

# Variety Trials

## sugar beets compared for growth, sugar content in controlled chambers

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The growing of sugar beet plants in controlled climates is used to aid the selection of better varieties for commercial beet sugar production.

As the desired climates with the proper sequences of light, temperature, and rainfall can not be controlled in nature, the advantages or disadvantages of field-tested varieties may not be discovered until they have been used in commercial plantings for some time.

In the laboratory the performances of varieties can be compared in preselected controlled climates in which moisture supply and nutrient level can be predetermined and controlled.

In an experiment using eight sugar beet varieties, information was obtained about variety performance in six controlled climates in which the plants were amply supplied with water and nutrients.

The results obtained for two commercial varieties, U. S. 22/3 and G. W. 304, indicate that the G. W. 304 variety produced, on the average, 52% more beet-root growth and 62% more sugar than the U. S. 22/3 variety.

The best performance of the G. W. 304 variety in the six climates was mainly in the cool climate and natural day length. When the plants were grown in a warm climate with natural day length, the performance of U. S. 22/3 improved but did not equal the G. W. 304 variety. When the plants were grown in eight hours of sunlight at 79° F with nights at the same temperature the G. W. 304 variety grew relatively less than the U. S. 22/3 variety.

Under these conditions U. S. 22/3 was about equal to G. W. 304.

From the practical standpoint, variety trials conducted in cool climates would undoubtedly favor the G. W. 304 variety while similar variety trials conducted in warm climates would show no preference for either variety. Susceptibility to diseases and pests must, of course, be considered in the final selection of the variety to be used in commercial plantings. California planters would favor the curly-top-resistant U. S. 22/3 variety over the nonresistant G. W. 304 variety. In the mountain states the G. W. 304 variety is likely to be preferred for field plantings.

The growth of inbred sugar beet varieties and their hybrid offspring was studied in different climates.

The beet root weight of one hybrid, H148, was greater than that of either of its inbred parents when grown in a cool climate; but in warm climates the superiority of the hybrid was observed only in the plants grown with a natural day length. In an eight-hour day at 79° F followed by a 16-hour night at 68° F these differences decreased until, for plants maintained continuously at 79° F day and night, the hybrid roots weighed less than those of the parents. Thus, the relative performance of the inbreds and their hybrids varied, depending upon the climate in which the comparison was made. If the growing season was predominantly cool, hybrid vigor was observed, but if the comparison was made



Sugar beet plants in a variety-climate experiment. The beets were planted October 15, 1951, and after thinning were moved to their assigned climates November 9, 1951. Thereafter, the plants at the left were grown at a temperature of only 5° F less than those at the right.

in a warm climate hybrid vigor was not evident.

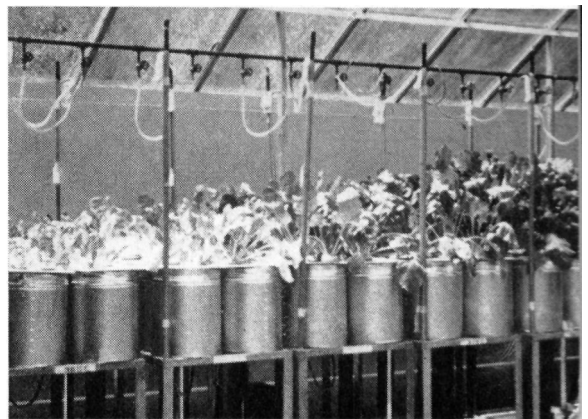
The sugar content of the inbreds and their hybrids was investigated. Generally, a hybrid beet root has a sugar content intermediate between those of its parents. Again, in the warmer climates this intermediate sugar content of the hybrid declined so much in the climate with eight hours of sunlight and constant temperature of 79° F that the hybrid contained less sugar than either of its parents.

The amount of sugar produced by the inbred parents and their hybrid offspring varied with the sugar content and the size of the beet root formed. Thus, hybrid vigor for sugar production was observed in all climates studied except in the warm climate with eight hours of sunlight. Under the latter conditions the hybrid produced less sugar than either of its parents.

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The experiments reported above were conducted in the Earhart Plant Research Laboratory, California Institute of Technology, Pasadena, by the University of California College of Agriculture in co-operation with the California Institute of Technology and the Beet Sugar Development Foundation. A complete report of this work will soon appear in the 1952 Proceedings of the American Society of Sugar Beet Technologists.

Sugar beet plants, varieties U. S. 22/3 and U. S. 35/2, grown in a warm climate with solutions containing increasing amounts of nitrogen. The plants at the left have become deficient in nitrogen while those at the right still have an ample supply.



Sugar in Grams Per Pot (Average of Four Pots)

| Climates                            |                            | Sugar Beet Varieties |        |                       |                     |             |
|-------------------------------------|----------------------------|----------------------|--------|-----------------------|---------------------|-------------|
| 8 a.m. to 4 p.m. (8 hrs.)           | 4 p.m. to 8 a.m. (16 hrs.) | US 22/3              | GW 304 | Female parent of H148 | Male parent of H148 | Hybrid H148 |
| 1. 68° F                            | 57° F (NL) <sup>1</sup>    | 34.4                 | 76.8   | 33.4                  | 58.1                | 69.6        |
| 2. 68° F                            | 57° F (Dark)               | 19.4                 | 31.9   | 10.3                  | 11.9                | 25.2        |
| 3. 68° F                            | 68° F (Dark)               | 19.9                 | 34.1   | 12.4                  | 10.7                | 14.6        |
| 4. 79° F                            | 68° F (NL) <sup>1</sup>    | 58.5                 | 72.9   | 31.6                  | 48.2                | 62.3        |
| 5. 79° F                            | 68° F (Dark)               | 16.9                 | 31.1   | 8.9                   | 14.8                | 15.9        |
| 6. 79° F                            | 79° F (Dark)               | 13.3                 | 18.2   | 7.5                   | 13.5                | 6.5         |
| Significant difference <sup>2</sup> |                            | 21.4                 | 18.2   | 10.3                  | 15.3                | 15.3        |
| Mean (24 pots) <sup>3</sup>         |                            | 27.3                 | 44.2   | 17.4                  | 26.2                | 32.4        |
| % more or less than US 22/3         |                            | ...                  | +61.9  | -36.3                 | -4.0                | +18.7       |

<sup>1</sup> NL = natural day length at Pasadena which increased gradually from 10.6 hours at the time of planting—February 2—to 11.9 hours when plants were placed in different climates—March 13—to 14.3 hours when plants were harvested—June 5.

<sup>2</sup> At the 5% level.

<sup>3</sup> A difference of 7.5 grams is necessary for significance between variety means at the 5% level.