

# Fertilization and Time of Planting as Related to Yield of Sugar Beet Seed in the Hemet, California, Area

IRWIN E. FARRAR<sup>1</sup>

SINCE 1931, when the first crop of sugar beet seed for commercial production was planted in the Hemet area, constant search has been made to find the optimum crop rotation and fertilizer practice as well as the best planting dates, as both these factors are known to be of great importance in both the yield and quality of seed.

Chas. H. Price,<sup>2</sup> during the seasons of 1932 to 1940, demonstrated in his experimental plots near Hemet the value of nitrogen and manure. His later work showed the value of cover crops. Seed growers, however, have used cover crops in a very limited way, a practice mainly due to the close-by supply of dairy and poultry manures at favorable prices.

Field experiments near Hemet with various forms of commercial fertilizers, were started by the writer in 1935. These tests were mainly carried on by the strip-plot method, replicated at least three times. Plots were always harvested, threshed and cleaned separately. The following conclusions can be drawn from the results:

1. Phosphate in the form of ammonium phosphate, both 16-20-0 and 11-48-0, gave no increase either in yield or germination. Nitrogen was maintained at the same level in the check plots, the nitrogen being furnished in the form of sulphate of ammonia. Treble superphosphate broadcast immediately before planting at the rate of 200 pounds and 300 pounds per acre gave no increase in yield.

2. A 2-year experiment compared three mixes of complete fertilizer (4-12-10, 5-12-6 and 6-10-12) with sulphate of ammonia, the amount of nitrogen applied being the same in all plots. No worthwhile differences appeared.

3. Of late many growers have tried a complete 6-9-6 fertilizer, applied as soon as possible after planting. There has been no apparent benefit over simple nitrogen.

Many tests have been carried on to endeavor to find the best form of nitrogen and the best time for application. Price, in his work previously referred to, found that a pre-planting application of a limited amount of nitrogen was good practice; but that an early fall side-dressing, plus a

<sup>1</sup>Partner, Farrar-Loomis Seed Co., Hemet, California.

<sup>2</sup>Agronomist, Division of Sugar Plant Investigations, United States Department of Agriculture, Riverside, California.

like amount in the spring, gave equally good results. He used in these experiments 80 to 120 pounds of nitrogen per acre, in the form of sulphate of ammonia.

Field work by the writer has been carried on with nitrogen in various forms—calcium nitrate, sodium nitrate, uramon, liquid ammonia ( $\text{NH}_3$ ), ammonium nitrate, and ammonium phosphate (referred to above). It has been found that there is little difference in the value of any of these forms of nitrogen, if properly applied and timed. However, application of liquid ammonia ( $\text{NH}_3$ ) is not practiced during the rainy season and nitrate of soda has a tendency to leach during the winter months. Since it has been available, ammonium nitrate has been widely used because it has the evident ability to give quick response combined with lasting results.

At the present time six field plots, widely scattered, are being checked to test the results of liquid ammonia ( $\text{NH}_3$ ) applied at the rate of 60 pounds of nitrogen per acre drilled into the soil before planting. No apparent stimulus to early growth has been detected when compared to ammonium nitrate side-dressed as soon after planting as possible.

Experience over the years with various forms of nitrogen has led to the present recommendation of 160 pounds of nitrogen per acre in the form of ammonium nitrate or sulphate of ammonia, 60 to 70 pounds applied as early as possible after planting (some prior to planting, if possible) and 90 to 100 pounds in the spring in two applications, the first in late January or early February, and the balance drilled in just prior to holting.

Gypsum at rate of  $2\frac{1}{2}$  tons per acre has proved its worth on heavier soils by increasing water penetration and promoting better soil condition. Two-year experimental tests showed a gain of 400 to 500 pounds of seed per acre on soils of slow water penetration.

The first tests with manure in commercial seed fields started in 1936. Small amounts were used at first with no outstanding results. In 1938 a large field experiment was carried on in an endeavor to show whether or not approximately 3 tons of pure dropping-board turkey manure would give justifiable results on a light soil that had a poor crop history. This experiment was conducted by strip-plot method with three replications, each plot being a little over  $\frac{1}{2}$  acre. Each plot was harvested, threshed and cleaned separately. Results showed the manured plots produced an average gain of 618 pounds of cleaned seed per acre, or a 28 percent increase.

Later work demonstrated that 3 to 4 tons of good-grade poultry manure or 6 to 9 tons of dairy manure on average good soil could be relied on to increase the crop by an average of 700 to 800 pounds per acre, with definite carry-over benefits to following crops.

On the basis of these findings some seed growers started in 1939 to apply manures to their soil, plowing it under about a month before planting, especially where alfalfa had not been a crop in the rotation.

To check the benefits of manures, alfalfa or other legumes, and nitrogen alone as related to yield of seed per acre, accurate field records have been kept on every seed field as follows: Prior crop history, amounts of manure and nitrogen used, and dates of application. Generally all fields have received ample amounts of nitrogen in suitable form, with the average amount per acre being gradually increased from 110-120 pounds per acre in 1941-42 crop (first year of these records), to 195 pounds per acre in the 1946-47 crop. Six crops were considered in this study. Fields, where insect damage was severe, were not considered. The fields have been segregated into three groups:

Fertility level No. 1—Good soil, ample manure, nitrogen.

Fertility level No. 2—Good soil, alfalfa or cover crop plowed under, nitrogen.

Fertility level No. 3—Good soil, no manure, no legume, nitrogen only.

The results of this 6-year study appear in table 1.

**Table 1.**—Sugar beet seed yields as related to various fertility levels.

Year	No. 1 Yield in pounds per acre	No. 2 Yield in pounds per acre	No. 3 Yield in pounds per acre
1941-42	2,979	2,849	2,111
1942-43	2,816	2,519	1,698
1943-44	3,142	2,490	1,816
1944-45	3,094	2,691	1,991
1945-46	3,230	2,613	2,082
1946-47	3,440	2,758	1,908
Average yield	3,118	2,653	1,968

In addition to the important increase in yield of seed per acre germination has averaged better in the higher fertility-level fields and the size of seed has been larger. The carry-over effect of the manure has been observed to last at least 2 years in following crops. The humus of the manure or legume together with the plowed under beet straw has constantly improved soil structure.

### Date of Planting

It was believed that the ideal planting dates were from September 10 to September 30 during the first years of commercial production of sugar beet seed. Earlier dates were attempted in 1936 with some plantings as early as August 29. This same year an experimental plot was laid out with seeding as early as July 1. As a result planting before August 20 was decided against, for the earlier dates gave no evidences of improvement, and the expenses entailed for additional irrigation, cultivation and care were high. Early dates also proved to be impractical from the standpoint of land preparation, especially if the previous crop was oats or barley.

For the season of 1936-37 all commercial fields planted between August 29 and September 10 showed an average of 3,390 pounds per acre; between September 10 to 20 the acre average was 3,090 pounds; and those seeded after September 20 produced an average of 2,182 pounds per acre. For the crop of 1937-38 the fields planted before September 10 yielded 3,160 pounds per acre; September 10 to 20 averaged 2,769 pounds per acre; and after September 20 only 1,800 pounds per acre.

Earlier planting dates had sufficiently demonstrated practical benefits so that seeding was started August 20, 1938, in some fields.

During the last 4 years the starting planting date has been August 15. September 15 is now the deadline, except in an emergency, or where partial replanting is necessary.

To again check the advantage of early planting as related to yield, a study was made of all fields which were graded in fertility levels No. 1 and No. 2 (as above described) for the three seasons 1943-1946. Fertility level No. 3 was eliminated so that fertility would be as nearly uniform as possible for this study. Results appear in table 2.

Table 2.—Planting date as related to yield of sugar beet seed.

Year	Planted 8/15 to 9/5	Planted 9/5 to 9/15	Planted after 9/15
	Yield in pounds per acre	Yield in pounds per acre	Yield in pounds per acre
1943-44	3,155	2,630	1,582
1944-45	3,111	2,722	2,130
1945-46	3,261	2,553	2,410
Average yield	3,176	2,635	2,041

Early planted fields gave a 3-year average of 541 more pounds of seed per acre than the medium-period planting date and 1,135 pounds greater yield than the late-seeded fields.

### Summary

While all forms of nitrogen have given adequate results, ammonium nitrate and sulphate of ammonia are preferred in sugar beet seed production. Ammonium nitrate has the evident ability to provide quick response combined with lasting results. Nitrogen at the rate of 160 pounds per acre appears to give economic results. About 40 percent of this amount should be applied early to promote rapid fall growth, 30 percent added to the soil in late January or early February, with the balance drilled in just as bolting starts.

To date phosphate and potash have not shown their need as fertilizers.

Use of manures and legumes (either plowed under or used in crop rotation) has proved highly profitable to the sugar beet seed grower. When added to the soil in sufficient quantity, manures alone have increased the yield an average of 30 percent.

A 6-year study of soil-fertility levels has revealed that level No. 1 (manured fields) out-yielded level No. 2 (legumes) 465 pounds of seed per acre or 13.4 percent, and produced 1,150 pounds more seed per acre (59 percent) than level No. 3 (nitrogen only). The fertility level No. 2 seed crop was 685 pounds more per acre than level No. 3, or 34.7 percent.

Date of planting evidence consistently shows a greater yield of seed per acre for seedings made prior to September 5. Plantings should not be made after September 15 to 18. Previous findings have shown that quality of seed is improved by early planting.

For the Hemet area it is clearly evident that in order to obtain the highest yield of quality sugar beet seed per acre, planting should take place between August 15 and September 5 on fertile, manured soil, using 160 pounds (or more) nitrogen per acre during the growing season.