

The results for all 32 strains indicated that performance in wide spacing was closely correlated with that in normal spacing, both for weight and percent sucrose. The correlation coefficients were 0.624 and 0.779, respectively, and were highly significant.

In order to study the variability of individual beets under wide and normal spacings, individual weights and analyses were recorded for 80 roots from each of 6 representative strains, in each of the two spacings, amounting to a total of 960 roots. Coefficients of variability for percent sucrose were 10.62 and 9.59 for wide and normal spacing, respectively, indicating slightly greater variability for wide spacing. The difference, though statistically significant, was too small to be of much importance. Coefficients of variability for weight were 26.49 and 41.30 for wide and normal spacing, respectively, and the difference was found to be highly significant. On the basis of these data, approximately 24 beets would be required to make up a sample, from normal spacing, equivalent in statistical accuracy to a 10-beet sample from wide spacing.

MOTHER BEET STORAGE METHODS

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In the fall of 1936 approximately 650 sugar-beet roots of a commercial variety were trimmed in the usual manner for mother beets and placed in crates in a root storage cellar at Fort Collins, Colorado, where they were allowed to remain for a short time. On November 23 these roots were divided by a random method into 5 identical lots, numbered from 1 to 5. Lot #1 was analyzed immediately, and lot #5 was stored in a trench silo in accordance with customary procedure. All other lots were stored in crates in the root cellar. Individual weights and analyses were made on all roots, as indicated below:

Treat- ment No.	Method of Storage	Date of Analysis	Aver. Wt. per Rt. (lb)	Aver. Sucro. %
1	---	Nov. 24, 1936	1.452	15.74
2	Cellar(crates)	Jan. 4, 1937	1.416	15.53
3	Cellar(crates)	Feb. 16, 1937	1.491	15.09
4	Cellar(crates)	Mar. 29, 1937	1.460	14.77
5	Silo	Mar. 29, 1937	1.477	14.68

The roots in each lot were weighed only once—i.e. on the date of analysis—but since none of the weight-differences between lots were significant, it was assumed that neither type of storage appreciably affected the weight. Then, considering percent sucrose alone, the gradual loss during storage, in the cellar, apparently was accompanied by an approximately equal loss in the silo, as indicated by the fact that the differences in percent sucrose, between treatments #4 and 5, was only 0.09—an amount which was far from significant.

Rot was not a factor in either silo or cellar; consequently, it was concluded that, under the conditions of the experiment, the cellar besides

being a convenient place in which to store small lots of roots of breeding strains, provided conditions which were equal to those in the silo, insofar as loss in sucrose was concerned. In other words, the cellar was fully as good as the silo in holding the metabolic rate at a low figure.

A CRITICAL STUDY OF FAMILY AND GROUP BREEDING METHODS
FOR SUGAR BEETS

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Introductory

The Vilmorin principle of selection which was developed by Louis Leveque de Vilmorin and his father Louis de Vilmorin in connection with their studies of vegetables and sugar beets was published in a monograph in 1856. It became known as the progeny test principle since it provided for the growing and examination of the progeny of an individual as the only method for determining its value.

This principle quickly became an essential feature of the breeding methods for many crops including sugar beets. In sugar beets it is still the essential feature of much of the breeding work, particularly in Europe, as was graphically presented by Dr. G. H. Coons in the U. S. Dept. of Agriculture Yearbook of Agriculture (1).

Since it is the intention of this paper to refer frequently to various phases of the breeding work with corn, inasmuch as the two crops are similar with respect to the fact of being largely cross-pollinated, it is well to observe that the ear-to-row methods for corn are essentially similar to the family and group methods for sugar beets.

While the pure line methods of breeding were adopted for small grains at Svalof, Sweden, in 1891, it was not until after Johannsen in 1903 and 1906 conducted his famous selection experiments with beans and barley that the pure-line theory was developed. These being naturally self-pollinated crops, he showed that variation within the progeny of a single individual could not be retained, in other words, there was a complete regression back to the average in the progeny of both the plus and minus variations. It is the pure line concept which underlies the important recent advances in breeding work with many naturally cross-pollinated crops. The ear-to-row methods which were adopted for corn by early breeders have given way almost completely to pure-line methods. It is the intention in this analysis to study statistically, so far as possible, the results obtained from an extensive application of the progeny test or family and group breeding methods employed over a period of years by the research department of The Great Western Sugar Co. Without attempting to claim any undue credit or responsibility, the experiments from which these studies were made probably constitute the most extensive application of this breeding method to the sugar beet crop in America.

The statement was made by one of the foremost European beet breeders a few years ago that "a sugar beet breeder could well consider his life a