A Technique for Obtaining Identical Pairs of Seedling Beets[1]

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There is considerable genetic variation between sugar beet plants because they are cross-pollinated. A technique of splitting large beets has been used to obtain genetically identical plants (4)[3]. Cuttings from crown buds and semi-vegetative seed-stalks have also been used in asexual propagation of beets (2). Although these techniques will remove genetic variation they are not satisfactory when young plants are being studied. Pawlowski (3) obtained identical pairs of sunflowers by splitting seedlings. In 1962 identical pairs of seedling beets were obtained by a modification of Pawlowski's method.

The method used to obtain the paired plants was as follows: Beets in the 2-leaved stage were equally bisected between the leaves. The 2 halves of each plant were placed in vermiculite in compartments of small plastic trays, were watered with nutrient solution (1), and enclosed in plastic bags for several days to maintain high humidity. The trays were placed in either a greenhouse or plant growth chamber until established. They were then transplanted into soil in 8-inch pots.

The roots of the beets were sometimes shorter than normal with profuse growth of secondary roots at the tip. Figure 1 shows paired beets in an early stage of growth while Figure 2 shows larger paired beets with almost normal development of the tap root and secondary roots. These beets had the zone of small secondary roots along one side of the tap root only, rather

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[3] Numbers in parentheses refer to literature cited.

Captions for figures on next page.

Figure 1.—Genetically identical plants from a seedling that was evenly bisected.

Figure 2.—Genetically identical beets with near normal root development.

Figures 3 and 4.—Two pairs of beets from bisected seedlings. The leaf development appears to be normal and almost identical in the paired plants. The plant on the left is the mirror image of the one on the right and leaves with the same letter are nearly identical.

Figure 5.—Genetically identical plants from a seedling that was not evenly bisected.

Figure 6.—Genetically identical plants showing the effect of peat moss containers on the development of the tap root.

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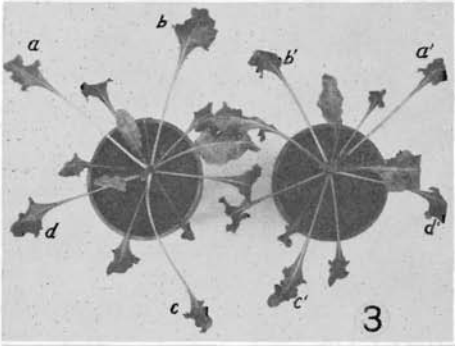

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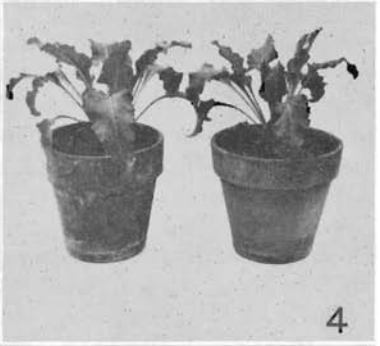

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than along both sides. Most of the paired beets had almost identical leaf shape, leaf position, and longevity of leaves, and one small plant was the mirror image of the other (Figures 3 and 4).

The degree of success achieved in establishing the identical pairs varied from 5 to 20%. As some fungicides cause abnormal root development, the divided plants were not treated with fungicides and a few seedlings were lost due to root rot. If the seedlings were not split equally, the smaller plant died or developed more slowly (Figure 5).

In early trials beets were transplanted from the plastic trays to small peat moss pots containing soil. Then, when well established, the beets, still in the peat moss pots, were placed in soil in 8-inch pots. As the peat moss pots did not disintegrate as expected and affected the subsequent growth of the beet root (Figure 6), the plants in later trials were transplanted directly from the trays to soil in 8-inch pots.

The main advantage of this technique is that valid paired comparisons can be made with seedling beets. Thus, greater uniformity of results should be obtained and the replication necessary for detecting differences due to the treatment applied could be reduced. The identical beets should be useful for studying the effect of host plants on the development of insect populations under various conditions, the physiological changes during growth of sugar beets, and the influence of temperature, soil moisture, or soil fertility on young sugar beets.

Literature Cited

(1) HOAGLAND, D. H., and D. J. ARNON. 1950. The water-culture method of growing plants without soil. Calif. Agr. Expt. Sta. Circ. 347.

(2) OWEN, F. V. 1941. Asexual propagation of sugar beets. J. Heredity 32 (6) : 187-192.

(3) PAWLOWSKI, S. H. 1963. A method of obtaining genetically identical sunflower plants. Can. J. Botany. 41: 743-744.

(4) POWERS, L., R. E. FINKNER, C. W. DOXTATOR, and J. F. SWINK. 1957. Preliminary studies on reciprocal recurrent selection in sugar beets. J. Am. Soc. Sugar Beet Technol. 9 (7) : 596-610.