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Comparison of Peanut Meal, Cotton Seed Meal, Velvet Bean Meal, Ammonium Sulphate, and Nitrate of Soda, as Fertilizers for Corn and Cotton

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COMPARISON OF PEANUT MEAL, VELVET BEAN MEAL, COTTONSEED MEAL, AMMONIUM SULPHATE WITH NITRATE OF SODA AS FERTILIZERS FOR CORN AND COTTON

By
E. F. CAUTHEN

The loss by fire of all surplus copies of Bulletin No. 208 of the Alabama Experiment Station, which was entitled "Comparison of Peanut Meal, Cottonseed Meal, Velvet Bean Meal, Ammonium Sulphate, and Nitrate of Soda as Fertilizers for Corn and Cotton," and the increasing number of inquiries about the fertilizing value of these meals from farmers and dealers in commercial fertilizers make it important to republish its data. To these data are added in this bulletin the results of the 1920 test on cotton. The data of the 1919 corn and cotton crops were destroyed when the Agricultural Building burned in October, 1920.

CORN

This bulletin gives the comparative results of approximately equal amounts of nitrogen in nitrate of soda, ammonium sulphate, cottonseed meal, peanut meal, and velvet bean meal used as a fertilizer for corn. The experiments were made at Auburn. The test in 1917 was made on a gravelly loam upland soil, the corn being planted June 20 following a crop of wheat. In 1918 and 1919 corn was planted in March on a deep sandy soil deficient in plant food.

The amount of nitrogen from the different sources was practically the same for all plots,—15½ pounds or that contained in 100 pounds of high grade nitrate of soda. The amount of fertilizer required to supply this amount of nitrogen varied from 80 pounds of ammonium sulphate to 400 pounds of velvet bean meal. The peanut meal and velvet bean meal were ground for feed and therefore contained the hulls of the pods. The effect of plant food elements other than nitrogen contained in the meals is not here taken into account. In addition to the nitrogenous fertilizer, 240 pounds of 16 per cent acid phosphate per acre was in all cases applied at planting time. One-fourth of the nitrogenous fertilizer was applied at planting time and the remaining three-fourths applied as a side dressing when the plants were about knee high.

TABLE 1.—*Relative Effects of Nitrogen from Different Sources for Corn*

Kind and amount of fertilizer per acre		Yield per acre		Av. per acre	
		1917	1918	Yields of grain	Gain from nitrogenous fertilizers
Lbs.		Bu.	Bu.	Bu.	Bu.
100	Nitrate of soda	26.0	17.5	21.8	7.5
80	Ammonium sulphate	25.1	17.6	21.4	7.1
200	Cotton seed meal	24.3	14.0	19.2	4.9
310	Peanut meal (including hulls)	25.7	16.0	20.9	6.6
400	Velvet bean meal (including hulls)	21.3	11.4	16.4	2.1
---	No nitrogen	19.4	9.1	14.3	---

The average gain for the different forms of fertilizer varies from 2.1 bushels of corn from velvet bean meal to 7.5 bushels from nitrate of soda. Eighty pounds of sulphate of ammonia produced nearly the same average increases as 100 pounds of nitrate of soda. Equal amounts of nitrogen in peanut meal in comparison with practically equal amounts of nitrogen in cotton seed meal increased the yield 1.7 bushels of corn per acre, but neither meal was as effective as nitrate of soda or ammonium sulphate.

For the purpose of comparison, the availability of nitrogen in nitrate of soda is assumed as 100 per cent. Measuring then the availability of nitrogen in the materials by the average yield of corn for two years, the approximate availability of the nitrogen was as follows:

In nitrate of soda	100 per cent
In ammonium sulphate	94 per cent
In peanut meal	84 per cent
In cotton seed meal	65 per cent
In velvet bean meal	28 per cent

The 1919 test occupied the same plots that it occupied in 1918 and gave yields very similar to those recorded in Table 1. Its results though lost, tend to confirm the data secured in the two preceding years.

Assuming the value of corn to be \$1.00 per bushel, the average increases per acre in value of crops due to the various nitrogenous fertilizers were as follows:

	Increase in crop value per acre
100 lbs. Nitrate of soda	\$7.50
80 lbs. Ammonium sulphate	7.10
200 lbs. Cottonseed meal	4.90
310 lbs. Peanut meal (with hulls)	6.60
400 lbs. Velvet bean meal (with hulls)	2.10

To determine the profit per acre let the interested reader subtract from the above values the cost of the respective nitrogenous fertilizers used.

COTTON

Approximately equal amounts of nitrogen in cottonseed meal, peanut meal (including hulls), velvet bean meal (including hulls), and nitrate of soda were applied to cotton. The tests were made on a sandy loam of medium fertility on the Experiment Station farm at Auburn for four years. The 1918 test was located on the same plots as that of 1917; and the 1920 test on the same plots as in 1919. Thus the plots in the later years probably received some of the residual effect of the corresponding fertilizer applied during the preceding test. The data for 1919 were lost by fire.

A mixture of 160 pounds of acid phosphate and 20 pounds of sulphate of potash or its equivalent per acre was applied with the nitrogenous fertilizer. All fertilizer was applied before planting.

The yield of seed cotton is given in the following table:

TABLE 2.—*Relative Effects of Nitrogen from Different Sources for Cotton*

Kind and amount of fertilizer per acre		Yield of seed cotton			Av. per acre	
		1917	1918	1920	Yield of seed cotton	Gains from nitrogenous fertilizer in 1918-1920
Lbs.		Lbs.	Lbs.	Lbs.	Lbs.	Lbs.
140	Nitrate of soda	823	1312	809	981	306
351	Cotton seed meal	825	1178	758	920	213
425	Peanut meal					
	(with hulls)	779	1161	678	873	165
754	Velvet bean meal					
	(with hulls)	550	1132	639	774	131
---	No nitrogen	---	1070	440	---	---

In the above table it is seen that nitrate of soda gave the largest average yield, and velvet bean meal the lowest. The average difference in yield between cotton seed meal and peanut meal was only 47 pounds of seed cotton per acre.

For a comparison of the effectiveness of nitrogen from different sources, the nitrogen in nitrate of soda is assumed at 100 per cent. The nitrogen in the several fertilizing materials then shows the following relative values for cotton:

Nitrate of soda	100 per cent
Cotton seed meal	94 per cent
Peanut meal	89 per cent
Velvet bean meal	79 per cent

The relative values of the different fertilizing materials for cotton, as secured from the above experiments, which were conducted under similar conditions, indicate that one ton of nitrate of soda was equal in fertilizing value to 2.66 tons of cotton seed meal, 3.63 tons of peanut meal (with hulls), or 6.82 tons of velvet bean meal (feed meal with hulls).

Assuming the value of seed cotton to be 5 cents per pound, the increase per acre in value of the crop from the different kinds of fertilizers is as follows:

	Increase in crop value per acre
140 lbs. Nitrate of soda (in 1918 and 1920 tests	\$15.00
351 lbs. Cotton seed meal	10.65
425 lbs. Peanut meal	8.25
754 lbs. Velvet bean meal	6.55

To get the profit per acre one should subtract from these figures the local cost of the named amounts of the respective nitrogenous fertilizers.

The results from the use of same fertilizing materials on corn and cotton show that nitrate of soda per unit of nitrogen was the most effective fertilizer, and therefore under the condition of these experiments and at prices prevailing in recent months it was most profitable. Velvet bean meal gave no profit when used as a fertilizer under corn or cotton but it was worth more under cotton than under corn. The cotton plant had a longer growing period than the corn plant, and therefore, it was probably able to utilize a larger per cent of the nitrogen in the slowly nitrifying velvet bean meal than was the corn plant.

RELATIVE EFFECTIVENESS OF NITROGEN FROM DIFFERENT SOURCES

Combining the average results for both corn and cotton, we have the following relative average efficiency for an equal amount of nitrogen (or of ammonia) in each of the nitrogenous fertilizers compared:

	For Corn	For Cotton	Average (both two crops)
Nitrate of soda	100	100	100
Sulphate of ammonia	94	--	--
Cotton seed meal	65	94	80
Peanut meal (with hulls)	84	89	87
Velvet bean meal (with hulls) ..	28	79	54

The figures in the last column represent most correctly the relative values in these experiments of a pound of nitrogen in each of the fertilizers compared, since they take account of three separate tests with cotton and two with corn.

According to these average figures for both corn and cotton a pound of nitrogen in low grade peanut meal and in cotton seed meal was of practically the same value, and not quite equal in effect to that in nitrate of soda. In velvet bean feed meal, (including hulls) a pound of nitrogen was of less value than in either peanut meal, or cottonseed meal, or in nitrate of soda.

ANALYSIS FOR FERTILIZING CONSTITUENTS OF PEANUT MEAL, VELVET BEAN MEAL, AND COTTONSEED MEAL*

Peanut Meal Containing Some Hulls

Phosphoric acid	1.10 per cent
Nitrogen	4.69 per cent
Equivalent to ammonia	5.70 per cent
Potash	1.36 per cent

Peanut Meal Without Hulls

Phosphoric acid	2.02 per cent
Nitrogen	6.12 per cent
Equivalent to ammonia	7.44 per cent
Potash	2.42 per cent

Velvet Bean Meal Containing Some Hulls

Phosphoric acid72 per cent
Nitrogen	2.78 per cent
Equivalent to ammonia	3.38 per cent
Potash	1.37 per cent

Cotton Seed Meal for Fertilizer

(Average of many analyses)

Phosphoric acid	2.44 per cent
Nitrogen	5.65 per cent
Equivalent to ammonia	6.86 per cent
Potash	1.50 per cent

*The analyses of the meals used in the experiments are those guaranteed by the mills producing the meals and are not exactly the same as the analyses here given, which latter were of samples of the various meals analyzed by the Chemical Department of the Alabama Polytechnic Institute.