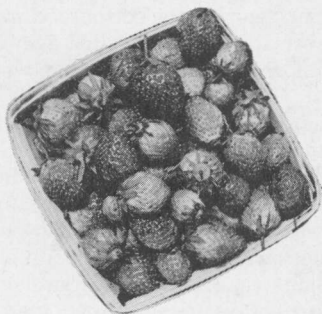


# SOURCES *and* RATES of NITROGEN *for* STRAWBERRIES



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ALABAMA FARMERS have long been interested in how to obtain good plant growth and large yields of high quality berries from their strawberry plants.

Fertilizer studies in Alabama<sup>1</sup> comparing organic nitrogen, ammonium sulfate, and sodium nitrate as sources of nitrogen have shown the favorable influence that nitrogen has on the growth and fruiting habits of strawberry plants.

In 1955, tests were begun to determine a satisfactory level and source of nitrogen for maximum plant growth and yield. Cottonseed meal, urea-formaldehyde, and urea (organic sources), were compared to sodium nitrate and ammonium nitrate. The urea was applied to the soil and as a foliar spray.

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<sup>1</sup>Taylor, R. W. Influence of Nitrogenous Fertilizers on the Number of Flower Clusters, Flowers, and Fruits of the Strawberry. Proc. Amer. Soc. Hort. Sci. 29: 313-317. 1933.

## MATERIALS AND METHODS

Plants used in the first year tests were certified Konvoy set 9 inches apart in 3-foot rows in concrete field bins. After harvest these plants were replaced with Klommore. Runners were removed as they developed, leaving only the original set plants throughout the test.

Fertilizer treatment was 48 pounds each of available nitrogen, phosphate, and potash applied in the form of 600 pounds of 8-8-8 per acre to the soil 2 weeks prior to setting plants. An additional 48 pounds per acre of each material was applied in June. These treatments were changed October 1, 1955 to include 96, 128, and 160 pounds of available nitrogen per acre.

Sources used were sodium nitrate (16 per cent), ammonium nitrate (33.5 per cent), urea (45 per cent) applied to the soil and as a spray to the foli-

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age, urea-formaldehyde (38 per cent), and cottonseed meal (6.9 per cent). All materials were applied at rates of 96, 128, and 160 pounds of N per acre per year except cottonseed meal, which was applied at the first two rates only. Phosphorus and potassium were applied at the rate of 128 pounds each per acre. Three equal applications were made to the soil; October 1, January 15, and after harvest (about June 1) each year. A total of nine urea sprays was applied; one each month for three consecutive months, beginning at the same time soil applications were made. No sprays were applied in April, May, and September. Sprays were formulated to supply the same levels of nitrogen as soil treatments.

## RESULTS

### Effect on Yield

Foliar sprays of urea at all rates of N increased yields more than any other source or rate, Table 1. The 3-year average yield of No. 1 berries where

96 pounds of N per acre was applied to the soil was 1,345 quarts per acre from sodium nitrate, 2,358 quarts per acre from ammonium nitrate, 2,111 quarts from urea, 1,748 quarts from urea-formaldehyde, and 2,083 quarts from cottonseed meal. Foliar applications of urea at 96 pounds of N per acre produced a yield of 3,133 quarts per acre. When rates of N were increased to 128 and 160 pounds per acre, yields increased for all sources except foliar sprays of urea. Ninety-six pounds

TABLE 1. YIELD OF STRAWBERRIES AS INFLUENCED BY SOURCE AND RATE OF NITROGEN, 3-YEAR AVERAGE, 1956-58

Source	Pounds of N per acre		
	96	128	160
	<i>Qts.</i>	<i>Qts.</i>	<i>Qts.</i>
Nitrate of soda	1,345	1,714	1,662
Amm. nitrate	2,358	2,195	2,191
Urea (soil app.)	2,111	2,045	2,737
Urea (foliar app.)	3,133	3,102	3,239
Urea-			
formaldehyde	1,748	1,963	2,691
Cottonseed meal	2,083	2,396	-----

**This plot received 96 pounds N per acre from soil application of sodium nitrate.**



of N per acre from urea applied as a foliar spray appeared to be a desirable level of nitrogen, Table 1.

### Effect on Nitrogen Content of Leaves

Nitrogen content of leaves for the 3-year period is presented in Table 2. Although there was little difference in nitrogen content for different sources and rates of nitrogen, foliar sprays of urea at all rates increased nitrogen con-

TABLE 2. NITROGEN CONTENT OF STRAWBERRY LEAVES FROM DIFFERENT SOURCES AND RATES OF NITROGEN, 3-YEAR AVERAGE

Source	Lb. N added per acre		
	96	128	160
	<i>Pct.</i>	<i>Pct.</i>	<i>Pct.</i>
Nitrate of soda	2.89	3.00	3.08
Amm. nitrate	3.10	3.00	3.12
Urea (soil app.)	3.00	3.00	3.02
Urea (foliar app.)	3.24	3.21	3.32
Urea-formaldehyde	3.11	3.01	3.12
Cottonseed meal	3.20	3.25	---

**This plot received 96 pounds N per acre from urea foliar spray application.**



tent of foliage more than other sources, with the exception of cottonseed meal at the 128-pound rate.

### Effect on Fruit Size and Firmness

Foliar sprays of urea produced larger fruits and did not delay harvest or reduce firmness, Table 3. Increased rates of N from urea sprays or soil applications from other N sources had little effect on firmness and maturity of fruit.

### Effect on Plant Growth

When nitrogen rates from all sources were increased, plant growth also increased. The best growth came from foliar sprays of urea. All sources of nitrogen used in this study induced more plant growth than sodium nitrate at all levels of N.

### Summary

Foliar sprays of urea increased yield, fruit size, and plant growth of strawberries more than any other source of nitrogen or method of application. A 96-pound rate of N from urea sprays was sufficient for maximum yields.

Soil applications of ammonium nitrate, urea, urea-formaldehyde, and cottonseed meal at each level of N produced higher yields and better plant growth than sodium nitrate.

Organic sources of nitrogen produced greater yields and plant growth than sodium or ammonium nitrates at the highest level of N. Foliar sprays of urea were best at all levels of N.

TABLE 3. EFFECTS OF SOURCES AND RATES OF NITROGEN ON STRAWBERRY FRUIT SIZE, EARLINESS, AND FIRMNESS, 1956-58

Source of Nitrogen	Rate of N <i>Lb./a.</i>	Berries per quart <i>No.</i>	Harvest each week			Firmness of fruit <sup>1</sup> <i>Gm.</i>
			first <i>Pct.</i>	second <i>Pct.</i>	third <i>Pct.</i>	
Sodium nitrate	96	135	41	32	27	97
	128	139	41	30	29	109
	160	142	38	31	31	118
Ammonium nitrate	96	129	42	30	28	137
	128	129	42	32	26	125
	160	131	35	36	29	155
Urea (soil application)	96	133	41	33	26	164
	128	133	40	34	26	159
	160	134	40	33	27	144
Urea (foliar sprays)	96	123	34	35	31	138
	128	122	39	32	29	136
	160	118	34	36	30	146
Urea-formaldehyde	96	128	38	33	29	121
	128	129	40	32	28	122
	160	124	37	31	32	134
Cottonseed meal	96	125	40	34	26	140
	128	126	38	35	27	133

<sup>1</sup> Average of 50 puncture readings with  $\frac{1}{8}$ -inch plunger.