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COLLECTION AND PRESERVATION OF FOOD CROP GERM
PLASM WITH WIDE GENETIC DIVERSITY

(Agenda Item 13.a)

TAC SECRETARIAT

FOOD AND AGRICULTURE ORGANISATION OF THE UNITED NATIONS

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The objective of this project is to preserve for the future the resources of diverse germ plasm to provide current and future plant breeders a possible genetic source of characteristics they may need in the development of food crop plants. For the most important crops, at least, it seemed the objective could best be achieved by selecting for each crop one man (a recognized authority on that specific crop) who, in turn, would select a small group, also knowledgeable about the crop, and together they would act as a committee to:

- 1) Determine the status (extent and viability) of existing collections;
- 2) Assess the need for supplementing existing collections;
- 3) Devise a scheme of documentation that would be understandable and could be usable throughout the world on the crop;
- 4) Recommend a plan that would satisfactorily provide for long-term preservation of the germ plasm;
- 5) If necessary and where possible, make recommendations for supplementing existing collections, including geographic areas, characteristics sought, and names of people who could possibly make such collections.

To date, four such committees have been formed. They are for:

- 1) Wheat, Barley and Rye - Chairman, Dr. L. R. Reitz
- 2) Maize - Chairman, Dr. W. L. Brown
- 3) Sorghum and Millets - Chairman, Dr. Jack Harlan
- 4) Rice - Chairman, Dr. T. T. Chang

The committees are comprised somewhat differently. The first three are organized. The corn and sorghum committees have met once and the wheat committee twice. The rice committee consists, at present, of only Dr. Chang. I have attended the four meetings which have been held. While this group of committees covers a relatively small number of crops produced in the world, the crops they represent comprise well over half of the world's cultivated acreage.

The first question that seems to confront the committees is determining a satisfactory description of what constitutes an adequate germ plasm resource. All realize that all existing genetic diversity is not going to be preserved in collections, but practical considerations appear to evolve into the following consensus:

- 1) Collections should provide, where they are available, primitive cultivated varieties as well as wild relatives, depending on the imminent danger to their respective existence. In this respect, the primitive cultivars appear to be more threatened than wild or weedy relatives.
- 2) Collections for long term storage should include samples of modern reproducible material or material considered to have special genetic value.
- 3) Collections of this type should not include the full scope of breeders' lines or special genetic stocks.

Status of Existing Collections:

The discussion of this topic invariably ran into some problems. Even with the groups involved with specific crops where the individuals had wide knowledge of the crops, there appeared to be a lot yet to learn about the nature of existing collections.

The entries in many collections are not well documented regarding the ultimate origin. Many items included in collections around the world are shown to have originated from a certain country when, in reality, that country was only a transient repository for the material which had actually originated in some other country. Thus, there are many overlaps and duplications, which is understandable, but at this time unidentified.

Except in some cases, viability of the collections is not well defined. Conditions for long term storage are not generally good, so viability of many collections is correspondingly not good. Plans are under way, however, in several parts of the world for exceptionally good storage facilities which will be completed in the immediate or near future.

The best single source of information on existing collections throughout the world at this time appears to be F.A.O., and this source has definite limitations in understanding what material is available in these collections. In some of their compilations, it appears that plant breeders may have entered the number of lines with which they are working, a number which, from a genetic resources viewpoint, could be extremely misleading. Many good collections are available, however. Interchange of materials seems to be generally good.

Plans for continued maintenance of these existing collections appear to vary with crop, country, and individual in charge of the collection. Outside the so-called world centers, or in some cases, national centers for specific crops, plans for continued maintenance is not generally good, being dependent primarily upon the continuing interest of an individual or a small group of individuals. Security measures are not generally good and a rather small amount of information is available regarding the longevity of seed under existing conditions.

Assessing the Need for Supplementing Existing Collections:

Priority in this category generally seemed to be on supplementing and preserving those collections of remaining native cultivars of the crops involved. Improved transportation and communication are implementing rapid transfer of new varieties of these crops around the world, and in many cases supplanting and eliminating the old native cultivars. This is particularly true in wheat, maize and sorghum.

The wild and weedy species of these crops, where they are known to exist, were generally of second priority for two reasons:

- (1) the general belief that there was less threat to the continued existence of this material than to the native cultivars;
- and (2) their potential importance.

Geographical areas not known to be adequately represented in existing collections were recommended as avenues to explore further in supplementing existing collections. The question of what is required to adequately represent a geographical area

in a germ plasm bank, like that of what constitutes an adequate collection, becomes difficult to answer in finite terms. Opinions seem to depend on the interests and purposes of the individuals involved in the discussions. The final report on these crops will include the best assessment the committees can give on what constitutes an adequate sampling and identifying geographical areas not adequately represented in existing collections for the specific crops.

Perhaps as important as the areas requiring supplemental material for an adequate collection were the discussions involving how these collections should be made. The general consensus seems to be that, with the evolving improvement in understanding by some indigenous peoples in developing countries, the need is no longer so great for foreign collectors to make specific collection trips. Training people indigenous to an area offers the advantage of familiarity with the language and the area and living in the area all the time. Most people going to a new area specifically on a collecting trip do not understand the language, are not familiar with the area, and are in the area only for a limited time. Thus, material collected can be only that material which is mature and collectible at the time they are there. The disadvantages of collections by indigenous people are that they often do not know what or why to collect, and if they do collect, do not understand a satisfactory documentation system. The need here, then, is demonstrated for some type of training for indigenous collectors which would be coordinated with plans for maintaining and preserving the collected material.

Documentation:

It appears that everyone involved in collections and documentation of them has his own system, developed primarily upon the requirements established by the purpose of his collection. The system chosen affects the information recorded, the method in which it is recorded, and the ability to recall recorded information. Systems in use have a great range in complexity. Perhaps the simplest is that of recording the desired information while collecting, then transferring it to a card which is filed for future use. The most elaborate method described is one in which all recorded data are transferred to computer memory banks from which almost instantaneous recall is available on any characteristic or combination of characteristics in a manner as simple as dialing a telephone.

Probably one of the most available and workable systems of data recording with the capability of recall is that used by the United States Department of Agriculture on wheat. This is a large collection of over 20,000 entries, well documented, with the information put on IBM punch cards to facilitate rapid recall. The general consensus appears to be that instant recall is not a necessity for plant breeders, but something to reduce the information to manageable quantities is required. Identical systems among crops or collections for the same crop are probably not essential as long as the information from the different systems is understandable and usable.

Provide Recommendation for Long Term Maintenance and Storage:

The unanimous recommendation of all committees was also that two types of collections be maintained. One would be a long term storage and preservation of material entered. This material would be increased only often enough to maintain satisfactory germination. No general distribution would be made from this material. The other type of collection would be a working collection which would be periodically and regularly regrown for observation of various characteristics and from which general distribution could be made. Each committee will make specific recommendations on this point.

It seems that without exception these committees are recommending that samples of material for long term storage be placed in the National Seed Storage Laboratory in Fort Collins, Colorado. This laboratory has been in existence for approximately ten years, has the capacity for approximately twice as many entries as are now stored there and has excellent facilities for seed preservation in a viable condition.

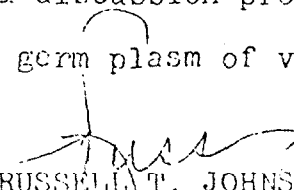
In most cases, if other good storage facilities were available, these committees would like to have the collection duplicated in another area. In the case of wheat, for example, the 20,000+ entries in the USDA collection mentioned above are maintained under good storage conditions at Beltsville, Maryland, as well as the National Seed Storage Laboratory at Fort Collins, Colorado. The working collection conceivably would be growing in several locations at any given time. These locations would be determined by the characteristics being sought by the various research workers

on a particular crop. In general, the true working collection should be grown in areas with an environment somewhat similar to the areas in which they were collected or adapted. Many of these crops, if transported into an environment foreign to that for which they were adapted, either fail to flower and reproduce at all, or where reproduction is possible, genetic drift may influence the characteristics of the material.

A problem that appears to arise in this part of the discussions is the ever tightening plant quarantine restrictions that countries seem to be imposing. These restrictions can and do affect imports as well as exports. An example is that just recently importation into the United States of several species of plants from India has been terminated for plant quarantine reasons. Howard Hyland of New Crops Research, USDA, has been contacted about the possibility of getting material into a storage facility like the one at Fort Collins without going through a long plant quarantine impoundment. Such entries could be labelled in some manner to prevent their distribution other than back to the source from which they came. He informed me they are working on the possibility of doing something like that at this time.

The reports of the individual committees will have specific recommendations which each believe will provide for this long term storage as well as maintenance for the respective crops.

This memorandum is not intended to be a report on any specific crop, but is just to summarize the general discussion problems encountered in collecting and maintaining germ plasm of various crops.


RUSSELL T. JOHNSON

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