A NEW SUGAR-BEET BREEDING TOOL—
TWO SEED GENERATIONS
IN ONE YEAR

The biennial nature of the sugar beet (Beta vulgaris L.) is one of the chief obstacles in the way of rapid improvement of the crop through breeding. Various techniques, involving use of the greenhouse, have been employed by breeders in the United States to reduce the length of the life cycle. One of the most efficient of these techniques, from the standpoint of time required for the complete cycle, was developed by the Division of Sugar Plant Investigations of the U. S. Department of Agriculture and has been in use at the Fort Collins Station for a number of years. Seed is planted in the greenhouse in the fall, photothermal induction\(^2\) of the young seedlings is accomplished by means of continuous illumination and cool temperature (approximately \(^{50}^\circ\) F), and the new seed crop may be harvested within 6 or 7 months from date of planting. The method frequently is quite helpful where a quick seed crop is needed, but because a prolonged period of cool weather is required, this procedure is not adapted to summer use.

As a result of a series of experiments conducted recently at Fort Collins, a new method has been developed by means of which two successive generations of sugar-beet seed can be produced in 12 months, with approximately \(100\%\) flowering. Seed yields are not large. However, in many breeding jobs and genetic studies the quantity of seed per plant is relatively unimportant, being far outweighed by the urgent need for a short life cycle. Although further research on this problem undoubtedly will lead to refinements in technique, it is felt that immediate release of the following outline, based on results obtained thus far, will be helpful to breeders desiring to make use of the method at once:

A. Pre-induction period:

Give plants a start of approximately 2 weeks (from date of seeding) in a warm greenhouse, with all-night supplemental light provided from time of emergence by means of a 150-watt, white frosted, incandescent bulb in a medium-depth reflector suspended approximately 30 inches above soil level. For best results the plants should be grown in individual pots, 2-inch diameter being adequate, or so spaced in flats or other containers that transplanting at the end of the induction period may be performed with very little injury.

B. Induction treatment:

1. Light.—Provide continuous artificial light (no sunlight) by means of the same type of unit as described under "A", with reflector approximately 20 inches above the surface of the soil.

2. Temperature.—With bulb of thermometer directly beneath the light, about one-half inch above soil level, and not shaded, maintain temperature between 46 and 49\(^{\circ}\) F.

3. Time.—For varieties or strains having average bolting tendencies, 10 weeks' induction treatment apparently is sufficient. Relatively nonbolting or slow-bolting types require some additional time.

C. Post-induction period:

Crowded seedlings in flats, or seedlings in small pots, should be transplanted (e.g., to soil beds or to 6-inch pots) if relatively vigorous growth is desired. Sunlight—in greenhouse or out of doors—should be supplemented with artificial light as described under "A", with light unit raised as seedstalks elongate. Since induction tends to be lost or reversed by high temperatures\(^3\), such conditions should be avoided during the first few weeks of the post-induction period. On the basis of experience at Fort Collins, and until more is known about this phase of the problem, the following temperature range at that critical time is suggested for strains with average bolting tendencies: 60\(^{\circ}\) F or below at night, with the maximum during the day (in the shade) seldom exceeding 80\(^{\circ}\) and then only for very short periods; daily thermograph average about 65 to 68\(^{\circ}\). After all healthy plants are bolting and the majority of the seed stalks have obvious flower buds, temperatures about 10\(^{\circ}\) higher can be tolerated with safety and in fact are preferable because of the more rapid development which results. Under such conditions, with thoroughly induced plants, the seed crop should be ready to harvest within 12 to 13 weeks after the end of the induction period.