

Research Report

Sugarbeet Conference, Fort Collins, Colorado

February 5, 6, 1974

Prepared by Garry A. Smith, January 7, 1974

- A. Location of Project: Western Region  
Colorado-Wyoming Area  
Crops Research Laboratory, CSU  
Fort Collins, Colorado
- B. Work Reporting Unit Title: Improved Sugarbeet Varieties and Sugarbeet  
Production Practices
- C. Work Reporting Unit: No. 401-5602-10710
- D. SMY's for Past Year at Location: 1 SMY
- E. Names of Scientists in Project at Location: G. A. Smith, also  
cooperating with R. J. Hecker, G. W. Maag, and E. G. Ruppel
- F. Mission of Research:

Our research is directed toward improved sugar production and toward solution of problems which cause losses to beet growers and processors. Both applied and basic research is conducted on sugarbeet genetics, breeding, and quality problems to provide answers directly to growers and processors or to breeders and other scientists.

- G. Objectives of Research:

To develop genetic principles and effective breeding methods for improved sugarbeet productivity, quality, and disease resistance. Establish parental lines that are disease resistant and excellent in quality. To achieve these objectives, the basic research program has the following approaches: (1) To investigate the nature of genetic plant resistance to *Cercospora beticola*. (2) To determine the types of gene action controlling the components of sugar yield. (3) To determine the types of gene action controlling nonsucrose constituents which affect quality. (4) To investigate the genetics of hybrid vigor. (5) To determine which breeding methods or conditions most quickly achieve set breeding objectives.

- H. Research Accomplishments:

Resistance to *Cercospora* leaf spot was found to be determined by a minimum of 4 pairs of genes with a narrow sense heritability of .243.

The degree of foliar leaf spot damage in the field was shown to affect the storability of sugarbeets. Selection of sugarbeet plants for high as compared to low leaf spot resistance resulted in a 50% reduction in storage rot of harvested roots.

Additive genetic variance was found predominant for six nonsucrose components of purified juice. Significant amounts of nonadditive gene action were found for all six nonsucrose components at either or both high or low nitrogen levels. Nonadditive genetic variance was of prime importance in controlling root weight under low and high nitrogen levels, accounting for 51% and 68% of the total genetic variance, respectively. For recoverable sugar, nonadditive genetic variance accounted for 67% and 83% of the total genetic variance under low and high nitrogen. Additive genetic variance accounted for most of the genetic variance for sucrose percentage and root/shoot ratio.

The components of recoverable sugar yield were found to rank differently in relative importance in improved populations of sugarbeet than in relatively unimproved populations. Results suggest that the emphasis of breeding programs will need to change with changes in the genetic structure of the improved population.

#### I. Impact of Research Accomplishments on Science and General Public:

The 10 published research papers and 16 interim reports which have come out of this research have provided basic information to other scientists, especially in industry. This information can be used directly to solve problems which cause losses to growers and processors and thus maintain a constant supply of sugar to the general public. The release of disease resistant germplasm to the industry has helped to achieve these same objectives.

#### J. Obstacles to Achieving Objectives:

Genetic research requires extensive field testing to identify and separate genetic differences from environmentally conditioned differences. Technically trained people are necessary to help establish field tests, harvest, process seed, and record data. In the last 3 years we have lost two experienced technicians through retirement and within the year will lose yet another high grade technician. We have managed to maintain our genetic and disease nursery plots in spite of these losses. Maintenance of good technical support personnel will allow us to maintain our efforts.

#### K. Future Plans and Needs:

A distinct need exists for further information on the genetics of resistance to *Cercospora beticola* and the combined resistance to *Cercospora* and the curly top virus. Research efforts to obtain this information will be pursued.

Because of the high costs and duration of field testing, we are trying to discover methods by which the best combining parents for sugar and disease resistance can be identified before actually making the crosses or at least, before the crosses are tested in the field.

Efforts to find a simple method of identifying lines or crosses which are efficient in photosynthesis and respiration will be pursued in the laboratory and greenhouse.