Literature Cited

1. Deming, G. W. Comparative Yields of Equal Plant Populations of Sugar Beets with Different Spacing Relations. Proc. Amer. Soc. Sugar Beet Techn. 3 (i. e. 2, 1940) : 32-36. (1941) No. 1.
2. Gaskill, J. O., and G. W. Deming. Wide Spacing as an Aid In Selection. Proc. Amer. Soc. Sugar Beet Techn. 1 (1938) : 40-41.
3. Nuckols, S. B. Methods of Testing Sugar-Beet Varieties. Presented before the American Society of Agronomy, Washington, D. C., Nov. 20, 1936.
4. Nuckols, S. B. Growing of Sugar Beets in Hills Free from Competition. Proc. Amer. Soc. Sugar Beet Techn. 1 (1938) : 39-40.

Comparison of Field Seeding of Sugar Beets and Mangel Wurzels with Two Methods of Transplanting[1]

JOTIN- O. GASKILL[2]

Experiments regarding transplanting of sugar beets for commercial beet-sugar production have been reported by Nuckols (2), Pritchard and Longley (3), Goss and Holt (1), and various other investigators. The reports differed as to the feasibility of transplanting for this purpose, and the method has not come into general use.

Transplanting of seedlings obtained from very small seedlots recently has become a common practice in connection with sugar-beet breeding work. The principal reasons for the adoption of this method are: First, that the limited numbers of seedlings obtained from such seedlots can be used to maximum advantage, and second, that gaps

[1]Contribution from the Division of Sugar Plant Investigations, Bureau of Plant Industry, U. S. Department of Agriculture.

[2]Assistant Pathologist, located at Fort Collins, Colo. The writer is indebted to R. Ralph Wood, Agent, for assistance in carrying out the details of this experiment.

in stand largely can be avoided. It is recognized that transplanting of sugar-beet seedlings ordinarily causes abnormal branching of the tap root, but it has been assumed that neither this change in type of root growth nor other effects of transplanting interfere seriously with development of final root size and sucrose percentage, in so far as comparison between strains or individual plants is concerned, provided that the population in any given test is made up entirely of transplanted seedlings.

The preliminary experiment reported in this paper was conducted for the purpose of comparing relative performance of widely differing types of beets grown from direct field seeding and from transplanted seedlings, respectively. A wide-spacing arrangement was used in order to avoid the effects of competition.

Methods

Ten sugar-beet varieties or strains, three mangel-wurzel varieties, and two F_1 hybrids of mangel wurzels and sugar beets, representing a wide range of types in both root-yielding ability and sucrose percentage, were used in the experiment. In the field, plants were spaced 40 inches apart in 40-inch rows, and plots were 1 row wide and 23.3 feet long. Each variety occurred in a compact block of 3 plots in which the following treatments were applied, respectively:

a.—Seed planted in field, directly.

b.—Seed planted in 3-inch flower pots in the greenhouse; seedlings transplanted in field 4 weeks later.

c.—Seed planted in 1 x 8-inch paper tubes in greenhouse; seedlings transplanted in field 4 weeks later.

In each treatment seed was planted on May 4, 1940.

In order to offset an expected nitrate deficiency in the paper tubes, they were watered, during the third and fourth weeks after seeding, solely with a 0.7-percent solution of sodium nitrate; and a few days after transplanting, each of these plants was given a surface application of approximately 1 heaping teaspoonful of sodium nitrate. Thinning of plants in pots and tubes was done before transplanting, leaving a single plant in each container. Thinning of plants of treatment "a" was done about June 13.

All roots were dug on September 27, trimmed as mother beets (see fig. 1), and washed. After a short period of storage in the root cellar, each beet was weighed and analyzed for sucrose percentage. Analysis *was* performed by means of a standard boring method.

Figure 1.—Representative roots of an F_1 hybrid, of sugar beet x mangel wurzel, which were grown to maturity in the field, under 40 x 40-mch spacing, after being started as follows: ta) direct field seeding, (b) seedlings started in 3 inch flower pots, and (c) seedlings started in 1 x 8-inch paper tubes. Note differences between treatments in length and degree of branching of the fleshy part of the tap root. Rule at left is 18 inches long.

Results

As shown in the summary of results (table 1), the correlation coefficients for weight of root were **0.91** for treatments "a" versus "b" and 0.85 for "a" versus "c". For sucrose percentage the coefficients were 0.96 for treatments "a" versus "b" and 0.97 for "a" versus "c ". All four of these values were highly significant.

Coefficients of variability for weight of root did not differ significantly, but the difference approached significance in one case, namely: Treatment "b" (28.05) and "c" (35.92), suggesting that the tube method of transplanting ("c") tended toward a greater variability between individual plants. In sucrose percentage, none of the differences between coefficients of variability approached significance.

The average weight of root for treatment "a" was larger than that for treatments "b" and *"c",* being significantly larger than the latter. In sucrose percentage the treatment means were almost identical.

In comparing the three treatments as to apparent effect upon the fleshy part of the tap root (see figure 1), it was noted that the tube method of transplanting did not materially affect root shape, while the use of pots resulted in short, highly branched roots.

Table 1.—Comparison of field seeding of sugar beets, mangel wurzels, and their hybrids with 2 methods of transplanting; data obtained by weighing and analyzing individually 239 roots grown under 40 x 40-inch spacing.

Variety No.	Treatment and average weight of root* a	b	c	Treatment and average sucrose* a	b	c
	(pounds)	(pounds)	(pounds)	(percentage)	(percentage)	(percentage)
Sugar beets (inbred):						
1	7.90	0.26	5.55	9.8	10.9	10.5
2	2.61	1.49	1.55	7.5	7.1	8.9
3	3.53	3.20	3.28	9.9	9.7	9.4
4	3.12	2.98	2.54	4.4	4.7	3.7
5	6.51	4.16	3.20	8.8	10.1	10.4
6	4.16	3.94	4.68	9.8	9.4	9.5
7	3.05	2.40	2.76	12.2	11.8	11.3
Sugar beets (commercial):						
8	5.42	5.53	4.95	8.8	8.9	8.8
9	7.50	6.75	4.18	9.2	8.4	10.3
10	4.87	4.82	4.76	10.4	8.8	9.9
Mangel wurzels (commercial):						
11	10.47	6.88	5.84	3.5	4.0	4.3
12	10.90	7.52	6.01	2.8	2.6	2.2
13	7.48	7.00	6.44	3.2	3.3	3.5
Sugar beets x mangel wurzels (F_1):†						
14	9.87	9.78	8.36	8.0	6.2	7.1
15	9.29	7.53	6.54	6.3	6.5	6.2
Total number of roots	97	70	72	97	70	72
Mean	6.46	5.37	4.75	7.6	7.5	7.8
Variance analyses:§						
S. E. (mean)	0.489	0.389	0.440	0.325	0.295	0.303
C. V.	29.34	28.05	35.02	16.98	13.26	15.42
S. E. (c. v.)	2.28	2.55	3.36	1.25	1.32	1.32
Correlations (treatment "a" versus "b" and "c", respectively).‡						
r		0.91	0.85		0.96	0.97
t		8.12	5.80		12.04	13.50
1-percent point (for t)		3.01	3.01		3.01	3.01

•Treatments (seed planted May 4, 1940):

a.—Seed planted in field, directly,

b.—Seed planted in 3-inch flower pots in greenhouse; seedlings transplanted in field 4 weeks later.

c.—Seed planted in 1 x 8-inch paper tubes in greenhouse; seedlings transplanted in field 4 weeks later.

+Thinned to known F_1 plants, by means of red-hypocotyl color factor.

§Calculated from individual-root data.

^Calculated from plot means shown above.

Summary and Conclusions

Under the conditions of this experiment, relative root size and sucrose percentage of transplanted beets closely paralleled root size and sucrose percentage of beets grown directly from field seeding. Root shape of plants started in 1 x 8-inch paper tubes was more nearly normal than that of plants started in 3-inch flower pots, but in weight of root the latter class of plants more nearly approached the performance of field-seeded beets.

The data presented suggest that satisfactory preliminary evaluation of the root-yielding ability and sucrose percentage of new strains of sugar beets can be made, under suitable conditions, and in the relative absence of competition, by means of transplanted seedlings.

The occurrence of root diseases was negligible in this experiment, but the greater possibility of root infection afforded by rootlets broken during the transplanting process should not be overlooked.

Literature Cited

1. Goss, A., and A. M. Holt. New Mexico Sugar Beets — 1898, N. M. Agri. Exp. Sta. Bul. 29 : 194. 1899.
2. Nuckols, S. B. Transplanting Sugar Beets in Utah and Idaho. U. S. D. A. Circ. 156, 14 p. **1931.**
3. Pritchard, F. J., and L. E. Longley. Experiments in Transplanting Sugar Beets. Jour. Amer. Soc. Agron. 8 : 106-110, 1916.

Mosaic and Seed Production

H. E. BREWRAKER[1]

When Gaskill reviewed previous literature and presented experimental data obtained in 1938 and 1939 bearing on the effect of mosaic upon seed production in the sugar beet, he found from 23 to 39 percent loss in seed production for mosaic-affected plants as compared with those not affected, the infection having occurred during the vegetative year.[2] In one test, apparently healthy plants were inoculated with mosaic 1 month after planting out for seed production with a measured loss of 26 percent in seed production. There was no significant effect on germination in any of his tests.

[1] Agronomist, The Great Western Sugar Company.

[2] Gaskill, John O. Effect of Mosaic Upon Yield of Seed by Sugar-beet Roots, Proc. of A. S. S. B. T. 2:190-207. 1940.