

PRESENT STATUS OF SUGAR BEET BREEDING WORK

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This report is limited to curly top resistant varieties and for practical purposes is further limited to the intermountain area. The California work, which Dr. McFarlane may discuss, is more diverse and involves consideration of non-bolting tendency and related problems.

Present Accomplishments

Sugar beet varieties are now available with a high degree of curly top resistance. A recent added feature has been the incorporation of high sugar percentage combined with a high degree of disease resistance.

Four years' results with male sterile hybrids derived from topcrosses to inbred lines show total sugar per acre increases of 10 to 20 percent.

Thanks to Dr. Savitsky, the monogerm character was discovered in 1948. Many F₂, F₃ and backcross populations are now available.

Tetraploid and triploid hybrids have been produced on a limited scale. A relatively good collection has been made of primitive and otherwise desirable beets, including several wild species. From this material many hybrids have also been made.

Problems Yet to be Solved

The need is urgent for increased yield and sugar content with greater uniformity and with a root better adapted to mechanized harvesting. If male sterile hybrids constitute an answer to this question, some rather definite problems have been suggested in our 1950 report on performance of varieties.

Information Dr. Doxtator and others have given us on sodium analyses indicates that this will be an important future consideration, along with other chemical analyses.

With ever-mounting expenses in factory construction, varieties with improved storageability are much needed to lengthen the campaigns.

Nematode resistance is one of the most crying needs of the industry, and it is entirely possible that breeding work may be helpful in solving this problem.

Immediate Further Objectives of Breeding Program

Production of high yielding male sterile hybrids on a commercial scale.

Production of acceptable monogerm varieties with satisfactory curly top resistance.

Development of varieties with more rapid germination and greater seedling vigor, especially at the low temperatures that prevail in the spring.

Thorough study of storage problems with special emphasis on techniques that may be feasible and practical to carry out.

Continued study of tetraploids.

Breeding Methods Which Have Been Used and Which Will be Used

Mass selection has been the most useful method for rapid development of good curly top resistant varieties. The high degree of disease resistance now available has established an ideal situation for the use of superior methods, especially certain backcross procedures. Any new desirable character can now be introduced and after backcrossing to present varieties good curly top resistance can soon be recovered.

Self fertile lines carry a gene for self fertility which distinguishes them from the usual self sterile sugar beets. Since 1935 many backcrosses have been made between the best inbreds and the self sterile stocks. This line of approach should be continued with emphasis on incorporation of the monogerm character.

During the past three years renewed emphasis has been placed upon clonal propagation of the best self sterile genotypes. One of the prime considerations with these clones is selection of the Type O (Nxxxx) genotype, whose MS hybrids are completely male sterile. By hybridization of these genotypes we are developing Type O self sterile populations. Self fertile hybrids for development of Type O inbreds are a byproduct of the operation.

Material and Information Considered of Most Value in the Breeding Program to Meet Objectives

More information is needed to check more carefully the basic principles associated with self sterility, self fertility, male sterility, polyploidy and species hybrids. Environmental effects on all these processes need much elucidation. Dr. H. Savitsky has come to this country with extremely interesting ideas on environmental control of self sterility, self fertility and even male sterility. Using crude methods a year ago, I succeeded in partially emasculating some extremely self fertile beets by use of low temperatures. To do this work properly controlled equipment would be highly desirable.

There is much room for development of superior methods of reproducing breeding stocks. We are fortunate in the vicinity of Salt Lake City in having many fine cooperators who permit us to use space in their gardens for isolation purposes. In many respects the greenhouse isolators utilized in Denmark have advantages over the garden isolations. Some preliminary studies would help to determine the best type of construction and whether or not investments would be justified.

The wild species, B. macrorhiza might be of great value to sugar beet breeders in this country. Unlike B. trigyna and B. lomatosogona, B. macrorhiza has a fleshy root and offers possibilities not seen in any other species.

Through the use of wild species it may be possible to make strides that can be made in no other way. Nematode resistance appears to be one of the most important considerations.

There is much need for improved facilities for the breeding work, including convenient fireproof seed storage.