Studies on Transplanting Sugar Beets in Southern Alberta

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Received for publication March 28, 1958

The maximum yield that can be attained in the production of sugar beets in northern areas depends, among other factors, upon the length of the growing season. The production of seedlings in hotbeds for subsequent transplanting into the field provides a means of extending the season.

In southern Alberta the length of season is limited by both the spring and the fall weather. Generally, the harvesting of beets commences the last week of September and continues through October. The extension of the harvesting period into November might result in some loss of crop because of bad weather and, therefore, this approach to the problem of lengthening the season is not practical.

The present practice is to seed late in April or early in May. Cold soil conditions and weather hazards limit the possibility of extending the growing season by early field planting.

The Experimental Farm, Lethbridge, Alberta, conducted a study (1)[2] of dates of seeding sugar beets over a nine-year period from 1929 to 1937. Beets were seeded at 10-day intervals from April 10 until July 1. The data for the seeding dates April 20 to June 10, inclusive, are given in Table 1. The data for the April 10 seeding have not been included as it was not possible to seed on or near that date in four out of nine years.

The data indicate no significant difference in the mean yield of beets seeded within the period from April 20 to May 10. Significant reductions in yield resulted from the seeding of beets after May 10 as compared with the April 20 seeding.

Transplanting trials were carried out with sugar beet seedlings in Quebec (3) during 1946 and 1947. Drilled beets yielded an average of 8.13 tons per acre as compared with 15.85 tons per acre from the transplanted beets. The roots from the transplanted beets were very rough and prongy and were not favored for processing.

Transplanting studies in Bavaria, reported by Rasmussen and Warley (4), resulted in yields from seedlings produced by the soil-cube method equal or superior to those obtained from drill seeding. The drilled beets were sown 21 days earlier than the soil-cube-raised plants, and the latter were established in the

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[2] Numbers in parentheses refer to literature cited.

Table 1.—Mean Yields of Sugar Beets, in Tons per Acre, from Plots Seeded at 10-Day Intervals During the Nine-Year Period 1929 to 1937. Lethbridge, Alberta.

Year	Date of Seeding						Mean
	April 20	May 1	May 10	May 20	June 1	June 10	
1929	25.93	24.87	25.20	21.10	15.60	12.25	20.82
1930	29.97	26.82	27.90	26.01	18.01	15.96	24.11
1931	23.28	20.89	20.50	18.32	14.22	10.20	17.90
1932	15.40	14.13	17.33	16.26	10.14	13.33	14.43
1933	27.74	27.52	26.16	25.09	14.96	12.87	22.39
1934	17.54	17.54	14.42	13.12	11.40	8.31	13.72
1935	15.82	15.23	15.51	12.69	11.82	8.97	13.33
1936	17.35	13.89	15.86	14.91	12.73	9.93	14.11
1937	14.17	15.93	15.29	13.26	12.01	11.26	13.65
Mean	20.80	19.65	19.80	17.86	13.43	11.45	

L.S.D. for date means = 2.87 tons/acre at the 5% level of significance.

field more than seven weeks after they were sown. The soil-cube-raised beets frequently produced up to 2 percent higher sugar content than the drilled beets.

Rasmussen and Warley (5) also reported on the results of studies at Nottingham in which seedlings produced by the soil-cube method were subsequently transplanted into the field for comparison with drilled plots. The drilled and soil-cube plots were seeded in mid April, and the seedlings from the latter were transplanted to the open field in early June. The yield of washed beets from the soil-cube-raised plants was 14.9 tons per acre as compared with 20.0 tons per acre from the drilled beets.

Procedure

A trial was conducted at Lethbridge during 1956 on quadruplicate one-fiftieth-acre plots in a randomized block design. Ten tons per acre of manure and 700 pounds per acre of ammonium phosphate fertilizer (16-20-0) were incorporated into the seedbed. Seed was planted in flats in a greenhouse on April 3. The seedlings were transplanted to the field on May 16 at 11-inch plant intervals within the rows, and the drilled plots were sown on the same day. It was planned to transplant and seed on or before May 10, but inclement weather prevented field work between May 1 and May 16. Plot yields were determined by hand sampling on October 11 and again on October 24. An "in-place" and a "within-machine" harvester were used to harvest

the residual border rows on all plots to obtain experience in the handling of transplant beets.

The weather conditions experienced during the latter half of April and the first half of May were unfavorable to early field planting and to good plant growth. The maximum temperature recorded on May 16 was 75.5 degrees. The conditions that prevailed during the two-week interval between transplanting and the first irrigation were generally hot and dry.

One twenty-fourth-acre plots were used in the 1957 study in a randomized block design with six replications. The plot land received an application of 10 tons per acre of manure in the fall of 1956, and 300 pounds per acre of ammonium phosphate fertilizer (16-20-0) were worked into the seedbed. In addition, 100 pounds per acre of ammonium phosphate fertilizer (11-48-0) were applied in the rows with the seed and just ahead of the transplanter.

Seed was planted in flats on April 1, 1957, and the flats were placed in hotbeds which were heated by electric cables. Transplanting was carried out on May 6 at 12-inch plant intervals within the rows. One set of drilled plots was seeded in the field on April 18, and a second was sown on May 6. Harvesting was carried out by hand methods on October 2 and again on November 6.

The weather conditions experienced during the latter half of April were generally favorable to good growth subsequent to early seeding. The maximum temperature recorded on May 6 was 75.0 degrees, and relatively cool, moist weather conditions prevailed during the three-week interval between transplanting and the first irrigation.

The sugar beet seed used throughout these trials was a decorticated commercial variety supplied by Canadian Sugar Factories Ltd. Irrigation and cultivation treatments were carried out uniformly on all treatments for both years, and 22-inch row spacing was used on all plots.

The transplanter used was equipped with a water tank and injector nozzle. Water was fed into the furrow with each seedling to provide optimum conditions for plant survival.

Results and Discussion

Mean yields and percentage sucrose for the 1956 and 1957 trials are given in Tables 2 and 3. In Figure 1, the shape and size of transplanted and drill-seeded beets are compared.

The 1956 trials resulted in an average increase in yield of 9.2 tons per acre from the transplanted beets as compared with

the drill-seeded beets. The mean yield from transplanting in 1957 exceeded that from the April 18 and May 6 seeding by 4.24 and 7.51 tons per acre, respectively. The drill seedings were conducted at an earlier date in 1957 than was possible in 1956. This factor probably resulted in the smaller gain in yield attributable to transplanting in 1957 as compared with 1956.

The results for both years indicate that root growth continues throughout the normal harvest period and that yield increases can be obtained by a delayed harvest. However, weather factors make this a hazardous approach to the problem of obtaining a longer growth period.

The data in Tables 2 and 3 show that no significant differences in percentage sucrose existed between the transplanted and drill-seeded beets in both years.

Table 2.—Mean Yields of Sugar Beets and Percentage Sucrose from Drill-Seeded Beets and from Transplanted Beet Seedlings at Two Dates of Harvest. Lethbridge, Alberta, 1956.

Harvest Date	Drill-Seeded		Transplanted		Mean	
	Yield	Sucrose	Yield	Sucrose	Yield	Sucrose
	tons/ac.	%	tons/ac.	%	tons/ac.	%
October 11	15.51	16.9	26.59	17.2	21.05[1]	17.0
October 24	20.09	17.4	27.43	16.8	23.76[1]	17.1
Mean	17.80[2]	17.2	27.01[2]	17.0		

[1] Difference between harvest date means was significant at the 5% level.

[2] Difference between treatment means was significant at the 1% level.

Table 3.—Mean Yields of Sugar Beets and Percentage Sucrose from Drill-Seeded Beets and from Transplanted Beet Seedlings at Two Dates of Harvest. Lethbridge, Alberta, 1957.

Harvest Date	Drill-Seeded				Transplanted			
	April 18		May 6		May 6		Mean	
	Yield	Sucrose	Yield	Sucrose	Yield	Sucrose	Yield	Sucrose
	tons/ac.	%	tons/ac.	%	tons/ac.	%	tons/ac.	%
October 2	22.81	13.8	19.06	14.7	26.08	14.6	22.65	14.3
November 6	25.09	13.5	22.03	13.2	30.30	13.2	25.09	13.3
Mean	23.95	13.6	20.68	14.0	28.19	13.9		

L.S.D.[3] for treatment mean yields — 3.09 tons/acre

L.S.D.[3] for harvest date mean yields — 1.82 tons/acre

[3] Differences significant at the 1% level.

Figure 1.—Transplanted beets (left) compared with drill-seeded beets. Experiment Farm, Lethbridge, Alberta, 1957.

The final stand counts on the transplanted and drill-seeded beets in 1956 averaged 103 and 90 beets, respectively, per 100 feet of row. The final stand counts in 1957 on the transplanted, early-seeded, and late-seeded plots averaged 90, 90, and 112 beets, respectively, per 100 feet of row. Haddock (2) found that, with 22-inch row spacing, within-row plant intervals of 9.7 to 14.4 inches did not significantly influence yield, percentage sucrose, or percentage purity. These intervals are approximately equivalent to stands of 124 and 83 beets, respectively, per 100 feet of row. It is considered that the difference in stands encountered in the trials at Lethbridge did not influence the yields significantly.

The roots harvested from the transplant plots were not well shaped and had a tendency to pronginess, as shown in Figure 1. The mechanical harvester did a satisfactory job of topping and cleaning the root from the transplanted beets in 1956.

In Table 1 it will be noted that the April 20 seeding provided a definite yield advantage over the May 1 and May 10 seedings in the years 1930, 1931, and 1936. The May 1 and May 10 seedings yielded more than the April 20 seeding in 1932 and

1937. These data indicate the seasonal variability normal to beet production in southern Alberta. The weather conditions encountered in the spring of 1956 were in direct contrast to those experienced in 1957. It is considered that the spring seasons of 1956 and 1957 represent the extremes of conditions that can be expected in this area.

Although the seedlings wilted badly after transplanting in 1956, and to a lesser extent in 1957, recovery was rapid in both years and excellent growth was evident throughout the growing season. A difference in top growth, favoring the transplanted beets, was evident early in the season, but this difference leveled off considerably by harvest time.

The results of two years of study are in general agreement with those reported from Quebec (3), but are in disagreement with those reported by Rasmussen and Warley (4, 5). These latter studies emphasized the soil-cube culture method of producing seedlings rather than the production of seedlings under a technique that extended the season.

Conclusions

The production of sugar beet seedlings in a hotbed for subsequent transplanting to the field at normal seeding time provided increases in yield of from 4.24 to 9.2 tons per acre as compared with drill seeding. The percentage sucrose was equal in beets produced by both methods.

Sugar beet seedlings when transplanted may develop rough, slightly prongy roots.

The weather conditions encountered during the spring seasons of 1956 and 1957 represent the extremes that are experienced in southern Alberta. The increased yield obtained by transplanting can be attributed to an extension of the growing season under conditions favorable to rapid plant growth.

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