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AUBURN

Time of Applying Nitrate of Soda to Corn

PART I

Experiments at Auburn, 1910-1916

PART II

Experiments in Various Alabama Counties
1914-1919

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and
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SUMMARY

When 120 pounds of nitrate of soda was applied to corn at different stages of growth, namely at time of thinning, when it was 2½ feet high, when it was 3 to 4 feet high, and when bunching to tassel, the largest average increase for the five year period was 7.5 bushels per acre, and this came from the application made when the plants were 2½ feet high.

When the amount of nitrate of soda was doubled,—one-half applied when the plants were 2½ feet high and the other half when bunching to tassel, the average increase was 9.5 bushels.

When 240 pounds of nitrate of soda was applied,—one-half when the corn plants were 2½ feet high and the other half when they were bunching to tassel,—the average increase from this double application in a three year period was 11.9 bushels per acre; but when 240 pounds of cotton seed meal was substituted for the first application of nitrate of soda, this double application gave an average increase of only 10.0 bushels per acre. The 240 pounds of nitrate of soda per acre was more effective by 1.9 bushels than the 240 pounds of cotton seed meal and 120 pounds of nitrate of soda.

In a two year test on poor sandy soil, 120 pounds of nitrate of soda per acre applied at planting time increased the average yield 3.9 bushels; but when it was applied as a side dressing to corn 2½ feet high, it increased the average yield 9.3 bushels per acre.

When nitrate of soda was applied to corn at different stages of growth in 11 experiments conducted in various counties, an average of the results shows that when 100 pounds were used the largest increase (5.7 bushels per acre) was obtained when the plants were 2½ feet tall.

When the application of 100 pounds of nitrate of soda per acre was delayed until the plants were bunching to tassel, an increase of 3.1 bushels per acre was secured. However, this increase was so small that it was barely profitable.

Two hundred pounds of nitrate of soda per acre, (100 pounds of which was applied when the plants were 2½ feet tall, and 100 pounds when they were bunching to tassel), afforded an average increase of 6 bushels of corn per acre.

TIME OF APPLYING NITRATE OF SODA TO CORN

PART I

By E. F. CAUTHEN

EXPERIMENTS AT AUBURN

The purpose of this experiment is to determine the time when nitrate of soda should be applied to corn to get the maximum benefit. The tests of 1918 and 1919 were made on sandy land that had been planted in cotton and corn many years and was very low in plant food; but the tests of previous years were conducted on upland sandy loam soil that had been planted in cotton, corn and legumes and that was moderately well supplied with plant food.

The land was prepared in the usual way and the corn planted in the water furrow. The rows were $4 \frac{2}{3}$ feet wide and the plants stood 18 to 30 inches apart in the drill. The average date of planting for the seven year test was April 17th.

At the time of planting, a mixture of 240 pounds of acid phosphate and 100 pounds of kainit (or the equivalent potash from some other source) per acre was applied in the drill on all plots. The nitrate of soda at dates indicated in the table was evenly distributed in the drill or side cultivating furrow and covered with soil with the next furrow.

The corn was thinned after it was 10 or 15 days old and given clean shallow cultivation until it began to tassel. The high ridges between the corn rows were worked down level by the different cultivations, and the crop was usually "laid-by" on a level surface.

In 1914 the season was so very dry and hot at the time the corn was tasseling and silking that the crop from all plots was a failure; therefore the data for this year are omitted. When corn was planted on soil fairly well supplied with plant food, the increases due to different dates of application were not large. The largest increases were secured in 1918 and 1919 when the corn was planted on poor coastal plain soil that had not borne any recent crop of legumes.

Table I.—Effects of 120 Pounds of Nitrate of Soda applied to Corn at Different Stages of Growth;

Amount of nitrogenous fertilizer per acre	Stages when applied	Av. date of application	Bushels of corn per acre						Averages	Increase
			1915	1916	1917	1918	1919			
No nitrogen			27.4	19.7	20.7	7.4	5.8	16.2		
120 lbs. of Nitrate of Soda	Thinning	May 24	37.6	21.3	26.8	16.7	11.7	22.8	6.6	
120 lbs. of Nitrate of Soda	2½ feet high	June 12	32.9	25.5	28.2	19.3	12.5	23.7	7.5	
120 lbs. of Nitrate of Soda	3 to 4 feet high	June 21	35.1	26.9	23.6	15.9	10.8	22.4	6.2	
120 lbs. of Nitrate of Soda	Bunching to tassel	June 30	34.9	28.2	27.4	14.7	11.6	23.4	7.2	
120 lbs. of Nitrate of Soda	2½ feet high	June 12								
120 lbs. of Nitrate of Soda	Bunching to tassel	June 30	33.6	25.5	31.8	21.8	16.0	25.7*	9.5	
240 lbs. Cotton Seed Meal	2½ feet high	June 12								
120 lbs. of Nitrate of Soda	Bunching to tassel	June 30			31.4	19.4	13.2	21.3	5.1	

* The average yield for 1917, 1918, and 1919 was 23.2 bushels per acre.

In the five year period the no nitrogen treatment gave an average yield of only 16.2 bushels per acre. When 120 pounds of nitrate of soda was applied at thinning time the average yield for the same period was 22.8 bushels per acre. The nitrate of soda here gave an average increase of 6.6 bushels.

When the same amount of nitrate of soda was applied to corn plants 2½ feet high, that is about 40 days after planting, the average yield was 23.7 bushels, or an increase of 7.5 bushels over the no-nitrate plot.

When the nitrate of soda was applied to corn from 3 to 4 feet high, that is about 50 days after planting, the average yield was 22.4 bushels per acre—an average increase of 6.2 bushels. This is 1.3 bushels less than when it was applied to corn 2½ feet high.

When the same amount of nitrate of soda was ap-

plied to corn bunching to tassel, that is about 60 days after planting, the average yield was 23.4 bushels per acre. This is an increase of 7.2 bushels per acre over the no-nitrate of soda plot.

The largest average increase was secured from the application made when the corn was 2½ feet high. However the increases resulting from the different dates of application did not differ widely.

When the amount of nitrate of soda was doubled and one-half of the amount applied when the plants were 2½ feet high and the other half when the plants were bunching to tassel, the average yield was 25.7 bushels per acre. The increase from the use of 240 pounds of nitrate of soda in divided applications was 9.5 bushels or 58.6 percent. When 120 pounds of nitrate of soda was applied to corn 2½ feet high, the average increase was 7.5 bushels per acre or 46.3 percent. The percentage of increase from the double application was not in the same proportion as that from the 120 pound application and therefore the profit per unit of soda was less.

The use of nitrate of soda applied at the rate of 120 pounds per acre at any of the dates indicated in the table was profitable. If the corn was valued at \$1.50 per bushel and the nitrate of soda at \$75.00 per ton, the average increase of corn, which was 6.6 bushels per acre, would be worth \$9.90, while the cost of the 120 pounds of nitrate of soda would be \$4.50, leaving a difference of \$5.40 as profit less the cost of handling the increased yield of grain. When the application of 240 pounds of nitrate of soda was used per acre, the increase from the fertilizer was 9.5 bushels, which was worth \$14.25. After deducting \$9.00 the cost of the 240 pounds of nitrate of soda, the profit was only \$4.25—\$1.15 less than the profit from 120 pounds of nitrate of soda.

COMPARISON OF COTTON SEED MEAL AND NITRATE OF SODA ON CORN 2½ FEET HIGH

In 1917, 1918, and 1919 an additional plot was added to this experiment to compare the efficiency of 240 pounds of cotton seed meal as a substitute for the first application of the 120 pounds of nitrate of soda, in the double application plot, one at 2½ foot high stage and

the other at bunching to tassel stage. The 240 pounds of cotton seed meal carried about the equivalent nitrogen of 120 pounds of nitrate of soda.

The average yield from the double application of nitrate of soda for the three years was 23.2 bushels per acre; the average yield from the double application of one cotton seed meal and one nitrate of soda, was 21.3 bushels. During these three years the double nitrate of soda application made an average increase of 1.9 bushels per acre over the cotton seed meal and nitrate of soda application.

Comparison of Nitrate of Soda Applied at Planting Time With Other Dates

In 1918 and 1919 there was added to the above experiment a new plot on which was applied 120 pounds of nitrate of soda per acre at planting time. During these years the experiment was conducted on poor coastal plain soil. For comparison of yields see Table II.

Table II.—Effects of Applying 120 Pounds of Nitrate of Soda Per Acre to Corn at Different Stages of Growth; Bushels of Grain Per Acre

Year	No nitrate	Stages when the nitrate of soda was applied				
		Planting	Thinning	2½ feet high	3 to 4 feet high	Bunching to tassel
	Bu.	Bu.	Bu.	Bu.	Bu.	Bu.
1918	7.4	10.9	16.7	19.3	15.9	14.7
1919	5.8	10.0	11.7	12.5	9.8	11.6
Av. yield	6.6	10.5	14.2	15.9	12.9	13.3
Gain from 120 lbs. nitrate of soda		3.9	7.6	9.3	6.3	6.7

The average yield of the no nitrate plot for these two years was only 6.6 bushels per acre, while for the same years the average yield from the 120 pound application of nitrate of soda at planting time was 10.5 bushels per acre, and the average yield from the 120 pound application at the 2½ foot-high-stage was 15.9 bushels per acre. When the 120 pounds of nitrate of soda was put under the corn, it increased the average yield only 3.9 bushels per acre, but when it was with-

held till the corn plants were 2½ feet high, it made an average increase of 9.3 bushels per acre.

Assuming the value of corn at \$1.50 per bushel, the profit from the 120 pound application of nitrate of soda at planting time was only \$5.85 which was in excess of the cost of the nitrate of soda, at \$75.00 per ton only to the extent of \$1.35 per acre; but the profit from the 120 pound application when the plants were 2½ feet high was \$13.95 per acre, which was \$9.45 in excess of the cost of the nitrate of soda. It is thus seen that 120 pounds of nitrate of soda applied when the plants were 2½ feet high on coastal plain soil deficient in plant food was more beneficial by \$8.10 per acre than when a similar amount was applied under the corn at planting time.

The table shows that the maximum increase from the application of 120 pounds of nitrate of soda per acre at different stages of growth was secured from the 2½ foot-high-stage, that is about 40 days after planting.

The application of 120 pounds of nitrate of soda at planting time usually has the effect of making the corn grow off rapidly as soon as it comes up and of attaining a greater height, than it does when applied after the corn has made some growth. When the application is made at planting time on such sandy soil, the available supply of nitrogen may become exhausted at the time when the growing plants stand in greatest need of it to complete their growth and to produce the ears. Stated in another way the early application may be consumed in making plants and not in making ears. The farmer usually needs bushels of grain and not tons of stover.

EXPERIMENTS IN VARIOUS ALABAMA COUNTIES
ON TIME OF APPLYING NITRATE OF SODA
TO CORN

PART II

By J. T. WILLIAMSON

The experiments recorded in Part II of this bulletin were made possible by the Local Experiment Law passed by the Legislature of Alabama in 1911. These experiments were conducted in various Alabama counties by selected farmers. In conducting these tests the writer endeavored so far as possible to have the nitrate of soda and the cottonseed meal used under natural farm conditions. The experimenting farmers were directed to apply the nitrate of soda to the corn at certain stages of growth. However, in doing so they were expected to make these applications just as they would have made them to much larger areas of their own crop at these particular stages of growth. In other words, an attempt was made to see that these experiments were carried out on a thoroughly practical scale. In some cases weather conditions made it necessary to delay the applications of nitrate of soda beyond the time intended for its application. For the same reason, it was sometimes necessary to make certain applications of the nitrate of soda without covering; although the directions specified that it be lightly covered and thoroughly mixed with the soil.

The areas on which the experiments were made were selected and measured by some representative of the Experiment Station. The correct quantity of fertilizer for each plot was weighed and sacked at Auburn and shipped to each experimenter in labeled bags. Uniform directions for applying fertilizers were supplied to each cooperative farmer, and from time to time representatives of the Experiment Station visited each experimenter to assist him in conducting the test and to take notes on the different plots.

In most cases no fertilizer was applied other than the nitrogenous fertilizer sent from Auburn. In all cases where fertilizer was used other than that sent from the Experiment Station, the same quantity was applied to each plot, a due record of quantity and kind being

made. It is possible that in some cases better yields would have been obtained had there been made an application of phosphate, or of phosphate and potash, in addition to the nitrogenous fertilizer.

The same strain of corn was used thruout any single test.

In calculating the profits, prices nearly up to those prevailing now were assumed as follows:

Corn \$1.50 per bushel.

Nitrate of soda \$75.00 per ton.

Cottonseed meal \$70.00 per ton.

AVERAGE RESULTS ON VARIOUS SOILS OF AP- PLYING NITRATE OF SODA TO CORN AT DIFFERENT STAGES OF GROWTH

The following pages record the results of the application of nitrate of soda to corn at different stages of growth in eleven experiments on various soils in Alabama. These tests were made on farms of men especially interested in and suited for experimental work of this nature. The two forms of nitrogen were subjected to usual farm conditions so far as possible in keeping with directions for time of application.

In these experiments the average date of planting corn was April 23. The average date of the first application of nitrate of soda was May 27. The corn experiments were made on soils of average fertility, as may be seen by the fact that the average yield of the plots receiving no nitrate ranged from 15.2 to 17.5 bushels per acre.

Table III shows the average yields of corn per acre; the calculated increase and profit due to the application of nitrate of soda at different stages of growth; the rate, kind, and amount of nitrogenous fertilizer applied; and the date of application. (See page 27).

Table III.—Average Yield, Increase, and Profit Secured
When Nitrate of Soda was Applied to Corn
at Different Stages of Growth.

Kind and amount of fertilizers per acre, and stages of growth for application.	Average date nitrogenous fertilizers were applied	Average yield	Increase over	Profit from
		per acre	no nitrogen plots	nitrogenous fertilizers per acre
		Bu.	Bu.	\$
No nitrogen -----		15.2*		
100 lbs. nitrate of soda before plants were 12 inches tall -----	May 27	21.0	5.6	4.65
100 lbs. nitrate of soda when plants were 2½ feet tall -----	June 12	21.2	5.7	4.80
100 lbs. nitrate of soda when plants were 3½ feet tall -----	June 22	20.8	5.1	3.90
No nitrogen -----		15.8		
100 lbs. nitrate of soda when bunching to tassel -----	July 2	19.3	3.1	0.90
100 lbs. nitrate of soda when plants were 2½ feet tall -----	} June 15	22.7	6.0	1.50
100 lbs. nitrate of soda when bunching to tassel -----				
200 lbs. cottonseed meal when plants were not over 12 inches tall -----	} May 27	23.6	6.5	-1.00
100 lbs. nitrate of soda when bunching to tassel -----				
No nitrogen -----		17.5**		

* Average 10 experiments.

** Average 7 experiments.

Average planting date April 15.

Table III shows that the largest profit (\$4.80 per acre) was secured from the use of 100 pounds of nitrate of soda per acre when the corn plants were 2½ feet tall.

When the application of 100 pounds of nitrate of soda per acre was delayed until the plants were bunching to tassel, an increase of only 3.1 bushels of corn per acre was secured. However, this increase did but little more than pay for the nitrate of soda.

An application of 200 pounds of nitrate of soda per acre, (half of which was applied when the plants were 2½ -feet tall, and half when they were bunching to tassel), produced an increase of 6.0 bushels of corn per acre, at a profit of only \$1.50.

When 200 pounds of cottonseed meal per acre was applied by, or before, the time the plants were 12 inches tall, and 100 pounds of nitrate of soda was added to this when the corn was bunching to tassel, the largest increase, 6.5 bushels per acre, was secured. This increase, however, was produced at a loss of \$1.00 per acre.

Experiments in Tallapoosa, Covington, Etowah and Montgomery Counties

Kind and amount of fert. per acre and stages of growth it was directed to be applied.	1916 W. T. Langley, Camp Hill			1916 J. F. Hicks, Andalusia			1916 E. R. Cornelius, Murray Cross			1914 W. P. McGehee, Montg'y		
	Yield corn per acre	Inc. over no nit'gen plots	Date nitrate applied	Yield corn per acre	Inc. over no nit'gen plots	Date nitrate applied	Yield corn per acre	Inc. over no nit'gen plots	Date nitrate applied	Yield corn per acre	Inc. over no nit'gen plots	Date nitrate applied
100 lbs. nitrate of soda when plants were not over 12 inches tall --	Bus. 24.0	Bus. 1.6	May 26	Bus. 17.5	Bus. 6.4	June 6	Bus. 18.3	Bus. 8.8	June 9	Bus. 8.4	Bus. 1.9	May 5
No nitrogen -----	22.3			10.9			10.5			7.3		
100 lbs. nitrate of soda when plants were 2½ feet tall -----	26.5	4.2	June 12	16.1	5.5	June 20	17.9	6.4	June 19	8.4	0.2	May 21
100 lbs. nitrate of soda when plants were 3½ feet tall -----	26.7	4.5	June 22	10.3	-0.1	June 28	15.2	2.7	June 28	7.1	-1.9	May 31
100 lbs. nitrate of soda when bunching to tass-el -----	28.0	5.8	July 10	9.7	-0.4	July 11	15.9	2.4	July 6	9.4	-0.5	June 8
No nitrogen -----	22.1			9.8			14.5			10.7		
100 lbs. nitrate of soda when plants were 2½ feet tall -----	28.6	6.5	{ June 12	16.5	7.0	{ June 20	18.9	3.4	{ June 28	12.6	1.0	{ May 21
100 lbs. nitrate of soda when bunching to tass-el -----			{ June 22			{ July 11			{ July 8			{ June 8
200 lbs. cottonseed meal when plants were not over 12 inches tall -----	29.5	7.5	{ June 10	18.9	9.9	{ June 6	19.3	2.8	{ May 27	13.6	1.2	{ May 5
100 lbs. nitra e of soda when bunching to tass-el -----			{ June 22			{ July 11			{ June 27			{ June 8

Experiments in Lamar, Wilcox, De kalb and Limestone Counties

Kind and amount of fert. per acre and stages of growth it was directed to be applied.	1918 W. H. Vail, Millport			1918 C. F. E. Munger, Sunny South			1917 J. W. Watson, Collinsville			1917 Chas. King, Athens		
	Yield corn per acre	Inc. over no nit'gen plots	Date nitrate applied	Yield corn per acre	Inc. over no nit'gen plots	Date nitrate applied	Yield corn per acre	Inc. over no nit'gen plots	Date nitrate applied	Yield corn per acre	Inc. over no nit'gen plots	Date nitrate applied
No nitrogen -----	Bus. 11.2	Bus.		Bus. 9.7	Bus.		Bus. 16.6	Bus.		Bus. 26.6	Bus.	
100 lbs. nitrate of soda when plants were not over 12 inches tall --	19.0	8.4	May 16	15.3	5.5	May 20	23.7	6.1	May 28	31.2	4.8	May 29
100 lbs. nitrate of soda when plants were 2½ feet tall -----	17.5	7.5	June 11	16.3	6.4	May 29	27.3	8.8	June 18	32.4	6.2	June 14
100 lbs. nitrate of soda when plants were 3½ feet tall -----	19.0	9.6	June 11	15.3	5.4	June 10	27.4	7.9	July 4	34.7	8.8	June 25
No nitrogen -----	8.8			10.0			20.4			25.7		
100 lbs. nitrate of soda when bunching to tassel -----	14.7	6.2	June 27	10.5	0.7	June 18	26.5	5.5	July 4	32.7	5.8	June 30
100 lbs. nitrate of soda when plants were 2½ feet tall -----			{ June 11			{ June 1			{ June 18			{ June 14
100 lbs. nitrate of soda when bunching to tassel -----	19.4	11.1	{ June 24	15.3	5.7	{ June 18	30.6	9.1	{ July 4	31.8	3.7	{ June 30
200 lbs. cottonseed meal when plants were not over 12 inches tall -----			{ May 16			{ May 20			{ May 28			{ May 29
100 lbs. nitrate of soda when bunching to tassel -----	17.9	9.8	{ June 24	13.2	3.8	{ June 18	39.3	17.2	{ July 4	35.8	6.5	{ June 30
No nitrogen -----	7.8			9.2			22.6			30.5		

Experiments in St. Clair, Dale and Coffee Counties

Kind and amount of fert. per acre and stages of growth it was directed to be applied.	1919 W. H. Jenkins, Ashville			1918 J. W. Wilkinson, Ozark			1918 M. A. Helms, Elba		
	Yield corn per acre	Increase over no nitrogen plots	Date nitrate applied	Yield corn per acre	Increase over no nitrogen plots	Date nitrate applied	Yield corn per acre	Increase over no nitrogen plots	Date nitrate applied
	<i>Bus.</i>	<i>Bus.</i>		<i>Bus.</i>	<i>Bus.</i>		<i>Bus.</i>	<i>Bus.</i>	
No nitrogen -----				19.4			17.4		
100 lbs. nitrate of soda when plants were not over 12 inches tall --	28.6	15.1	June 6	22.8	3.6	June 1	22.6	4.7	May 25
100 lbs. nitrate of soda when plants were 2½ feet tall -----	30.9	17.4	June 30	22.7	3.6	June 14	17.4	-1.1	June 8
100 lbs. nitrate of soda when plants were 3½ feet tall -----	29.1	15.6	July 8	22.7	3.8	June 25	21.1	2.1	June 22
No nitrogen -----	13.5			18.7			19.5		
100 lbs. nitrate of soda when bunching to tassel -----	22.9	9.5	July 21	21.4	2.5	July 2	20.5	1.0	July 6
100 lbs. nitrate of soda when plants were 2½ feet tall -----			{ June 30			{ June 14			{ June 25
100 lbs. nitrate of soda when bunching to tassel -----	34.5	21.2	{ July 21	21.9	2.8	{ July 2	19.5	0.0	{ July 25
200 lbs. cottonseed meal when plants were not over 12 inches tall -----			{ June 6			{ June 1			{ May 25
100 lbs. nitrate of soda when bunching to tassel -----	29.5	16.3	{ July 21	21.7	2.4	{ July 2	21.1	1.6	{ July 25
No nitrogen -----	13.1			19.5			19.5		

Nitrate of Soda Applied to Corn at Different Stages of growth; Details Relative to Experiments Conducted in Various Counties of Alabama.

Location, P. O., distance and direction from	Year	Character of soil and subsoil	Years in cultivation	Previous Cropping		Date of planting	Date first nitrate applied	Other fertilizers used and rate per acre of applying
				Preceding Year	Second Year preceding			
Ashville 4½ mi. S. W. of	1919	(a) Grayish fine (b) Red clay	Many	Corn	Corn	5- 3	6- 6	No other
Ozark 5½ mi. N. E. of	1918	(a) Dark gray sandy (b) Stiffer red	Many	Corn	Corn	4-13	6- 1	No other
Elba 1½ mi. N. of	1918	(a) Gray sandy (b) Stiffer yellow	About 25	Corn and velvet beans	Corn and velvet beans		5-25	No other
Millport 1 mi. E. of	1918	(a) Gray fine sandy (b) Stiffer yellow	Many	Cotton	Wheat stubble		5-16	No other
Sunny South 2½ mi. E. of	1918	(a) Gray fine sandy (b) Stiffer yellow	Many	Corn	Cotton		5-20	No other
Collinsville 3 mi. S. of	1917	(a) Fine gray gravelly (b) Red clay	Many	Cotton	Corn		5-28	Acid phosphate
Athens 4½ mi. S. of	1917	(a) Reddish clay (b) Red clay	Many	Corn and cowpeas	Corn and cowpeas	About 4-25	5-29	No other
Camp Hill 2 mi. S. of	1916	(a) Red sandy loam (b) Stiffer red	About 50	Cotton	Cowpeas	5- 1	5-26	No other
Andalusia ¾ mi. N. E. of	1916	(a) Gray sandy loam (b) Stiffer yellow	About 10	Corn and velvet beans		4-20	6- 6	Acid phosphate
Murray Cross 6 mi. S. E. of	1916	(a) Gray fine sandy (b) Stiffer reddish	About 30	Cotton	Corn	4- 1	6- 9	200 lbs. of 10-2-2
Montgomery 10 mi. S. of	1914	(a) Dark gray prairie	Many			4- 1	5- 5	240 lbs. Acid phosphate 50 lbs. muriate of potash