Research Report

Sugarbeet Conference, Fort Collins, Colorado

February 5, 6, 1974

Prepared by J. Clair Theurer, January 8, 1974

A. Location of Project: Western Region
Idaho-Montana-Utah Area
Crops Research Laboratory
Utah State University

B. Work Reporting Unit Title: Sugar Beet Production Practices

C. Work Reporting Unit: 10710

D. SMY's for past year at location: 1 SMY

E. Names of Scientists in Project at Location: J. C. Theurer

F. Mission of Research:

To obtain knowledge on the genetic, cytological, and breeding behavior of cytoplasmic, male sterility; to determine the inheritance and linkage of genetic characters of the sugarbeet; to develop breeding material and formulate breeding methods that have potential use in the sugarbeet industry.

G. Objectives of Research:

To determine the inheritance and morphological development of male sterility; to acquire knowledge concerning the variability in partial fertile sugarbeet plants and observe the influence of environmental factors on male sterility; to determine if CMS is virus-like; to search for new and different sources of cytoplasmic male sterility; to develop pollen fertility restorer lines; to search for genetic characters in sugarbeets and determine their association in genetic linkage groups; to conduct combining ability tests and variety yield trials and select inbreds that merit possible use in commercial hybrids; to evaluate sugarbeet breeding and selection methods and cultural practices.

H. Research Accomplishments:

The genetics and breeding behavior of cytoplasmic male sterility has been found to be extremely complex. Progenies of partial fertile genotypes are highly unstable and variable in their breeding behavior, and are greatly influenced by environment. Several diverse sources of male sterility are being evaluated. One source shows possible differences from the CMS presently being used in commercial hybrids. Three good pollen restorer inbreds have been developed. Studies have shown no relationship of the curly top virus disease with sterile cytoplasm.

Chlorophyll deficiencies, root and leaf characters of sugarbeet we have studied, generally have shown monogenic inheritance. Only a few linkage associations have been observed.

Experimental 4-way pollen restorer hybrids have shown good for yield, sugar percentage and quality. Differences in yield and sugar percent of restored vs non-restored hybrids have been observed. Two and four week

old sugarbeet seedlings transplanted 12 inches apart in 22 inch rows have shown better tonnage, but no difference in sugar percentage or impurity index than direct seeded and thinned beets.

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

Male sterility is an important basic tool in the production of commercial hybrid sugarbeet seed. More knowledge regarding its cytological development inheritance, breeding behavior, variability and environmental influences will help the industry to surmount problems associated with the production of hybrid varieties of sugarbeets. Only one source of cytoplasm is used today in sugarbeet commercial seed production. New sources of plasm could avert a catastrophe in sugarbeets as occurred in maize when southern corn leaf blight attacked T plasm hybrids. Release of new inbreds provides parent material for new varieties having higher yield and sugar percentage, and better disease resistance which results in greater production of sugar.

J. Obstacles in Achieving Objectives:

One of the major obstacles that has delayed achievement of objectives is the lack of sub-professional personnel trained in genetics, cytology, and laboratory procedures. A well trained GS-5 lab technician would greatly help progress.

The biennial nature of the sugarbeet and the difficulty of controlling environment, associated with the complex genetic behavior of cytoplasmic male sterility makes progress slow. The need for additional greenhouse space and seed isolation chambers has delayed progress in achieving some of the objectives. Power and mechanical failures have delayed research work due to freezing of plant material in winter months and overheating in summer months in seed production chambers. We have had problems of contamination and poor steckling production in St. George plots.

K. Future Plans and Needs:

Present studies concerning the breeding behavior, variability and environmental influences in partial male fertile material will be continued. Studies on graft transmission of male sterility will be completed. New sources of cytoplasmic male sterility will be sought, and attempts will be made to derive new male steriles by interspecific crosses of Beta species and Beta vulgaris. Pollen fertility restorers from diverse genotypes will continue to be evaluated for their inherent differences. Genetic and breeding behavior of isogenic male sterile and isogenic pollen restorer lines will be studied. Evaluation of the effects of restorer vs non-restorer and male sterile vs o type equivalent, performance will be continued. More emphasis must be placed on cytogenetic studies and the morphological development of male sterility. New breeding material will be released to the sugarbeet industry when it shows promise for use in improvement of the crop.