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March 28, 1975

TO: Mr. Richard Demuth
Chairman, IBPGR

Mr. Robert Pichel
Chief, FAO/AGPE

FROM: David J. Rogers
Director, GR/CIDS Project and
Senior Officer for Documentation
FAO/AGPE

Gilbert N. Hersh
Deputy Director
GR/CIDS Project

RE: Attached Report

The following report is submitted for the information of the Executive Committee of the IBPGR and as a draft report as required in FAO contract, HQ/RF - AGP 1 1974.

We wish to call your attention to Section II. Action is requested of the Executive Committee and FAO.

GR/CIDS PROJECT REPORT

TO

THE EXECUTIVE COMMITTEE OF THE
INTERNATIONAL BOARD FOR PLANT GENETIC RESOURCES

AND

THE FOOD AND AGRICULTURE ORGANIZATION
OF THE UNITED NATIONS (AGPE)

APRIL 2-4, 1975

ROME, ITALY

David J. Rogers
Project Director
Crop Ecology and Genetic Resource Unit
Plant Production and Protection Division
Food and Agriculture Organization of the United Nations

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## PROJECT OVERVIEW

Based on the strategy that it is crucial for extensive contacts to be made with all areas of the genetic resources field and that active cooperation and involvement from these areas is of the utmost importance, the following is a center/activity description of the current status of the work.

Significant working contacts have been initiated with scientists and administrators in the genetic resources community across all functional and crop aspects. Significant crop data is being received continuously on maize, wheat (small grains), rice, groundnuts, potatoes, sorghum, beans, cowpeas, and cassava. Participation and sponsorship of workshops, seminars, and conferences has provided another means of initiating significant contacts. These contacts have often been the stimulus for invitations to continue discussions for the development of projects through site visits.

Without exception every individual contacted has endorsed the approach specified in the design of the GR/CIDS concept.

## CENTERS/INSTITUTIONS

### UN/FAO

Basic data has been provided in non-machine readable variable format. Conversion to machine readable format and data content analysis are underway. The data we have received are the following.

AGP through Dr. Brandolini, advanced genetic resources lines of Latin America Maize through 1972 and preliminary germplasm data on Southern Mediterranean collections of Maize (Italy, Rumania, Spain, Bulgaria and Greece).

We have also received AGPE data through Mr. Pichel. This includes: questionnaire file on genetic resources in global collection, 1969-1970; questionnaire file on genetic resources contact for global network, 1969-1970; the mailing list of the Plant Genetic Resource Bulletin; and agroclimatological measurements at specific stations in Latin America, preliminary data.

### CGIAR International Centers

The following is a brief description of the CGIAR centers visited and/or contacted from October 1974 to the end of March 1975.

### CIMMYT

The CIMMYT working arrangement is far-ranging. Three site visits at CIMMYT have taken place. Five CIMMYT staff have come to Boulder to facilitate various aspects of the project. The CIMMYT data received has been extensive. This includes: the maize germplasm collection files, the wheat nursery files and the maize progeny testing files. All of these have been sent for the purpose of data format and content analysis. (Further details on this project are included in, CIMMYT, page 11)

CIP

Exchange visits between CIP and the GR/CIDS staff have resulted in some preliminary information sharing. Initially Dr. Roger Rowe came to discuss in depth both our approach and his specific problem.

The primary needs at CIP are for computer assisted methods for management and maintenance of the germplasm and herbarium data information. Two primary concerns are (a) evaluation of germplasm diversity in the collection for immediate use (screening and cross selection) and planning for obtaining new material through exchange or exploration and (b) the use of computer assisted methods to accumulate and effectively display information at the decision points in the field. The availability of computing equipment is limited however. For this reason there is a great interest in minicomputers.[1]

We have recently received sample data sets from CIP for analysis of format and content. These include the germplasm collection on disease and morphological evaluation and the collector records. A GR/CIDS team is currently visiting CIP to set up specific working agreements.

Because of our work with the University at La Molina we have sought to suggest certain working relations with respect to computer access between CIP and the University Computing Center.

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[1]Please note, the term "minicomputers" as used here refers to a set of computer related hardware with a central processor having at least 32K, 16 bit words (64K Bytes) using a disk operating system and related peripheral devices.

CIAT

A discussion of joint work with CIAT is underway. Dr. Franklin, a systems engineer from CIAT, was a participant at the Maize Workshop. The bean germplasm bank sent by him has been analyzed. A GR/CIDS team is currently at CIAT discussing further areas of joint work.

IRRI

Prior to our recently completed visit to IRRI, we were in touch with Dr. MacKenzie of Pennsylvania State University, a consultant to IRRI on progeny testing. Dr. MacKenzie discussed with us his recommendations on IRRI computer hardware and software needs. We have been asked to review his recommendations for meeting these needs for possible implementation.

The discussions with IRRI have gone well and a mutual working arrangement has been suggested. Sample sets of the IRRI germplasm data will be sent shortly for analysis. When completed we will probably meet in Boulder with Dr. MacKenzie and Dr. Gomez of IRRI to develop a work program. We will return to IRRI in late July or early August.

IITA

A report/catalog on the IITA cowpea collection will be completed by the end of April. A current IITA staff member has been asked to join us in our work with the specific approval of IITA. We will visit IITA for extensive discussions in June.

ICRISAT

Dr. Rogers is at ICRISAT at the time of this writing. We will return to ICRISAT in late July or early August. (We feel it important to note at this time that discussions have evolved with other

institutions concerning sorghum and groundnuts. We have had contacts with the USDA; the principal USAID sorghum development contractor, Dr. John Axtel of Purdue University; and Dr. Varnell of the University of Florida concerning groundnuts. A verbal report on this will be made to the executive committee.)

ICARDA

We have not yet visited ICARDA but we feel it is important to speak to them soon. This will insure the development of integrated data management CIDS for their operations.

AVRC

Although we have not yet visited them, we expect to do so in August.

Non-CGIAR International Centers and Associations

IZMIR

No visit has taken place by us since June, 1974. However, work has been completed on the analysis and cataloging of initial data sets of about 3,000 collections sent to us in card format via the FAO pouch. A full report will be made to Mr. Pichel. A presentation is available to the executive committee along with operational recommendations.

BOGOR Regional Center

Dr. Rogers has just completed a visit to Bogor and a verbal report will be made if requested.

EUCARPIA

We have received germplasm data of the northern maize committee progeny tests and the southern maize committee germplasm collection records by national center. The national centers included are Italy,

Rumania, Bulgaria, Greece, and Spain. A presentation on our work will be presented to the EUCARPIA Executive Board.

TURIALBA

Although we have not re-visited Turialba since September 1973, we have had very preliminary discussions with Dr. L. Seidewitz of FAL/West Germany concerning joint assistance in developing the GR/CIDS system for Turialba and the development of an area-wide CIDS training center there.

WARDA

At the suggestion of Dr. Guy Baird, Deputy Director, Office of Agriculture, USAID, we may be visiting WARDA this June.

National Genetic Resource Centers

ICA/Colombia

Three visits were made to ICA including a team visit to install EXIR on the IBM 370/145 at the Colombian government DANE installation. ICA sent two division directors to the Maize Workshop. Specific working agreements have been proposed and are discussed below. These concentrate on maize as a focus for the institution as a whole. The problems under consideration relate to the development of an internal CIDS for integrating germplasm data flow throughout the institution, and for the integration of crop specific data bases with those from other national and international centers.

The current efforts will be to create from existing records a complete, valid data set about all maize germplasm collections at ICA. There is a specific need for installing and evaluating certain quantitative methods for use in assessing germplasm collections and making

them useful to the breeder/scientist. Dr. Pedro Onoro, chief of the statistical division, is interested in working closely with us on this problem. We have received from ICA a data set on maize germplasm in machine readable form covering 4,000 collections and using 30 descriptors.

PCIM/Peru

The PCIM visit was scheduled in conjunction with the team visit to CIP. The specific PCIM project concern at the moment is the lack of adequate computing facilities. We are exploring this situation with IBM and the minicomputer companies.

PCIM has given us their entire maize data sets in machine readable format of some 6,500 collections using 60 descriptors. We have been asked to function as a service bureau for them to answer germplasm queries posed by and to them and to perform data analysis using advanced quantitative methods to assist their breeding program.

INIA/Mexico

Discussions with INIA have been extensive. To date we have completed three visits to them and they have sent four staff members to Colorado. Their primary interest is to develop an integrated CIDS within their institute. The wheat program has been selected to be the initial target. After the initial wheat work they have expressed an interest in working jointly on their important maize collections. Joint working arrangements will be completed by May 1975.

Preliminary data sets have been supplied on the maize collections and extensive information on wheat will arrive soon. INIA, in conjunction with CIMMYT, has developed a new computer adaptable pedigree system for wheat. We have been asked to test this using EXIR.

EMBRAPA/Brazil

EMBRAPA sent two staff members to Colorado for the Maize Workshop, the chief of systems development and the chief for genetic resources coordination. (The EMBRAPA problem is described on page 18) A working agreement with them will be discussed during a field visit with the genetic resources chief in April or May.

We have received from them a pilot data set on the future maize germplasm collections.

USDA-National Seed Storage Laboratory (NSSL) and also

Small Grain Center/United States

Two visits have been made to the National Seed Storage Laboratory and one to the Small Grain Center. We have from the NSSL a full data set on magnetic tapes for their complete germplasm collection inventory. The USDA has further provided complete machine readable data sets on their wheat germplasm collection, barley germplasm collection and bean germplasm collection.

UK-PBI and Reading/United Kingdom

We have made one visit to each of the British centers. We have received from them data on their wheat germplasm collection.

FAL/West Germany

Dr. Lothar Seidewitz spent several weeks in Colorado discussing his work and our mutual interests. We have tentative plans for a visit to FAL this summer. We have received from them in machine readable format, data on their present germplasm collections on several crops. Through the Wheat Workshop we have reached an accord on certain aspects of descriptor standards as proposed by Dr. Seidewitz (see page 20)

Additionally, we hope to complete visits to genetic resources centers in Italy, Czechoslovakia, the USSR, and Nigeria in the near future.

Workshops/Conferences/Seminars

Major input by the GR/CIDS team at the following described workshops and conferences has not only provided a means for disseminating information and generating responses about the GR/CIDS project but it has often led to follow up invitations to visit specific centers and personnel.

The following conferences have been completed during the early part of this year: MAIZE (see page 14), WHEAT (see page 20 ), and SYSTEMS DESIGN (see page 29 ).

Additionally, an initial seminar was held with the US National Center for Atmospheric Research. It concerned our work and their interest in agroclimatological problems. They have assisted us at the outset by providing their world mapping systems which are used extensively for world weather mapping and for creating climate models.

The following workshops are currently in the active stages of planning: the International Wheat Conference/Leningrad (see page 20); the University of Florida Conference on Groundnuts, planned for July 1975; a Quantitative Methods GR/CIDS Workshop; a seminar for USAID/Office of Agriculture, Office of Nutrition on GR/CIDS; and jointly with CIP a Potato Germplasm Workshop for late 1975.

The following workshops and conferences, although not under our sponsorship are ones in which we have recently participated: CGIAR Centers Conference on Computers for Comptrollers; USAID International Sorghum Conference; USDA National Germplasm Coordinating Committee

Meetings; Passo Fundo Regional Workshop on Wheat; El Salvador Regional Conference on Agricultural Development; USAID Germplasm Contractors Meeting; and a Workshop at Bogor.

## CIMMYT Projects

A detailed working relationship in the area of wheat and maize germplasm is the outcome of project negotiations with CIMMYT. They have requested advice and assistance in computer utilization focusing on the development and use of the minicomputer for genetic resources work. Included in these considerations are the various agreements with IBM of Mexico for computer based assistance. We are primarily working with CIMMYT on the maize germplasm banks emphasizing the development of a complete data base.

The data base was being prepared by Dr. Robert Bird, a Rockerfeller Foundation Fellow at CIMMYT. Due to organizational and management difficulties CIMMYT agreed that the GR/CIDS team would assume the project responsibility. Dr. Bird was then assigned to work with us to continue and complete the data base under our direction (see page 16 for further development on this project).

All those in the maize program have clearly stated a concern that cannot be ignored. They have unanimously expressed that the germplasm bank as it exists now represents the least of their immediate problems. Other problems concerned with the evaluation and use of working germplasm had to be solved first or the bank would not be used effectively within or outside of CIMMYT. It was succinctly stated by Dr. E. Sprague that the top priority in the maize program was the continued development and integration of the international progeny testing program. This was to include all the program aspects such as the installation of a minicomputer at CIMMYT and the development of attendant back up computing systems in Mexico and the US.

Backup resources would have to be exceptionally reliable because progeny testing is the most important central core of the maize program work at this time. Integration would definitely include the development of the genetic resources bank. This would provide material to the progeny testing program as well as receive the results of the program.

Since our work on minicomputers had concentrated on the USSR Wheat Conference, this represented an opportunity to immediately develop and transfer the work toward solving a core problem at an international center. The CIMMYT problems are very similar to those encountered at IRRI, CIP, CIAT and IITA. Thus CIMMYT is providing a valid opportunity to work under the real pressures of a working center environment in a model experience.

CIMMYT has some similar problems with their international wheat nurseries. Dr. Finlay has pointed out that these working genetic resources collections present problems as important and complex as those of the germplasm base collections. Work will be done to assure that the current data system is operationally integrated within CIMMYT. This will be implemented first on large scale backup computers at IBM, Mexico. Eventually the computer program will be developed for use on the in-house minicomputer to be installed at CIMMYT.

The work with CIMMYT has provided a test base for determining the interest of IBM and Hewlett-Packard, important multinational corporations, in assisting with the genetic resources project. Negotiations by the GR/CIDS team have enabled the following: The Mexican Science Center of IBM has provided one hour of computer time on the large IBM 370/158 in Mexico City; one-third time of a principal systems programmer, who had been loaned to us previously in connection with the

transfer of EXIR to IBM equipment (see page 29); and open access for certain CIMMYT personnel to the IBM computing center with immediate access privileges.

Discussions are underway with Hewlett-Packard for assistance in the development of genetic resources quantitative methods on minicomputers. CIMMYT would be used as the pilot center, as it is anticipated that the same problems will arise at other CGIAR centers and many national centers.

## Workshops and Related Project Sets

The following is a brief report on the workshops on wheat and maize held in Boulder during February 1975. Both had the similar purpose of presenting the GR/CIDS concept for comment and criticism. Cooperation was sought from the participants through our hope that they would participate on one of three operational groups. The workshops were considered a beginning in joint efforts.

The workshops differed in the specific accords or projects which were to be derived from them. The maize group was to determine and define accords for continued work, center by center. The initial responsibility of finding a common project concept would be left to the GR/CIDS team. The purpose of the Wheat Workshop was to assist in presenting critical ideas and recommendations to the Leningrad conference and to begin at once on implementing certain project concepts.

### Maize Germplasm Project Set

The Maize Workshop reached no resolution concerning any descriptor standards. All aspects of plant description were left to the individual worker with recommendations for using the MKS system whenever possible. A need was identified for detailed studies on the use of descriptors/characters in all maize GR functions now and in the near future. This study could be implemented through establishing a working group on germplasm material and data. An immediate project will be the development of observation/measurement standards for descriptors. This has not been worked on in the past. (see page 20 ) Another working group was to be formed for the study of useful and available computer assisted quantitative methods--how these could be obtained and transferred

effectively to centers that could use them. (see page29 ) A third group would assist in investigating the methods establishing a network of communication and exchange for maize data and germplasm. This would include an analysis of the blockages to such communications exchange and the probably pressures placed on the network to meet the changing demands from genetic resources workers across all genetic resources functions.

Seemingly the most critical problems to emerge from the workshop deal with motivating the operating scientist at every genetic resources function, to use the data and germplasm banks effectively. To do this, blockages must be understood and the data/germplasm bank system must be made responsive to these reasons for blockage.

Resultant from the workshop, the following are brief reports on specific maize projects that have been discussed. They represent projects that are at some level of planning or execution at the present time.

The overall project goals are to bring essential maize germplasm collection information up to maximum availability and validity. This will be done by integrating all the available data from many sources for use at each center. This includes data from previous evaluations.

With the data base, the current inventory in the genetic resources collection can be carefully checked and reviewed. Subsequently the maintenance methods and systems can be evaluated so that the germplasm bank maintenance information systems can be updated to allow for computerized control. A basic center specific catalog can be developed to test new methods of cataloging genetic resources information. Futhermore, the data bank can be used to explore the reasons for its non-use, within the center and at other centers.

Then data bases from several critical centers will be combined using maximum descriptor methods (include all descriptors defined by all workers). Necessary conversions will be made based on the specified standards for measurement. This combination will be used to make geographic mappings of areas collected and to calculate indices of genetic diversity by a number of methods. This information and basic exercise will be used as input to standardize descriptor definitions, to measure standards and evaluations, and to meet collections requirements.

Currently the following centers are participating in various stages of this work: CIMMYT, ICA, PCIM, EMBRAPA, and INIA. Each has a specific type problem, one that is applicable at many other centers with important germplasm collections. We seek to work on each of these type problems and basically we have been invited to do so. The following is a center by center description of the type problems within our focus.

We have been directing Dr. Robert Bird of CIMMYT to complete a selection and integration of data sets about the CIMMYT maize germplasm bank from a number of sources. This will produce an extensive data base about the collections and allow for an examination of the validity and format of the available information for internal and external use. An evaluation pattern can thus be devised which will make the bank a more integral part of the internal operations.

ICA in Colombia has the major collection of Andean Maize. The extensive collection information is incomplete in machine readable format. Access to critical information on the collection is poor. Much of the information resides in journals, field notebooks and in

the memories of certain operating scientists. The task is to systematically gather this data and then to implement the program at ICA as described for CIMMYT.

Two other essential parts to the ICA operation are the training of national personnel to carry out this task and the use of personnel to assist other centers in Latin America. Because ICA is an integrated national center with multicrop responsibilities, they desire to see this approach used throughout the institute. A critical problem that ICA wishes to address is the blockage to use of the germplasm collections. This includes entry of material to the collections as well as extracting material from the collections. As with CIMMYT, the personnel at ICA view this as a major problem within every center and among different centers. The problem of blockages will need to be attacked as a group effort.

The PCIM collection contains important Andean material including lowland material that complements the ICA collection. It is the most useful collection we have in terms of machine readable data, collection utilization and amount of information available about the collections. However, the problem is that the available data within the current descriptors do not meet the total and immediate needs of the breeders. There is a need for priority scheduling, taking into account that resources are scarce for the evaluation of extensive collections for new descriptors. The feasability of using certain genetic resource quantitative models will be tested to establish reliable empirical relationships among currently evaluated descriptors with other desired descriptors that have been less extensively evaluated.

EMBRAPA/Brazil is a newly formed organization. Among other things, it has been given the task of coordinating all agricultural research work. One individual has been charged with the responsibility of pulling together the diverse but important genetic resources collections, especially on those plants which have considerable genetic variability in Brazil. Maize is viewed as one of these crops. Although the problems at ICA and CIMMYT are similar to the one at EMBRAPA, the Brazilian one is even more complex.

There are many centers with maize collections and the necessary data is recorded in diverse recording formats. It is essential to coordinate the data at each center with the germplasm and then to create a central collection or a network. This problem represents in microcosm the network in maize and other crops as well. Brazil is interested in cooperating and they have the funds to do this work. They are also willing to coordinate their efforts with other centers.

INIA in Mexico has a very important collection of maize. Portions of the collection are in the CIMMYT collection. It represents an integral part of the overall maize diversity. The INIA collection is documented in a number of journals. None are machine readable. Further, there is some resistance to participate. The stated concern is that INIA will not be credited for their collections and will lose control over their collections if they enter their data in a network. These concerns probably express only a portion of the latent concerns. The INIA concerns (fears) of entering data and material into some international collection must be solved. Probably this could be done by providing assistance to them for publishing a catalog similar to the CIMMYT one, giving them credit for their own collections.

At the director level, INIA has indicated that these problems need to be solved. However, there are higher priority problems than the maize collections with which they would like our assistance.

For other maize collections, each center will be asked to remit the names of those who hold portions of critical collections to make this overall project meaningful. These individuals will be contacted and once their problems are assertained, they will be invited to join the project.

As a natural progression of the work, we recommend that an international maize germplasm conference be held. We suggest that the input for this conference come from several workshops to be held strategically as the project develops. The basic purpose of the conference would be to discuss in detail certain problems concerning evaluation, collection, exchange of information and material, descriptor measurement standards based on this experiment, and to cooperatively develop ways to resolve these problems at the conference itself. It is suggested that the conference take place in late 1976.

In the interim, the GR/CIDS team will attempt to identify and mobilize resources, especially from the multinational corporations, and possibly from some of the larger multinational and national development agencies to assist in funding the maize project set. This includes field methods in management training and supervision, to help in the preparation of data, optimum design and execution of evaluations, etc.

The maize germplasm project would serve as a prototype for other crops which may have similar coordination problems.

Wheat Germplasm Project Set

The preliminary concepts, which are very tentative at this time, emanate from the Boulder Wheat Workshop. Some of these concepts will be presented in greater detail at the Wheat Conference in Leningrad. Other ideas and concerns must be brought in from the Passo Fundo regional wheat meetings and other mini-workshops which will be held prior to the Leningrad meetings.

Certain accords have been reached on recommended descriptor reporting standards and data reporting formats. These follow the Seidewitz proposal as endorsed by EUCARPIA. Specifically they are:

(a) Whenever a relative scale descriptor is used, a code will be assigned to the observation state in the increasing order of empirical expression of the characteristic beginning with the minimum or weakest observation state. If code numbers are used, the range will be from one to nine. Alphanumeric character codes may be used as for disease/pest reactions. The range will be from hypersensitive to immune with as many steps as required.

(b) Regarding data transmission, for non-machine readable data a written matrix will be used. An 'item' or accession or collection will be row data with each marked column representing a descriptor/character state.

For machine readable data, the use of punched cards is discouraged for international communication. Magnetic tapes should be nine track, external BCD with standard labels, 800 BPI; card images constituting an entire item (accession) with as many cards as required in sequence. The testing of images is to be included, with tape or paper. A clear legible carefully prepared statement must accompany

the data. The statement must carefully define the descriptor as to: name of descriptor, observation/measurement methods, method of recording, location and length on columnar or card images, location in file.

The substance of the discussion at the workshop was concerned with the development of a set of minimum recommended descriptors. It is essential to choose the minimum set of descriptors for a systematic reason. The minimum set specified is to provide sufficient data feedback to allow for the mapping of location of collection sites and to measure quickly the genetic diversity of collections. The minimum set of descriptors are also to provide basic information for collection identification as it is processed, evaluated and distributed.

Beyond the minimum set of descriptors it was decided that each worker/center would determine the descriptors and characters to be evaluated and used. Evaluations must be standardized to assure data validity and precision. Data must enter the information system as part of the centers' function and from there to the international network. The technology to do this is available and the GR/CIDS team is willing to explain and assist in the transfer of this technology to the centers.

Participants at the conference debated on whether the backlog of basic data should be made operational before the current data in germplasm collections is brought up to an operational level. On the one hand, knowing what is in a collection and what can be made available for mapping and diversity functions can lead to better planned and executed research. On the other hand the loss of current material is happening at such an alarming rate that it is necessary to record as much diverse current information as possible. It was pointed out that it would be ideal to proceed along both lines if possible.

An interesting discussion accompanied the above debate. It was felt that the subjective and expert opinions of collectors concerning the diversity of germplasm within an area was all the information needed for future collection planning. It was then pointed out however, that data studies using various computer assisted diversity techniques have demonstrated that expert opinion was often very incorrect in these matters. The GR/CIDS personnel pointed out that there are methods available for recording subjective opinions and that together with objective data these could be used in analyzing collection planning.

To this end, the group decided to encourage all who had important collections to contribute both their data and their subjective judgments. A standard letter was developed from one of the workshop sub-groups which was sent to the participants' colleagues seeking their immediate support. The GR/CIDS team will coordinate the information data flow and analysis to present this at the Leningrad meeting as a continuing project recommendation.

There was further concern that work be done on developing useful diversity models and subjective judgment analysis models. What is currently available however is to be used immediately.

Review of Strategies

We have presented our overall mission and specific points of strategy for accomplishing this mission to over 250 genetic resources related personnel to date. In all instances we asked for criticism and recommendations. From these we have revised certain points but in general the operating strategy has been approved and reinforced by these contacts. We wish to restate critical points of approach.

1) There is an operational GR/CID system. Although informal and poorly defined, it is changeable.

2) The primary mission is to change this current system to make it as effective as possible, constrained by currently available technology including management/organizational techniques, real international politics, and funds available.

3) The process of maximizing effectiveness is implemented through systems analysis, systems design/development and transfer. The objective is to do the systems analysis by using currently available and immediately transferable technology/methods on real problems at the places where the problems have to be solved.

In short, the process of improvement begins with an immediate attack on visible problems with the techniques at hand. Development follows with an emphasis on fast, effective utilization of techniques.

4) To accomplish this, the primary entry points into the GR/CID system are individuals or groups at the various operational centers. It is necessary to work with them first on the specified problem set to fully understand their concerns and fears. The solution to a problem is far more than the mere availability of a technique.

5) From the first problem, care is taken to proceed in a systematic way to other more general problems. These problems and designed solutions are to be linked with other genetic resource personnel with similar problems in the center and then among centers. This begins to define a real network.

6) The effort must be fully cooperative--respecting the ideas and solutions generated by each individual working on the problem within the network. Individuals must feel the need to cooperate. Full credit will be given to all those involved in the process.

7) The work of coordinating, planning and executing must be flexible and systematic to focus on the problems which actually are the basis for blockage for the continued improvement of effectiveness of the GR/CID system.

Further, the coordination, planning and execution must examine the future demands that will be placed on the system and to assist in design and execution of a system that can be effective and responsive in the future.

The Network Concept for Communication/Planning

As previously stated, the beginning point of operation is the current informal network. To be understood it must be analyzed to thus determine where and how to enter the network for implementing changes that will result in improved effectiveness. To do this it is essential to get assistance from operating members of the network who can facilitate introductions to other members for gathering more information. Through proper introduction, interviews and carefully constructed questionnaires and sets of data being used in genetic resources work across all functions, it is possible to understand the system and find entry points for making improvements.

We are now preparing network lists provided by the network members (through the workshops and site contacts), the 1970 FAO/AGPE base genetic resource collections questionnaires, and associations and publications lists. We hope to use the IBPGR members and FAO staff systematically for such introductions as well. This will be presented at the May meeting.

Specific center based (real) projects are being designed to fit into larger multi-center project sets, as with the maize and wheat projects described earlier. Such project sets are crop related, in some instances also regional. Each project set, based on the crop must somehow interface with CGIAR centers having a crop 'responsibility". At this point significant problems arise.

We have found differing opinions at the CGIAR and regional centers regarding the understanding of their role in the network system. Some see their role with a coordination view. Others see themselves with the direct control of the network for that crop. We have made

no attempts to argue the merits of individually stated policy ideas. We have tried to find the means for working with each within the context of their stated policy. The maize and the wheat projects at CIMMYT are based on a specific type of network operating policy as expressed by Dr. Finlay and Dr. Sprague. (Their stated policy is to assist and use good offices and to offer no control, and in fact little coordination.) As we work with other centers our policy approach will undoubtedly change. We would at this point, however, like further clarification from the board on the issue of CGIAR centers' control over access to the entire network for a particular crop.

Furthermore, there is evidence of some resistance on the behalf of certain national centers to cooperate in a network which may be dominated by the CGIAR center. An analysis of this problem area is not yet complete but we hope to have it by May.

Data/Germplasm Material

From the workshops and various contacts, a working group on Data/Germplasm Material has been established for each crop and in general. Our collective thinking at the current time is expressed here. It is open to change. The working group will increase as other contacts are made.

In each instance we have asked the center or institution with whom we are working, to provide actual data sets as they exist and as they are currently used. The information about the data sets in conjunction with how they are or are not used and the desires of the personnel at the center are incorporated in an analysis of the data system. This allows for the development and installation of the best method of a CIDS at the specific center. Through the data and

related information it is possible to demonstrate how centers communicate to strengthen their operations inhouse and with other centers. Although we have no preconceived notion of the necessary design of the data sets, we do feel that from an analysis of what is currently being done, recommendations can be made in critical areas.

We suggest that standards be established in the method and precision of recording descriptor character data. For example, a simple stick drawing could be used to delimit the external points of measurement for an ear of corn. A statement could accompany this, indicating the measurement device, perhaps a centimeter scale and the nearest estimation to which it is taken.

For descriptors whose observations are relative observations and not made over a period of time, the above also applies but the standard used would be one to express order of expression of the descriptors. For example, disease reaction for a specific disease could be noted on a scale from hypersensitive to immune reactions.

A third suggested strategy is that once methods of measurement and precision are specified, a descriptor name could be given to an observation set. This could be clearly recorded and sent to the GR/CIDS team.*

In this way for each genetic resource function and for each crop, a minimum set of descriptors and a minimum set of descriptor definition standards could be established by some collective cooperating group. Each center could if they wished choose their own descriptor

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*The center making use of this descriptor standard would need to follow it carefully.

standards as long as they were well defined and clearly recorded. Blanket international standards, even minimal ones, are not entirely useful. To be useful, minimum standards must exist for a collective group that has a reason to work together. Hopefully for certain tasks, these collective groups will encompass the entire genetic resources community.

This approach allows for considerable flexibility. By directly working with what is available at the current time and by encouraging cooperative involvement, a basis is provided for leadership through a central information system. This is accomplished without superimposing difficult restrictions. For the most part, data transmission channels will occur via the international post. The FAO can play a central role through the use of pouch service for critical data communication when it is capable of handling the load. Suggestions on the format for data communication should be exact and rigorous. These will be specified in detail as they are developed.

The subject of quarantine and germplasm flow is of critical importance. It presents some very difficult problems. Clearly, the data flow is easier to facilitate but may be meaningless in many cases if material cannot follow that data. The contractors at the USAID germplasm conference have requested us to highlight this imperative need to the international board. We want to work closely with a special group studying this essential problem.

Computers and Quantitative Methods

It is clear that in most instances the computer is becoming a necessity in genetic resources work. The limiting factors often are inaccessability to adequate computer equipment and to adequate software and problem solving programs. It is our intention to assist in solving these problems by making information available on both computer equipment (hardware) and programs (software). With respect to the minicomputer, we will make our expertise available for systems installations for genetic resources work.

We will also make available our information on programs and software for genetic resource functions on larger machines, Specifically, we will do all that is required to transfer those programs and packages, such as EXIR and others, to provide useful tools in specific genetic resources functions. In fact, the first two installations of EXIR onto available computer equipment has been accomplished at Mexico and Colombia.

To assist in this work, a working group on computers and quantitative methods has been formed among the genetic resources workers who have attended our workshops. We will work closely with them to determine a specific work program. It must be made clear that the basic attempt will be to make accessible, including instruction in its use, all the information that is currently operational and available. Refinements and development will be undertaken as needed. External assistance from a number of sources, especially IBM, will be sought for this implementation.

To this extent, the IBM corporation is apparently willing to make a major contribution through their science centers and through their systems experts. They may be willing to assign development

personnel to work with us. The personnel who have been assigned to us by IBM to date are being used to assure that the programs already available such as EXIR, will be compatible and transferable to IBM equipment. It is probable that IBM will be the equipment currently available in most areas of the world. For that reason the IBM personnel currently working with us have also been making sure that the programs will maximize the use of IBM hardware and systems design. The initial IBM assistance will provide the links among programs that are already available and take advantage of the IBM systems architecture. Such links are of major importance in providing a genetic resources set of computer programs to accomplish a number of tasks.

The work on the minicomputers is also important. In most instances the minicomputer can provide considerable and inexpensive computing capacity to a center whenever access to a larger machine is limited, unreliable or impossible. In the future such 'stand alone' operations may change as access to large equipment becomes more feasible. Thus, the minicomputer could serve as an 'intelligent terminal' to the larger machine. This would provide greater efficiency to the center and its computing abilities.

With respect to computers and quantitative methods in GR/CIDS, one of the most important services is to transfer the capacity to use computer assisted methods to the operating scientist. This means much more than the delivery and installation of a program. The instructional material needed to solve problems, not merely to describe the program, must be written and presented.

We are now working in this area and expect some considerable success both with regard to EXIR and other important programs.

We have worked with Mr. Hal Kanters, a consultant to FAO in manning the installation of EXIR and other packages at FAO in the near future. Problems of the operating environment and scheduling were also discussed.

## REQUEST FOR ADVICE/ACTION FROM IBPGR/FAO

Administrative/Budgetary

During the final preparation of our contract request for the GR/CIDS project, the University administration informed us of statewide changes in personnel policies (staff) that would affect our project costs. These changes resulted from regulations controlling the starting dates of staff appointments, changes in staff salary structure, and substantial increase in the cost of living increment. The net effect of these policies would be to change (increase) our costs for salaries and benefits by $12,000.

We discussed this problem with Mr. Demuth and he recommended that we stay within the Executive Committee approved budget of $212,000 until we could present our request for an increase at the April meeting. We made a series of budget adjustments in order to implement his suggestion. These changes will affect the operation of the project shortly, and thus we request an amendment to the contract of $12,000. as described below.

| Category | Inital Request | Contract amount | Present Request | change |
|---|---|---|---|---|
| Travel | 20,000 | 16,500 | 20,000 | +3,500 |
| Trainee/Center support | 10,000 | 2,250 | 8,500 | +6,250 |
| technical material prep | 13,250. | 11,000 | 13,250 | +2,250. |
| | | Net request | | +12,000 |

The Maize and Wheat Workshops were designed and scheduled with costs to be charged to the GR/CIDS contingency fund. Unfortunately, this involved a series of misunderstandings about the use of the cash fund.

Upon discussion with Mr. Demuth, it was decided to hold the workshops, charging expenses to the GR/CIDS contract, with the request/recommendation that the executive committee approve the transfer of these charges to the GR/CIDS contingency fund at its April meeting. Below are the statements of costs for both conferences.

| | |
|---|---|
| Maize Workshop | $9,850.00 |
| Wheat Workshop | 3,150.00 |
| TOTAL | $13,000.00 |

Cost Figures for IBPGR

March 25, 1975

Maize Conference

| Category | Cost Figures |
|---|---|
| Air Travel | $6,227.00 |
| Per Diem* 8 people 7 days @$33/day 3 people 10 days @$33/day | 2,838.00 |
| Local Travel | 177.00 |
| Translation/recording & support personnel | 158.00 |
| Hospitality | 190.00 |
| Other Cables | 260.00 |
| TOTAL | $9,850.00 |

*This covers all hotel, conference rooms, aids, meals at hotel.

Cost Figures for IBPGR

March 25,1975

Wheat Conference

| Category | Cost Figures |
|---|---|
| Air Travel | $1,805.00 |
| Per Diem* 7 people 4 days @ $33/day | 924.00 |
| Local Travel | 77.00 |
| Translation/recording & support personnel | 143.00 |
| Hospitality | 142.00 |
| Other | 59.00 |
| TOTAL | $3,150.00 |

*This covers all hotel, conference rooms, aids, meals at hotel.

## POLICY CONSIDERATIONS

We would like to submit for your consideration the following policy issues:

1) An extension of the terms of reference of the IBPGR to include our present work. If this is not possible we would like your help in arranging for a direct presentation to the CGIAR.

2) A clarification on the role of the international board vis a vis the CGIAR funded centers regarding the control of access for national centers according to crop responsibilities.

3) Requested additional contingency funds from the IBPGR(*)

4) Approval to seek additional resources on a project basis(**)

5) Decision on an International Maize Conference for the end of 1976.

(*) Initially, a special resource fund of $25,000 was established for 1975, to assist in transferring or assisting various centers with data preparation, installation and use of systems, etc.

We have requested charges to this account for the workshops conducted. These are part of the beginning developments of specific projects with various centers. It has been suggested that the University of Colorado salary cost adjustments also be charged to this account. This would bring the account balance to $0.

We have proposed several projects which integrate into crop/network concepts. These are viable and there is considerable interest in getting on with these projects. In fact, the interest and desire to work on these problems is greater than we had envisioned. National centers as well as as CGIAR centers are willing to commit most of the

resources needed to execute these projects.

What is needed is a small amount of seed money to catalyze a specific project within an institution and to get it moving in a faster time frame. Often the scientists are eager to work jointly and quickly but the administration is slower and less likely to respond as fast. The use of such seed money also raises the projects to a level of visibility within a larger institution.

It is requested that if possible, the $25,000 amount be reinstated to execute within this year the maize and wheat projects suggested. It will also allow us to move into the groundnut project, the rice project and to respond to the request by CIP earlier than otherwise possible.

This fund should be considered a contingency fund for virtually any purpose. It should be controlled as set up in the contract with FAO with the endorsement of Mr. Demuth when using the funds for a specific purpose.

(**) Because it is likely that there will be an acceleration of such projects around the world and across all crops, the seed money is of great importance. Even with seed money it may be necessary to augment these projects--especially the ones dealing with data backlog and specific integration of a CIDS into a center. The amount needed may be considerable. Mr. Demuth has noted that it may easily surpass the resources of the board in the near future. To this end, we request permission to approach several multinational and national foundations and funding agencies to make specific funds available for the transfer and data related operations in various international and national centers. This may include training for CIDS/Data related personnel. We would suggest that the IBPGR assist in coordinating the use of these funds when granted.

# DRAFT PROPOSAL

TO

THE TECHNICAL ADVISORY COMMITTEE

FROM

THE INTERNATIONAL BOARD FOR PLANT GENETIC RESOURCES

PREPARED BY THE

GR/CIDS TEAM

## INTRODUCTION

This document is a draft of a preliminary proposal for the International Board for Plant Genetic Resources (IBPGR) to the Technical Advisory Committee (TAC) of the Consultative Group on International Agricultural Research (CGIAR) to seek guidance and support in expanding its terms of reference.

Stemming from the investigations being conducted by the Genetic Resources Communications, Information and Documentation System (GR/CIDS) team, important considerations have emerged relative to the role of the IBPGR. If it can be seen from these considerations (discussed below) that to meet the objectives of the IBPGR, it may be necessary to expand into data management programs of more broadly defined genetic resources functions, then IBPGR may wish to carry such a proposal to TAC. At a minimum, the International Board's terms of references need to be clarified as a result of field studies on several crops at various agricultural centers.

## GENERAL BACKGROUND

The IBPGR's major terms of reference are to provide the means to collect and conserve food crop genetic resources* for those crops and from those regions where there is the apparent possibility of losing these crop genetic resources. Implicit in these terms of reference is a close cooperation between the IBPGR and international, regional and national agricultural centers. These centers, and the individual scientists employed in them, become a network (although the network is only partially defined at the moment). The goals of this network include the activities of collection, maintenance, conservation and exchange of data and plant germplasm materials, although the strategies

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* Genetic resources, broadly defined, are those viable propagules of primitive races, near-wild relatives, selections, varieties and advanced lines of the cereals, legumes and other types of crops necessary to continue improvement of food production.

for directing these activities are still in the development stage.

## OBJECTIVES AND WORK OF THE GR/CIDS TEAM

As a part of the work defined by the terms of reference of IBPGR, the International Board has given a contract to a GR/CIDS team at the University of Colorado under the directorship of David J. Rogers (who is a member of the professional staff of FAO). The objectives of the team (as presently conceived by IBPGR) are:

1. To investigate and define the current operational genetic resources communication, information and documentation system.
2. To update the current system to make it more effective.
3. To link these goals to the promotion of an international network of genetic resources activities.

The team is composed of biologists, computer programmers and systems analysts and operates under the guidance of management, information and biology techniques. It is guided by the IBPGR and FAO through the Crop Ecology and Genetic Resources Unit.

The program strategies of the GR/CIDS Project are:

1. Work with individuals and groups at the various operational centers.
2. Utilize currently available and immediately transferable technology on real problems.
3. Develop project sets that are problem and crop specific.
4. Apply computerized methods to the GR/CIDS activities of centers.

There is an implicit concept in the development work for CIDS - the system that is developed must provide continuous feedback of information from the many centers to the IBPGR to provide assistance for the Board's decision and policymaking process. This feedback mechanism aids in insuring that information about the overall genetic resources functions, as they exist in the field, can be used by the Board to guide its continuing activities.

## GENETIC RESOURCES FUNCTIONS

As a portion of the work plan for the CIDS contract, the team has been required to contact each international center, the regional centers, and many national centers* that must be necessarily involved in the network related to the International Board's objectives. From visits to the various centers and from crop data workshops held at the University of Colorado and elsewhere and from a wide array of personal contacts with genetic resources workers, we have defined the interrelated functions in genetic resources as follows: (Please refer to attached chart).

The priority functions of IBPGR are those first listed on the chart: exploration/collection, maintenance, evaluation. Our findings from the visits made (and from much past experience of the team members) indicate that the priorities of the centers are, in general, different from the priorities of the International Board, though the functions listed in the chart are generally established in most centers. By and large, the priorities of the centers are those functions on the chart concerned with breeding and utilization (or crop improvement). The centers' priorities for the first-listed functions (exploration/collection, maintenance and evaluation) are secondary functions of the centers. For example, there are centers that were

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* The international centers so far visited are: Centro Internacional de Agricultural Tropical, Centro Internacional de Mejoramiento de Maiz & Trigo, The International Potato Center, International Crops Research Institute for Semi-Arid Tropics, International Institute of Tropical Agriculture, and International Rice Research Institute. The regional centers (organizations) are Izmir and EUCARPIA. The national centers are: Instituto Colombiano Agropecuaria, Instituto Nacional de Investigaciones Agricolas, Programa Cooperativo de Investigaciones en Maiz, Empresa Brasileira Pesquisa Agropecuaria, Centro Nacional de Pesquisas y de Trigo, Agricultural Research Council/United Kingdom (Plant Breeding Institute), Institut Pflanzenbau FAL (West Germany), Consiglio Nacionale delle Ricerche, United States Department of Agriculture (National Seed Storage Laboratory).

designed and built without cold-storage rooms. The contents of germplasm banks are not well known by center personnel. Evaluations are incomplete and data is often inaccessible.

PROBLEMS OF MERGING IBPGR PRIORITIES AND OTHER CENTERS' FUNCTIONS

To discover how the International Board's priorities and the priorities of the centers could be merged, and how the data management aspects could assist in making these mergers, we have investigated some of the major problems that stand in the way of improving those genetic resources functions of primary concern to the IBPGR. These problems may be categorized as follows:

1. Breeding and utilization functions seldom can make use of any genetic resources that may be stored in a germplasm bank unless individual accessions stored in the germplasm bank have already been evaluated in field trials and laboratory tests so that the breeding program can achieve more successfully any of several objectives (usually a long task, over several years).

2. The germplasm material that has either already been collected (is now maintained in storage), or new genetic resources collected, are very poorly documented. The data describing these collections are either not available or were placed in forms that are impossible to retrieve readily. There is therefore little opportunity to use the unknown accessions in breeding/improvement.

3. At center after center we discovered that those scientists in charge of the genetic resources banks are frustrated by the non-use of their stored material. Seldom do the breeders request seed material to start their breeding programs from those accessions in the banks because the qualities of materials in the banks are unknown to them. The breeder cannot know what value or what problems will arise if he starts his breeding program

with unknown materials. Thus, there is no great impetus at the centers to spend time and money on further collections of primitive materials or to use any similar collections already existing.

From our investigations to date it seems apparent that there must be a coordinated flow of data and an expanded role through all of the genetic resources functions from initial collection onward to achieve the desired objectives of IBPGR as far as the CIDS program is concerned.

POTENTIALS FOR INTEGRATED PROJECT DEVELOPMENT

An expanded role for CIDS can best be exemplified by two actual projects under cooperative development. These are: (I) IRRI's recently-achieved problem-orientation for rice improvement, referred to as the Genetic Evaluation and Utilization (GEU) program; (II) The Joint Maize Project between CIMMYT and four Latin American national centers (Colombia, Peru, Mexico and Brasil), and the CIDS team.

Close cooperation between breeders, pathologists, agronomists, and the rice germplasm bank has been initiated at IRRI. This has demonstrated to the scientists that their major problem of thoroughly integrating their activities is one of data management and includes those data describing the genetic resources of rice now in their storage units (as well as new accessions continuing to be incorporated) and the other functions listed on the accompanying chart. IRRI is fully prepared to develop their information management system, in cooperation with the CIDS team, if there is an opportunity to do so.

The Joint Maize Project also incorporates several data management objectives that are agreed upon by scientists in the named centers. These are: (I) To develop a description of the functions and activities of the network of persons involved in maize work that could lead to improvement of

communication and exchange of data and material in the maize network, and to serve as a model for other crops. (II) To determine the amount, kinds and quality of information that currently exists in maize germplasm collections. (III) To determine the types of germplasm and environmental data used and the standards required in measurement of these data for the functions of genetic resources work, including exploration/collection, maintenance, evaluation, improvement and utilization. (IV) To re-evaluate existing germplasm collections to improve the data presently available, and (V) to improve the availability of data on maize germplasm collections within the network of the centers and scientists.

These two projects serve as models for development of improved activity across the whole spectrum of genetic resources functions, not solely for the specific crops involved, but for all crops. The CIDS functions within these projects provides the thread of continuity, by which all the functions can be seen in the proper role. A feedback mechanism is provided not only to the International Board, but also to the centers and scientists who can then more clearly appreciate the values of functions other than their own.

These projects and all allied work of the CIDS team have indicated that the promotion of the network can be expedited and that the strategies can be made more effective through an integration of the Board's work with the priority activities of the operational centers. The International Board at its Executive Committee sessions has been willing to share the ideas presented to them by the CIDS team, but has felt that within its present terms of reference it cannot authorize the development of an integrated system for data management that approaches the whole problem of crop improvement. The CIDS team therefore respectfully requests consideration of the following alternatives vis-a-vis the Board's terms of references.

## ALTERNATIVES AS VIEWED BY THE CIDS TEAM

To achieve integrated systems for promoting the genetic resources functions of the IBPGR:

1. Broaden the scope of the terms of reference of IBPGR to include the coordination of its concerns with center-specific priorities.

2. Include as a part of the GR/CIDS work for IBPGR the overall data problems of a more broadly defined network.

3. The partial extension of the Board's terms of reference as circumstances arise.

## ADDITIONAL CONSIDERATIONS

It is our considered opinion that the first of these alternatives will be beneficial to the terms of reference of IBPGR, across all of its functions, and should therefore be adopted. By adopting this alternative, the integration of Board functions and those of the various centers will have the effect of giving a rational basis for the various centers to participate at an expanded level and to incorporate the necessary collections into their relatively limited germplasm holdings.

Alternative two will limit the expansion of the Board's terms of reference to the data management problems alone. From the CIDS point of view, this is satisfactory, but in terms of meeting the over-all objectives, would be less effective.

Alternative three is suggested because at the moment there is a wide range of objectives at the various centers. Some of the centers are not prepared to advance further than use of CIDS for germplasm banks alone, while others place their emphases on the broader functions. This alternative would cause a continuing requirement to return for further advice from TAC, but would reflect the reality of the present situation.

| | |
|---|---|
| 1:30 pm - 5:00 pm<br>Spruce Room | Standards<br><br>General Discussion on Standards<br><br>A. Standards deal with specific problems concerning nature, number of characteristics recorded, standard methods of recording observations, storing, retrieving and processing information.<br><br>B. EXIS and Standards compatibility<br><br>C. Maintenance standards as related to the actual germ-plasm or herbaria collection. |
| 5:30 pm - 6:30 pm | Dinner at College Inn |
| 7:15 pm | Meet in the lobby of the College Inn for transportation to the Computing Center |
| 7:30 pm - 10:30 pm | Computing Center<br>---Work on designing own data bank from examples handed out, or from available data banks. All advisors will be present.<br><br>---Tour of facilities possible if interested. |

Wednesday, February 26, 1975

| | |
|---|---|
| 7:00 am - 8:00 am | Breakfast at College Inn |
| 8:30 am - 12:00 noon<br>and<br>1:30 pm - 5:00 pm<br>Spruce Room | Working Session on agenda for International Wheat Symposium |
| 12:00 noon - 1:00 pm | Lunch at College Inn |
| 6:15 pm | Meet in the lobby of the College Inn for transportation to the UMC |
| 6:30 pm | Farewell Dinner, UMC, East Lounge |