's Prolific	"	"	6	88	Medium	"	7 7-16
Colquit Corn.	Colquit	"	8	90	Large	"	11 5-16
Giant Normandy	Clayton	"	1	83	Small	"	7 9-16
Golden Beauty	"	June	29	81	"	"	5 1-12
Red Cob	McLendon.	July	16	98	Large	"	10¼
Red Field Corn	"	"	6	88	Medium	Prolific	11 2-16
Rice Corn	Bernard	"	11	...	Failure	...	.....
Strawberry Corn	Clayton	"	16	98	Large	Medium	9⅞
Champion White Pearl	J. C. Suffern.	June	26	78	Small.	"	6

VARIETIES OF COTTON COMPARED.

Planted 25th April.		Yield per Acre.		
Plat No.	Varieties.	Seed Cotton.	Lint.	% Lint.
1	Allan's Long Staple	809½	245	30 24
2	Barnett	704½	227½	32 04
3	Cherry's Cluster	691¼	218¾	31 64
4	Ellsworth	494¼	149	30.09
5	Hawkins' Improved	665	210	31.57
6	Jones' Improved	696	232	33.33
7	King's Improved Prolific	656½	210	32 20
8	Okra	661	227½	34.43
9	Peerless	682½	223½	32 68
10	Rameses	678½	227½	33.29
11	Truitt	818½	267	32.64
12	Welborn's Pet	722	241	33 33
13	Zellner	653⅓	233⅓	35 70
14	Peterkin	1947	735	39 53
15	Southern Hope	1730	476	27.5

Nos. 14 and 15 were not compared with the other varieties. These were planted 17th June on sandy creek bottom—better soil than that on which the others grew.

CLASSIFICATION BY MR. C. E. PORTER, an Expert.

No.	Variety.	Class.	Length of Staple.	Remarks.
1	Allan's Long Staple.	Strict Good Mid	¾ inch..........	Staple only moderate and irregular.
2	Barnett.............	Strict Good Mid	13-16 inch......	Staple very irregular.
3	Cherry's Cluster....	Strict Good Mid	⅞ inch.......	St'ple str'ng and regular.
4	Ellsworth...........	Strict Middling	1 inch...........	Extremely fine Staple.
5	Hawkins' Improved.	Good Middling	13-16 inch.......	St'ple str'ng and lint good
6	Jones' Improved.....	Good Middling.	1 inch..........	St'ple str'ng and firm.
7	King's Imp'vd Prolific	Good Middling,	1 to 1&1-32 inch...	Staple extrem'y strong and regular.
8	Okra or forked leaf..	Good Middling.	1 inch...........	Staple unusually strong and excellent mil'ng cotton
9	Peerless............	Good Middling	13-16 inch.......	Staple unusually strong and fine lint.
10	Rameses...........	Middling Fair..	1 inch..........	St'ple reg'lr and strong; handsome cotton.
11	Truitt............	Strict Good Mid	1 inch..........	Staple extremely fine.
12	Overl'ked by classifier	....	....	....
13	Zellner.............	Strict Good Mid	⅞ inch..........	Staple strong
14	Peterkin............	Strict Good Mid	⅞ inch..........	Staple moderately str'ng fine lint.
15	Southern hope	Strict Middling.	1 1-8 to 1 3-16 inch	Magnificent mil'ng cotton

As each variety was ginned. a sample was taken and numbered These were sent to Mr. Porter, with numbers, without the names.

EXPERIMENTS WITH COTTON PLANTED AT DIFFERENT DISTANCES—Plots ¼ acre each.

No.	Distance. Feet.	Lbs. Seed Cotton.	Lbs. Lint.	% of Lint.
1	4x4	913	294	32 99
2	4x3	1073	340	31 69
3	4x2	991.2	320	32.24
4	4x1	1001	312	31.16
5	4x5	806	266	33
6	5x5	824	268	32 52
7	3x1	832	267	32 09
8	3½x1	746	242	32.44
9	3½x1 Deep.	856	273	31 88
10	3½x1 Sh'low	739	240	32.47

In the above experiment sufficient care was not employed to preserve a full stand in Nos. 1, 5 and 6, which placed them at a disadvantage. The stands on the remaining plots were quite satisfactory. Plot 9 was cultivated deep at the first plowing only. The experiment in distances are repeated this season under more favorable auspices.

RYE FOR SOIL-FEEDING IN WINTER.

For the purpose of determining definitely the yield of green rye from successive cuttings during the fall, winter and spring, a plot from which summer cabbage had been harvested was sown in drilled rye 25th September, 1889. The land was well fertilized for cabbage but none was applied to the rye. The seed sown were grown upon the station—Northern grown seed will not answer. The rye was sown very thickly in the drills which were two feet apart. The plot was cut four times with the following results:

	Lbs. Green Rye per Acre.
First cutting, Oct. 30th to Nov. 14th, 1889	7,067.05
Second cutting, Nov. 22nd to Dec. 24th, 1889	4,323.65
Third cutting, Jan. 2nd to Feb. 10th, 1890	6,437.10
Fourth cutting, Feb. 20th to Feb. 27th, 1890	3,564.70
Total	21,392.50 lbs.

or 10.69 tons per acre of excellent green food during the months of November, December, January, and February.

The unprecedented freeze of March 1st so seriously injured the roots, exposed by the recent cuttings, that the stubble was plowed in for another crop.

No farm in the cotton states should be without its patches of rye or barley to be cut or pastured during fall, winter and spring.

CHUFAS.

Half an acre of very thin sandy land was planted in chufas in 1889 to be gathered by swine.

A portion of the area was carefully gathered by sections of the class in agriculture, picking by hand the nuts from each hill. These were measured green and showed a yield per acre of 172 bushels. Assuming a shrinkage of one third in drying the yield per acre of dry chufas was 115.24 bushels.

Eight average hills were selected, from which the chufas were carefully gathered and counted. The average number per hill was found to be 568 or a production of 568 nuts from one, planted.