

# Summary of Fertilizer Results, 1947

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**ABSTRACT:** The wide variety of soil types and climatological differences in the beet-growing areas of the American Crystal Sugar Company make for a considerable variation in fertilizer practices. Accordingly, the results of the commercial-fertilizer tests are summarized by the different growing areas.

## *California*

Of three fertilizer tests conducted in this area, only one gave significant differences. However, the tendency for high nitrogen applications to depress sucrose percentages was evident in all tests. The sucrose percentage of 11-48-0 was significantly higher than the two treatments with the highest nitrogen content. However, there were no significant differences between treatments in yield of pounds sugar per acre.

## *Arkansas Valley, Colorado*

The complete fertilizer 10-43-6 resulted in the highest pounds sugar-per-acre yield in this area. It was significantly better than the check and the ammonium nitrate treatments. Ammophos (11-48-0) gave a significantly higher sugar-per-acre yield than ammonium nitrate.

## *Northern Iowa-Southern Minnesota*

In the five tests in this area 4-24-4 fertilizer had the highest yields in tonnage and sugar per acre.

## *Red River Valley, Minnesota*

All fertilizers tested in this area resulted in significantly higher tonnage yields but only treble-superphosphate gave a significant increase over the check in pounds sugar per acre.

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**T**HE WIDE VARIETY of soil types and climatological differences in the growing areas of the American Crystal Sugar Company make for a considerable variation in commercial fertilizer responses. This situation makes it mandatory that fertilizer tests be designed with the needs, as indicated from previous testing, of the particular growing area in mind. Accordingly, the fertilizer tests conducted in 1947 are summarized for the area in which the tests were carried out.

## **Tests in the California Area**

The general fertilizer practice in this area is to apply liberal applications of nitrogenous fertilizers at the time of seedbed preparation, by side-dressing shortly after thinning, or by a combination of the two methods.

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Over a period of years, this practice has usually resulted in increased tonnages but in the last few years it has very often resulted in decreased sugar content of the beets.

Three replicated plot tests were run in this area. Each test consisted of eight fertilizer combinations replicated four times, in plots 100 feet long by four rows wide. The fertilizers were applied immediately before planting. There were two tests in the San Joaquin Valley and one test near Clarksburg. The fertilizers used, the rates per acre, yield of beets, percentage sucrose, and sugar-per-acre yields are summarized for the tests in table 1. The results for both the tests in the San Joaquin Valley are combined.

Curly top played an important role in the low tonnages obtained in these San Joaquin Valley tests. Under the conditions of these two experiments, there were no significant differences among the fertilizer treatments.

Because of missing plots, the 37.5-pound rate of nitrogen and the combination of 37.5 pounds of nitrogen with the 60-pound rate of 11-48-0 are not included in the data for the Clarksburg test. However, significant differences in tonnage yield and in percentage sucrose were obtained in this test. The 120-pound rate of 17-7-0 and this same fertilizer combined with the light and heavier rate of ammonium sulphate resulted in significantly better tonnage yields than the unfertilized check. Also the heavy rate of nitrogen plus 17-7-0 was better than the 75-pound rate of nitrogen alone. Whether this increase in yield was due entirely to an increase in total nitrogen, or whether phosphate played a role cannot be determined from this experiment, but it is worthy of further investigation.

There is a general trend at both locations for the sucrose to be depressed as the units of nitrogen applied are increased. The 11-48-0 fertilizer in the Clarksburg test resulted in a significantly higher sucrose percentage than the two fertilizer treatments which contained the highest amounts of nitrogen. This is in line with the findings of Pendleton and Robbins (2)<sup>2</sup> in the application of nitrogen on fairly high fertility fields.

### Arkansas Valley, Colorado Area

The results of previous testing has indicated the need for a high phosphate fertilizer in this area. A lesser response is obtained with nitrogenous fertilizers, depending to a large extent on rotational practices and on the use of barnyard manure. According to Skuderna (3) the requirement of potash in the fertilizer mixture may be necessary on the very light textured soils, but not required in the heavier textured soils which are usually higher in organic matter.

Six fertilizer strip tests were carried out in this area in 1947. Each test consisted of five fertilizer treatments run in duplicate on each of six farms. The plots were twelve rows wide and ran the entire length of the field, usually being  $\frac{1}{2}$  to 1 acre in size. Three samples of 20 beets each

<sup>2</sup>Numbers in parentheses refer to literature cited.

Table 1.—Results of fertilizer experiments in the California area, 1947.

Fertilizers	Rate per acre Units of plant food	San Joaquin Valley			Clarksburg		
		Tons per acre	Percentage sucrose	Pounds sugar per acre	Tons per acre	Percentage sucrose	Pounds sugar per acre
20.5-0-0	37.5	14.01	15.08	4225			
20.5-0-0	75	13.05	15.24	3977	27.80	18.10	10,063
20.5-0-0 } 17-7-0 }	37.5 } 60 }	14.14	15.24	4309	29.92	18.05	10,796
20.5-0-0 } 17-7-0 }	75 } 60 }	14.82	15.02	4451	31.19	17.68	11,035
20.5-0-0 } 11-48-0 }	37.5 } 60 }	14.75	14.93	4404			
20.5-0-0 } 11-48-0 }	75 } 60 }	13.03	14.61	3807	27.16	17.89	9,727
17-7-0	120	13.78	14.33	3959	28.84	18.00	10,390
11-48-0	120	12.80	15.09	3863	27.89	19.59	10,927
0-0-0	---	11.58	15.50	3589	24.65	19.12	9,428
Difference required for significance		NS	NS	NS	3.37	1.61	NS

were selected at harvest for sugar analysis. All of the beets from the twelve row strips were hauled to the beet dump and weighed. The results of the six tests and the kinds and amounts of fertilizer applied are presented in table 2.

**Table 2.**—Average results of duplicate strip tests on six farms in the Arkansas Valley, Colorado, 1947.

Fertilizer	Rate in pounds Plant food per acre	Yield in tons per acre	Percentage sucrose	Pounds sugar per acre
32.5-0-0	65	13.32	14.15	3787
0-43-0	106	15.42	15.25	4403
11-48-0	106	16.60	14.46	4826
10-43-6	106	16.56	14.60	4938
0-0-0	--	13.70	14.99	4117
Difference required for significance		.99	.55	779

The three high phosphate fertilizers were all significantly higher in tonnage than the unfertilized check and the ammonium nitrate treatment. Also, the ammonium nitrate application had a significantly lower sucrose content than the unfertilized check while the treble-superphosphate was significantly higher in sucrose content than the other three fertilizers used in the tests. However, in pounds sugar-per-acre yields, 10-43-8 was significantly higher than the check and the ammonium nitrate, while 11-48-0 was significantly better than the ammonium nitrate but not better than the check.

These results indicate that there is need for additional investigation on the use of potash in this area.

### Northern Iowa-Southern Minnesota Area

Superphosphate and such mixtures as 2-12-6, 0-12-12, and other low analysis fertilizers were commonly used in this area up until the past few years. In recent years there has been available 0-43-0 and higher analysis complete fertilizers. The use of these latter fertilizers in sugar beet farming has resulted in more satisfactory responses since there is the tendency to apply more plant food than formerly was done.

A total of five tests were made in this area. The tests were duplicated strips of four fertilizers and the unfertilized check. Three of the tests were made with one group of fertilizers and the other two tests were made with a different group. Since there were different fertilizers compared in each group all five tests cannot be averaged; therefore, table 3 gives the results of the fertilizers on yields, sucrose and sugar per acre for each group.

The results from all five tests reveal that the complete fertilizer 4-24-4 resulted in the highest tonnages and pounds sugar per acre. This is fairly well in agreement with results obtained the previous year<sup>1</sup> when 2-12-6 and 4-24-4 fertilizers gave the highest yields.

**Table 3.**—Results of fertilizer tests in the northern Iowa-southern Minnesota area.

Fertilizer	Rate per acre Units of plant food	Number strips used to obtain averages	½ acre Tons per acre	Percentage sucrose	Pounds sugar per acre
<b>Group 1</b>					
32.5-0-0	40	6	7.27	16.1	2241
0-43-0	86	6	8.35	16.4	2738
8-32-0	86	6	8.19	16.2	2653
4-24-4	71	6	8.80	16.8	2957
0-0-0	--	6	6.90	16.4	2263
<b>Group 2</b>					
20.5-0-0	40	4	9.44	16.51	3117
10-20-0	80	4	9.56	16.71	3195
11-48-0	94	4	9.43	16.84	3176
4-24-4	80	4	10.76	17.25	3712
0-0-0	--	4	9.21	17.52	3221

### Red River Valley, Minnesota

The common practice in this area is for beets to follow sweetclover-summer fallow. In addition, the soil type over the entire area is much more uniform than any of the other beet-growing areas in the territories served by the American Crystal Sugar Company. These conditions make it more nearly possible to make general recommendations as to commercial fertilizer practices.

Four tests were conducted in this area. Each test consisted of four fertilizer treatments and an unfertilized check, replicated twice in eight-row strips in four different fields. The results from all four fields were analyzed as a randomized block of eight replications. Table 4 presents the kinds and rates of fertilizers per acre, the tonnage yield, percentage sucrose, and pounds sugar per acre.

**Table 4.**—Combined results of fertilizer strip tests on four farms in the Red River Valley, Minnesota, 1947.

Fertilizer	Rate in pounds plant food per acre	Tons beets per acre	Percentage sucrose	Pounds sugar per acre
1-24-12	64	9.89	15.62	3028
0-24-12	65	10.20	15.24	3051
0-36-8	66	10.02	15.21	3002
0-43-0	65	10.90	15.24	3270
0-0-0	--	8.77	15.78	2682
Difference required for significance		.95	.49	379

The tests in this area resulted in significant increases in tonnage yield from all four fertilizers over the unfertilized strips; however, three of the fertilizers caused a significant decrease in the sugar content of the beets. The reduction in sucrose content is further reflected in the sugar-per-acre yield since only the treble-superphosphate gave a significant increase over the unfertilized check.

These results emphasize that a high phosphate fertilizer is the requirement for this area; however, over a period of years it has usually been profitable to include some potash with the phosphate. The fertilizer mixture 0-36-8 has performed very well, comparing very favorably with treble-superphosphate in most years.

### Summary

Fertilizer tests were conducted in some of the beet-growing areas of the American Crystal Sugar Company.

The tests in the San Joaquin Valley and at Clarksburg, California, resulted in increased tonnages by the use of high nitrogen fertilizer; however, in the Clarksburg test the sucrose percentages were reduced enough so that there was no significant differences in pounds sugar per acre.

Experiments on soils in the Arkansas Valley, Colorado, definitely demonstrated the need for a high analysis phosphate fertilizer. Applications of the 106 units of plant food in the form of 0-43-0, 11-48-0, and 10-43-6 significantly outyielded the unfertilized treatment, and the 65-pound application of nitrogen. However, the treble-superphosphate had a significantly higher sucrose percentage than did the other three fertilizers; and the 10-43-6 and 11-48-0 fertilizers gave significant differences in sugar-per-acre yields over the ammonium nitrate but only the 10-43-6 treatment was significantly better than the unfertilized treatment in this capacity.

Highest yields per acre in the Northern Iowa-Southern Minnesota area were obtained with the complete fertilizer 4-24-4.

All four fertilizers tested in the Red River Valley of Minnesota resulted in significantly higher yields than the unfertilized treatment. However, only treble-superphosphate was significantly higher than the check in pounds sugar-per-acre yield.

### Literature Cited

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