

SECTION III

DISCUSSION OF PROBLEMS AND OBJECTIVES

The chairman presented the following objectives:

1. It is our desire to work out closer cooperation between all breeders and research workers within the sugar beet industry and between the industry and other agencies dealing with sugar beet improvement.
2. This close cooperation should:
 1. Increase the scope of work that can be accomplished by having various projects carried through where the work can be most effectively and most economically done.
 2. Eliminate duplication of effort and reduce expenditure of money.
 3. Make an increased amount of fundamental work available to everyone for use in working out practical problems.
3. In order to implement the above objectives and to realize the above mentioned benefits, the committee feels that there should be an exchange of ideas, information, genetic material, breeding material, and methods of procedure between all cooperating companies and also between the companies and the agencies engaged in sugar beet improvement.
4. The industry committee believes that release of genetic material and release of breeding material to breeding programs within the industry can and will broaden the contributions which the Division of Sugar Plant Investigations makes, and that this will solidify the industry in support of the work carried on by said Division.
5. The industry committee believes that in order to establish and maintain the kind of cooperative relationships outlined above that a permanent committee should be organized to advise with cooperating agencies.
6. The industry breeders committee realizes that cooperative relation-

ships and release of information, genetic characters, and/or breeding stocks must be governed by basic policies of the Bureau of Plant Industry. We have, therefore, asked Dr. McCall to attend our discussion session this afternoon to outline to us policies of the Bureau in regard to above mentioned problems and principles, and also to cover any other things which he may care to.

Summary of Dr. McCall's Remarks

Dr. McCall stated that he was very pleased to have such a complete representation of the Sugar Beet Industry present, and that he hoped we would have a frank discussion of our problems and arrive at a complete understanding of how they might most effectively be solved.

He stated that problems had recently arisen between industry and government workers which made it apparent that a re-statement of policy would have to be made. He said he wished that some other groups had worked out as complete a statement of policy as that outlined in the Advisory Committee reports of the C.T.R.B.C., and stated that he would like to see an advisory committee, such as the C.T.R.B.C. Advisory Committee, expanded to cover the Sugar Beet Industry.

In laying down Bureau policy, Dr. McCall made the following points:

1. It is and always has been the policy and responsibility of a government agency to release varieties, genetic material, or breeding stocks to any qualified agency which can help this material reach the American Farmer.
2. Materials should be available to the American farmer in the shortest possible time. If agencies or individuals can help bring this about through a cooperative program, then it is the responsibility of the government agency to foster the closest type of cooperation.
3. The job can be done most effectively and most economically through

close cooperation of public agencies and industry. Wherever possible, duplication of effort should be avoided.

4. Such a program should be carried forward on a basis of reciprocity.

5. In answer to a question from Heinz Rietberg, Dr. McCall stated that it was the government policy to make any material desired by European breeders available to them as rapidly as supply of materials would permit.

Summary of Breeding Reports by the Chairman

It is apparent following the reports of the various men engaged in sugar beet breeding that there is a unanimity of feeling that much of future progress in sugar beet breeding can be most effectively accomplished through the development and use of self-fertile inbred lines and the use of cytoplasmic male sterility to make possible the combination of inbred lines to produce hybrid varieties. Breeders will, of course, continue to use mass selection or other broad methods where they can be used to advantage. It is the general feeling of this group, however, that as the number of characters which it is desired to combine in one variety increases, that inbred lines carrying these characters must be found and/or developed. The biggest job facing sugar beet breeders, both collectively and individually, is the development of inbred lines and the determination of the desirable genetic characters which they carry, and finally the determination of their combining ability.

What is an Inbred Line, and What Should be Tested? I feel that at this point we should define what we mean by an inbred line. Dewey Stewart gave the following definition: "It is a line developed from a single plant that has been selfed." The chairman then asked the question as to how many generations a line should be selfed before it should be indexed for desirable characteristics and tested for combining ability. It was quite generally decided that before

an inbred line went through a general testing program that it should be approaching the homozygous state as to all characters which can be used to evaluate this condition.

Is an Indexing and Testing Program Worthwhile? In response to the above question by the chairman, the following points were made:

Dewey Stewart stated that disease resistance should remain the major test in evaluating the worth of an inbred, and that top-crossing to varieties which are susceptible to the disease being tested for gave the most sharply defined readings. Following evaluation for disease resistance, then, secondary tests should be made to determine what other desirable characters are present. After considerable discussion, it was quite generally agreed that testing and indexing of inbreds was not only desirable but that it was an essential part of the program. It was felt, however, that some care should be exercised so as to not set up a program which would eliminate from testing for secondary factors, inbreds which might make important contributions other than disease resistance.

What Do We Need to Know About Inbreds? It was pointed out that many desirable characters had been mentioned by the various sugar beet breeders, and that a rather complete list of these characters was included in Dr. Brewbaker's paper. In this connection, it was again pointed out that genetic factors for low sodium, cold resistance, or other important characters, might be discarded if all inbreds were subjected to too rigid a selection on basis of disease resistance before a determination was made relative to some other important characters.

The monogerm character is a case in point. We were all glad to get that character, although as far as the Curly Top breeding was concerned the original monogerm strain possessed no disease resistance.

How Can the Information Relative to Inbred Lines be Most Effectively

Obtained? As the scope of the information desired in regard to the characteristics of inbred lines became apparent, attention was focused on the immensity of the job at hand. Considerable discussion followed as to how the job might be done most effectively. No definite program was decided upon, and details of such an evaluating and testing program will have to be worked out at a future meeting. The following points were made, however:

1. It will have to be a cooperative enterprise. For example: American Crystal might carry the responsibility of testing inbred lines for sodium and potassium content, and Great Western might carry the responsibility of testing for cold resistance. Great Western or the government agency might carry the responsibility of testing for respiratory rate and storagability, and tests for combining ability might be carried on in several areas.

At this point the question was raised as to whether it might be worthwhile to subject some varieties and inbred lines to a serological test to determine resistance to virus yellows. Dr. Rietberg stated that he could run these tests, and that he would need sufficient seed to produce about 50 plants from inbred lines, and from 600 to 800 plants from commercial varieties. It was indicated that seed could be sent directly to Dr. Rietberg by the various parties interested. Dr. Rietberg also agreed to test for nematode resistance.

The importance of selecting standard checks to be included in all cooperative evaluation work was stressed. What the checks should consist of, what the testers for combining ability should be, and how extensive the testing for various phases of the program must be remains to be worked out.

What Sources of Inbreds Are There, and How Many Would be Available for Testing? The question finally resolved itself down to (1) what inbreds

are there, (2) can they be made available for the type of an indexing and cataloging program as has just been discussed, and (3) more important still, can and will they be made available for use after they have been catalogued and indexed?

A brief report of the discussion on each of these problems follows:

1. At least a limited number of inbreds have been developed by the following individuals or organizations: American Crystal, Great Western, Holly, Kohls, and the Division of Sugar Plant Investigations. In the government organization these inbreds have been developed by and are in the possession of Dr. F. V. Owen, Dr. John McFarlane, Warren Deming, and Dewey Stewart.

2. Considerable discussion ensued, and it was agreed by all commercial companies that any inbred lines which they had, which the breeders committee should feel would be worthwhile, would be made available for testing, and that each company should assume the responsibility of increasing adequate seed supplies.

Dr. Coons stated that Mr. Deming's inbreds would be available for indexing and cataloging, and that he would write to Deming and ask him to cooperate all he could in increasing seed supplies. It was agreed that representatives of the companies should work with Deming in an attempt to screen out what should be increased.

3. In relation to inbreds which have been developed in Dr. Owen's, McFarlane's and Stewart's programs, some confusion still exists as to just what would and would not be made available. Dr. Coons stated that "Genetic Inbreds" would be made available, but no commitment was made regarding the availability of "Economic Inbreds". Considerable discussion followed, but no definite clarification was reached.

The committee felt, however, that a definite precedent had been set in the release of the monogerm inbred. What inbreds do any organization have that might any more legitimately be classed as "Economic Inbreds" than one carrying the monogerm character? The inference was left by Dr. Coons that final decision as to the extent to which all inbred lines of government origin would be made available would be governed largely by the attitude of the breeder who had developed the line in question.

The committee feels that if the broad policies of cooperation as laid down by Dr. McCall are followed, that there will of necessity have to be a liberal policy established in working out the availability of material and exchange of material between breeders in commercial companies and breeders in the government organization.

Principles governing the exchange of breeding material between breeders of the various companies and between company breeders and the cooperating government agency are already a matter of record in reports of the Advisory Committee of the C.T.R.B.C. Company breeders reaffirmed their willingness to make breeding material available to other bona fide plant breeders.

Miscellaneous Suggestions and Commitments

1. Suggested that Michigan 18 be surveyed as to other genes which might be important. Each company requested a small quantity of seed for this purpose.
2. Brewbaker suggested that each company should interchange inbreds carrying the monogerm character so as to bring together material with a broad base of inheritance.
3. Dr. Rietberg offered to exchange material carrying any disease resistance character which they have available.

4. Brewbaker suggested that we all make a search for monoploidy. He stated that Dr. Oldemeyer (Great Western Sugar Co.) has found several twin seedlings, one of each pair being a monoploid (3 identified to date). Monoploids offer a method of producing entirely homozygous lines in one generation, in case they can be successfully selfed.

5. Dewey Stewart stated that leafspot x monogerm hybrid material which he has made from F_1 hybrids made by Dr. Savitsky will be made available to the industry. This material is Savitsky F_1 (made between L.S.R. 216 x monogerm 101) backcrossed to L.S.R. 226.

6. Brewbaker and Dextator stated that the correlation between Na content of the root and sugar content had not proved to be so close as to indicate that selection for one would eliminate the need for consideration of the other character. Consideration of both will be necessary.

7. Rietberg stated that there was a high correlation between potassium content of the leaves and high sugar content in the root.

8. Kohls gave the following information concerning the origin of Michigan 125:

1. Kohls developed inbred
2. Used M.S. from U.S.22
3. Uses U.S. 216 for pollen parent

9. Kohls stated that the big increase in male plants or semi-male plants in increasing seed for commercial use results from the fact that male sterile population predominates as much as 10 to 1 in making increases. If one male plant is present in original M.S. population this is increased rapidly as successive increases are made. This is what has happened with Michigan 125.

10. Dr. Brewbaker reported that a complete report of their cold resistance testing procedures would be available.

11. In a discussion of breeding for Nematode resistance, Dr. Coons called attention to the fact that we would need almost complete immunity in a commercial variety. Partial resistance would only encourage poor farming practices and build higher Nematode populations.

12. It was generally felt that concentrated effort should be made to make hybrids with all wild species of sugar beets which possess resistance to Nematode. Crossing work with *B. Procumbens*, *B. Patellaris*, and *B. Webbiana*. are of particular interest.