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5th Floor, Hunt Library
Carnegie Mellon University
4909 Frew Street
Pittsburgh, PA 15213-3890
Telephone: 412-268-2434
Email: huntinst@andrew.cmu.edu
Web site: www.huntbotanical.org

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GRCIDS 1975 PROGRESS REPORT

TO

THE INTERNATIONAL BOARD FOR PLANT GENETIC RESOURCES

AND

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

FEBRUARY 17-20, 1976

ROME, ITALY

David J. Rogers
Director

Gilbert N. Hersh and Jay E. April
Associate Directors

Taximetrics Laboratory
University of Colorado

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Introduction.

The purpose of the Genetic Resources Communication Information and Documentation System (GRCIDS) is to assist in the development of an effective international genetic resources network. The primary purpose of the network is to collect, conserve, process and provide genetic resources for use by plant scientists around the world. To accomplish this, a secondary purpose is implicit: to systematically collect, conserve, process and provide data and information about genetic resources to the international community. These data and information are the critical link to provide access to the genetic resources in storage. Analysis of these data should be the important first step in the process of exploration and collection of germplasm from the field.

The GRCIDS provides an effective approach for extracting, compiling, processing and communicating genetic resources data and information throughout the network. The GRCIDS is designed to take full advantage of the current informal communication system in the genetic resources community and to develop a more formal data processing and reporting system based on the needs and requirements of the community. The GRCIDS activities in 1975 provided basic information on these needs and requirements and it is upon these that the GRCIDS contract objectives for 1976 and 1977 are based.

It must be noted that our contract requests to IBPGR/FAO are designed to fund only some of the work that must be done; our other funding sources

are identified in Table 1. The statements of work which follow correspond to the basic priorities set by the IBPGR and FAO, tempered to some extent by a somewhat different set of priorities of the operating international and national centers. As part of the implementation of GRCIDS and as part of our contracts with IBPGR/FAO, the Taximetrics Laboratory's GRCIDS team will attempt to identify and obtain additional resources to continue the overall GRCIDS/Network development. (A portion of the Administrative/Planning and Reporting item in the 1976 budget, Table 4, has been earmarked for this purpose.)

1975 was a year of learning and explanation. The GRCIDS concept was presented to the Consultative Group on International Agricultural Research (CGIAR) Centers, to several national centers and at several international meetings and workshops. Criticism and advice from over 200 investigators and administrators in the crop and plant science community have assisted in the development of the GRCIDS concept and in indicating work program priorities for effective GRCIDS implementation.

The driving strategy behind undertaking these projects has been to get on with the work, using the methods, systems and personnel at hand, to learn from the work experience, and to improve the methods, systems and ability of personnel to get on with more of the same work.

A Note of Explanation: EXIR

The Taximetrics Laboratory GRCIDS team uses wherever possible the EXIR (Executive Information Retrieval) System, which was developed at the University of Colorado. This system, EXIR, may be used in several ways: (A) as an interactive system, (B) for genetic resources data base analysis, and (C) for

TABLE 1: GRCIDS Funding Sources, including IBPGR/FAO

CONTRACTS AND GRANTS - TAXIMETRICS LABORATORY

Source	Project Designation	Resources Provided
International		
IBPGR	GRCIDS	Cash
FAO	GRCIDS	Cash
CIMMYT	GRCIDS	
National grants		
USAID (United States Agency for International Development)	Food research policy	Cash
USDA (United States Dept. of Agriculture)	GRCIDS	Cash
Corporate		
IBM Corporation	GRCIDS and Data Systems methods in International Agricultural Research 3	Cash grant Personnel grant Mexico Science Center computer time
Codevintec Pacific Inc. (Rothchild Subsidiary)		Cash grant Computer systems grant Consulting personnel grant
BRI (Behavioral Research Institute		Personnel grant

TABLE 1, page 2

Source	Project Designation	Resources Provided
University of Colorado Computing Center		Joint computer assisted methods development grant (GRCIDS related)
College of Arts & Sciences		Personnel grant
TOTALS		
IBPGR/FAO as a proportion of all resources		

1 CIMMYT - 1975 - cost share for travel of personnel in projects.
1976 - $10,000; 2,000 travel, 8,000 cash as of 1/20/76. This amount may increase.

2 USDA - invited proposal from USDA to be submitted 2/1/76.

3 Other assistance under discussion.

communication. Definitions and discussion of these components follow.

A data base system has two principal components: the data base processor and the data base.

The data base processor is usually a set of computer programs. A user communicates to these programs through a "language." As with any language, there is a set of rules and a vocabulary to structure commands. In systems like EXIR, the language is simple yet powerful and very similar to natural language (as contrasted with formal computer language). A user who is not a programmer can easily learn to employ it.

The data base contains the user's data. The data are structured according to the rules of the data base processor. In EXIR, great flexibility is permitted in the structure of the data. (Most machine readable data can be accommodated.)

The concept of an interactive system is built into EXIR. The user can write a series of commands that will be executed by the data base processor on the data base. The result of one command can then be operated on by another command. In this fashion the user can "interact" with the data base.

In the past, germplasm catalogs, even if computer generated, have been static. The catalog is a representation of the data base and the individual working with the data base. If he wishes to ask questions of the data, he must process it himself with pencil, paper and patience.

With systems such as EXIR, a user can look at a general catalog (or, as in the CIMMYT project, a list of what the data base contains), form his questions and resubmit them. He then will receive reports tailored to his questions and his needs. This process eliminates quantities of information which are not wanted--answering a complaint of most users of computer-generated information.

Although the term interactive usually applies to a momentary response between the user and the computer, it may be correct in the world of genetic resources to expand its time framework (through the international mail or FAO pouch, for example). An interactive system means that a user, with the assistance of an easy to use data base processor, can address a data base and get reports specifically tailored to his own needs.

There are two types of data base analyses: (i) analysis of data base structure, content and sources; and (ii) analysis of relationships or patterns of the content in the data base. Through an understanding of the data base, and knowledge of what is needed in the genetic resources community, actual germplasm evaluation can be effectively planned and executed. By specific analysis of the data bases from several centers for a specific crop, it becomes possible to know what descriptors are used, and how they are defined and points of agreement and divergence. This provides basic and important information of what is used to assist crop committees and crop coordinating centers in preparing crop reference manuals and then descriptor and data reporting standards.

Although the latter, ii, is of considerable importance, we will not cover it in this report, since we have presented information on this previously.

Experimentation with reporting, publishing and communicating data on genetic resources is of exceptional importance. Often there are either unusable data or too much data. The balance must be found and the methods of effective communication developed and used.

Communicating the process by which (1) information on genetic resources is distributed to and among interested people and, how (2) individuals or

groups make their specific interest or needs for such information known to others, has not been studied nor really improved over the past several years. The central requirements are to anticipate the basic type and format of information needed and to develop an effective channel to transmit this information. In addressing the communication problem, existing procedures or means are used first in an attempt to make them more effective. Pilot work is underway with CIMMYT to explore various reporting and catalog procedures. Further, there are discussions with FAO for the improvement in the strategy to get subscribers and more frequent publication of the pioneering Crop Genetic Resources Newsletter.

Section I: Formation of genetic resources data bases and use of computer assisted methods for processing and communicating information derived from them.

Genetic resources data base and computer assisted methods projects were undertaken with several centers during 1975. In addition to immediately placing genetic resources data into a useable information system, these projects provided both GRCIDS staff members and cooperating center personnel with better insight and awareness of the problems which arise when GRCIDS is installed in operating institutions. These projects also provided the GRCIDS team and our hosts with a cooperative training experience for staff members, which has accelerated GRCIDS staff development in a field which lacks trained and experienced personnel.

Table 2 (below) displays, by crop, genetic resources data that have been processed in joint projects between centers and project teams during 1975. The table also contains data that are not crop related about centers and

TABLE 2 presents basic information on genetic resources data processed for analytic and training purposes in 1975. All of these data banks are in effect pilot projects.

GENETIC RESOURCES DATA BASES PROCESSED AS OF 31 DECEMBER 1975

Crop	Center	Accessions	Descriptors	Notes
Bean	CIAT	8656	36	
	CIAT	929	66	pest reactions
	USDA/Pullman	1500	30	
Barley	USDA/Beltsville	1500	42	
Cassava	CIAT	2016	35	
	TAXLAB	6000	45	Herbaria data
Chickpea	ICRISAT	300	28	
Cotton	Colombia/ICA	120	11	
	USDA/Beltsville	2500	25	
Cowpea	IITA	4232	50	
Guar	USDA/Ft. Collins	1134	74	
Maize	CIMMYT	11030	23	
	Brasil/EMBRAPA	100	47	
	Colombia/ICA	3653	42	
	Mexico/INIA	100	52	
	Peru/PCIM	6275	64	
	EUCARPIA/S. Maize Committee	1500	30	
	UK/PBI	-	-	
Oil Palm	Nigeria/MARDI	-	25	
Peanut	US/Univ. Florida	100	35	
Pigeon Pea	ICRISAT	300	24	

TABLE 2 - page 2

Crop	Center	Accessions	Descriptors	Notes
Potato	CIP	2292	37	
	CIP	1400	15	Pest Reactions
	UK/CPL	150	14	
	USDA/Sturson Bay	200	25	
Rice	IRRI	8628	48	
Sorghum	ICRISAT	300	24	
Wheat	Brasil/CNPT	100	50	
	Italy/BARI	40	49	
	Germany/Braunschweig	1200	35	
	UK/PBI	430	14	
	USDA/Beltsville	32710	13	
	USDA/Beltsville	2700	40	Pest Reactions
Cereals	Turkey/IZMIR	2208	48	

about individual investigators. This latter information provides a working basis for further network analysis of data requirements.

Note that all data bases must be constantly updated, and thus none should be treated as "complete." It is a grave mistake to put up the backlog data without concern for continuous addition of new data as they are accumulated. Without a provision for continuous updating, the current GRCIDS will be useless in a few years.

This year we have provided specific data base formation assistance from various sources for several projects, including the projects on maize, potatoes, peanuts and wheat.

Section II: Analysis, planning and development of data/information processing and communication needs within the genetic resources network.

In addition to our work in collecting and preserving information about plant genetic resources, a second area of our operation is equally important. That is the dissemination of this collected information among plant scientists who need to know about it.

To facilitate the dissemination of collected genetic resources information, we have held discussions with the following groups that are considering the adoption of the GRCIDS concept, including EXIR: The Agricultural Research Service of the United States Department of Agriculture (GRCIDS methods will be used to facilitate the US-USSR germplasm exchange); Agricultural Research Council, United Kingdom; Empresa Brasileira Pesquisa Agropecuaria, Brasil; Instituto Nacional de Investigaciones Agricolas, Mexico; Programa Cooperativo de Investigaciones en Maiz, Peru; and Institut Pflanzenbau FAL, West Germany.

We have held follow-up discussions with several organizations that are now using earlier versions of TAXIR. These organizations are: the Central Office for the Plant Gene Resources of Canada, Ottawa, Canada; the Australian Wheat Collection, Tamsworth, Australia; Laboratorio del Germoplasma, Bari, Italy; International Soybean Program, Urbana, Illinois. Work will continue with these organizations on GRCIDS-related matters through 1976, including the update of EXIR where required.

EXIR has been transferred for use on several computers: IBM 360/370, PDP 10, CDC 6000 Series, CDC Cyber 70 and Data General Nova, and work is underway transferring EXIR to the Burroughs 5000 and Univac 1100 Series. The EXIR system was installed at CIMMYT in 1975. In 1976, we

will upgrade TAXIR, the older version of EXIR, at the appropriate centers. Also, in 1976 the modular and documented EXIR will be available for use on CDC, IBM, Data General and DEC (PDP) equipment. The older, fully documented CDC version is currently available on request.

In order to explain and promote GRCIDS and the Genetic Resources Network, to discover effective means to work with diverse centers, and to discover the real problems centers have with respect to genetic resources utilization, we have conducted or participated in seminars, workshops, symposia site visits and discussion. Many of these experiences have resulted in pilot projects, or in agreements to continue to work jointly.

On February 9-15, 1975, the Taximetrics Laboratory GRCIDS team sponsored a workshop on maize at Boulder, Colorado. Representatives of CIMMYT, CIAT, FAO and EUCARPIA were in attendance. On February 24-26, 1975, we sponsored a workshop on wheat at Boulder. Members of USDA, CIMMYT, INIA, PBI, FAL and EUCARPIA were present.

Members of the GRCIDS team participated in workshops and symposia at Urbana, Illinois (International Maize Symposium), and in discussions with representatives of CIMMYT, EUCARPIA, IITA. We contacted CIMMYT personnel again in discussions in El Batan, Mexico.

GRCIDS team members participated in the Regional Wheat Workshop: For Establishment of Southern Cone Cooperative Programs in South America at Passo Fundo, Brasil, in the IBPGR Symposium on Wheat Genetic Resources at Leningrad, USSR, and in the Bean Improvement Cooperative at East Lansing, Michigan.

An EXIR demonstration was held at the CIMMYT Institute in Mexico and in a workshop on Arachis at the University of Florida, Gainesville.

Site visits were conducted by GRCIDS team members at IRRI in the Philippines, at ICRISAT in India, at CIAT in Colombia, and at CIP in Peru.

Finally, we presented papers at the International Sorghum Workshop in Puerto Rico; at the Gainsville, Florida conference on Arachis; before the Plant Germplasm Coordinating Committee in El Paso, Texas; at the USAID-sponsored Crop Production Division Contractors Meeting; at the Expert Consultation on Agricultural Research in Latin-America; and at the twenty-first Annual Reunion of Programa Cooperativo Centro Americano para el Mejoramiento de Cultivos Alimenticos in San Salvador, El Salvador.

Table 3 (below) reports joint projects by center for the various crops. It includes information on data base formation, content analysis, communication of data and various computer-assisted methods to accomplish this work. The reports in the table are given for CGIAR-funded centers. Please note that crop priorities of wheat, maize, rice, sorghum and millet were established by the IBPGR after much of this work was done. Our original attempt was to establish introductory projects with each international center. The results of these attempts, as of the end of 1975, may be seen in Table 3.

Section III: Other GRCIDS team activities in 1975.

From our meetings with individuals around the world who are involved actually or potentially in the GRCIDS, we have developed an understanding of several general problems. Those problems arising within that area specifically circumscribed within the IBPGR mission statement are discussed below. However, GRCIDS as a concept subsumes these problems and certain other problems which are not covered by the IBPGR mission statement, and both kinds of problems are

Table 3: SUMMARY OF GRCIDS TEAM 1975 PROJECTS WITH CGIAR-FUNDED CENTERS
(centers listed in alphabetical order)

Center	Crop/Project	Status of Project
CIAT Colombia	Beans	Received and created an EXIR data bank on general working germplasm collection, November, 1975; agreed to do a pilot project using EXIR as an interactive system for genetic resources data base analysis and communication; held discussions on EXIR implementation at CIAT for the full data base; work was deferred pending crop priority specification for beans and funding for this work.
	Cassava	Received and created an EXIR data bank on general working germplasm collection of cultivars; agreed to do a pilot project in 1976 using EXIR as an interactive system for genetic resources data base analysis and communication.
	Personnel training	Agreed to train CIAT personnel in GRCIDS methods, especially in EXIR; project presently deferred until funding problems can be clarified.
CIMMYT Mexico	Maize (1)	Received and created an EXIR data bank on general working germplasm collection; gave assistance in data base formation; codified standardized description definition (adaptation of Leningrad Workshop resolutions); instituted use of EXIR as an interactive system for genetic resources data base analysis and communication system; completed preliminary germplasm catalogue.
	Maize (2)	Beginning study of CIMMYT/maize germplasm committee was linked to other maize germplasm centers; projected inclusion of procedures for descriptor definition and compatibility, data flow coordination.
	Maize (3)	Undertook study of present and potential role of formal germplasm collection in actual operation of CIMMYT program; a specific case of the use of formal germplasm collections in center programs. (The considerable, asystematic use of "informal" collections which are not part of the formal germplasm bank presents a problem which is as yet unresolved.)

Table 3, page 2

Center	Crop/Project	Status of Project
CIMMYT (con'd)	Maize (4)	Assisted in development of programs for International Progeny Testing Trials and Experimental Variety Trials; transferred these programs to a minicomputer, and made the production runs of the 1975 data. Assisted in the selection of a minicomputer system for in-house data processing; began response to request from CIMMYT to study links to germplasm banks and use of these programs for bank germplasm evaluation. This project addresses systems links of formal germplasm collection to overall CIMMYT maize mission; conducted demonstration of EXIR on minicomputer for germplasm collection access and maintenance.
	Wheat (1)	Offered assistance in the preparation of breeders' working collection (a few thousand lines) and in the use of EXIR on the minicomputer.
	Wheat (2)	Made a cost effectiveness examination of the computer program RAPID for use in general international wheat germplasm evaluation.
	Wheat (3)	Using RAPID, ran CIMMYT's 1975 international wheat germplasm evaluation.
	Wheat (4)	Conducted an investigation into the connection between formal base germplasm collection, such as USDA Small Grains, and the breeders' working collection at CIMMYT, with a reverse flow of materials and data.
CIP Peru	Potatoes (1) (Solanum)	Received data and created an EXIR data bank of general working germplasm collection; as collection develops, will set up a pilot program using EXIR as an interactive system for genetic resources data base analysis and communication.
	Potatoes (2) (Solanum)	Received data and created an EXIR data bank of a collection from breeders of pest/disease evaluation data (a subset of general working collection). Gave assistance in development, querying and communication.
	Potatoes (3) (Solanum)	Participation in March, 1976 at the Planning Conference on Exploration and Maintenance of Potato Germplasm Resources.

Table 3, page 3

Center	Crop/Project	Status of Project
ICARDA Lebanon	No contact	
ICRISAT India	Sorghum Chickpeas Pigeonpeas	Received data and created an EXIR data bank of general working germplasm collection; set up pilot project using EXIR as interactive system for genetic resources data base analysis and communication.
	Peanuts	Began work on this project through International Conference held in Florida (Germplasm Preservation and Genotype Evaluation in Arachis).
IITA Nigeria	Vigna	Received data and created an EXIR data bank of general working germplasm collection; set up pilot using EXIR as an interactive system for genetic resources data base analysis and communication; projected possible catalog update.
	Yams	Deferred request for assistance.
IRRI Philippines	Rice	Received data and created an EXIR data bank of general working germplasm collection; set up pilot using EXIR as an interactive system for genetic resources data base analysis and communication; request for full data base.
AVRDC Taiwan	No contact	

systematically linked. But we have dealt with that issue in several past presentations; some of these points are covered in the GRCIDS 1976 contract which has recently been signed.

The basic attitude of the GRCIDS team is one of interest in the exploration, maintenance and utilization of genetic resources as broadly defined; for example, we are concerned with species of cultivated plants, primitive cultivars, advanced lines and advanced breeding stocks. The utilization of genetic resources is extremely important to us; we think it imperative to further develop and improve systems methods to assure effective access to these collections. This basically includes flexible data flow and processing, systematic germplasm evaluation and ready access to germplasm.

Implicit in our endeavor are systematically and carefully operated collection centers, an effective data access and reporting system, and well planned and systematically executed exploration and collection. Moreover, there is a need for international crop genetic resource reference books that define the methods of evaluation used for all plant characteristics, and eventually produce reference standards for crop evaluation and for data reporting procedures and methods. At almost all centers, there is a lack of personnel already trained to make GRCIDS operational.

Further, and possibly of the greatest importance, we have learned through experience that cooperation with and among centers is mostly political and administrative in nature; problems in this area are <u>not</u> technical problems. Substantial resource commitments are needed to establish working relationships among centers before technical problems can be solved. This is true even under "ideal" cooperative circumstances.

Easy access to data and germplasm, real interest in sharing data and germplasm, real desire to integrate germplasm collections into the mainstream of work at centers, the desire to learn new methods; and the means of funding continued operations--all these pose the most serious administrative and policy problems. And these problems can only be addressed in time, with carefully planned demonstrations and extensive working contacts.

It is important that we have a clear understanding of policy and administrative problems if the Genetic Resources/Network is to continue to develop. Further, the real technical genetic resources data/information problems that occur at the centers must be understood. We have attempted to discover these problems and to demonstrate how these problems affect the systems operation of centers and relations among centers. We have done so in an attempt to develop and implement solutions so that the primary mission of the IBPGR can be fulfilled.

It is also necessary to be aware of other problems which, if not solved, will make the IBPGR efforts less than 100% effective. These problems may be external to the IBPGR mission statement, but they will impinge on the effectiveness of the IBPGR. If IBPGR resources are not used to solve them, other resources should be found. Most of these problems are general across all centers with specific ramifications in each center.

From the experiences of 1975, we have written draft training papers on genetic resources data base formation, processing and communication. This work will be completed during the balance of 1975 and early 1976, and will become a set of reference and training papers for GRCIDS. We are also working on specific training strategies for center personnel to assist in the work of data base formation.

The time and resources needed to overcome these problems should not be underestimated, nor should the interest and expressed desire of centers to fully and openly participate in all genetic resources activities. Careful study and thought should be given to the network concept and to the formation of strategies to increase the operating stability and effectiveness of the network. We will be able to provide information on this as we work on our primary mission.

PART II: PERSPECTIVE: WHAT REMAINED AFTER 1975; THE 1976 IBPGR/FAO - GRCIDS CONTRACT

To put our achievements in 1975 in perspective, it is useful to consider what remained to be done after our 1975 operations were completed. This was outlined in great detail as we worked on our 1976 IBPGR/FAO contract.

As Chart 1 (below) indicates, the IBPGR/FAO-GRCIDS 1976 contract supports two major GRCIDS operations: (1) the formation and transfer of genetic resources data bases for both major base and active collections, using effective data base processing techniques, and (2) the pilot project with CIMMYT to analyse the data flow and processing problems of genetic resources functions and to assist in implementing computer assisted methods to solve these problems. These operations are extensions of our major 1975 undertakings; (1) the formation of genetic resources data bases and use of computer assisted methods for processing and communicating information derived from them, and (2) the analysis, planning and development of data/information processing and communication needs within the genetic resources network.

Section I: Formation and transfer of genetic resources data bases in 1976.

As Table 4 (below) demonstrates, we place major emphasis on the objective of formation of genetic resources data bases and use of computer assisted methods for processing and communicating information derived from them. The IBPGR has assigned first priority to the formation

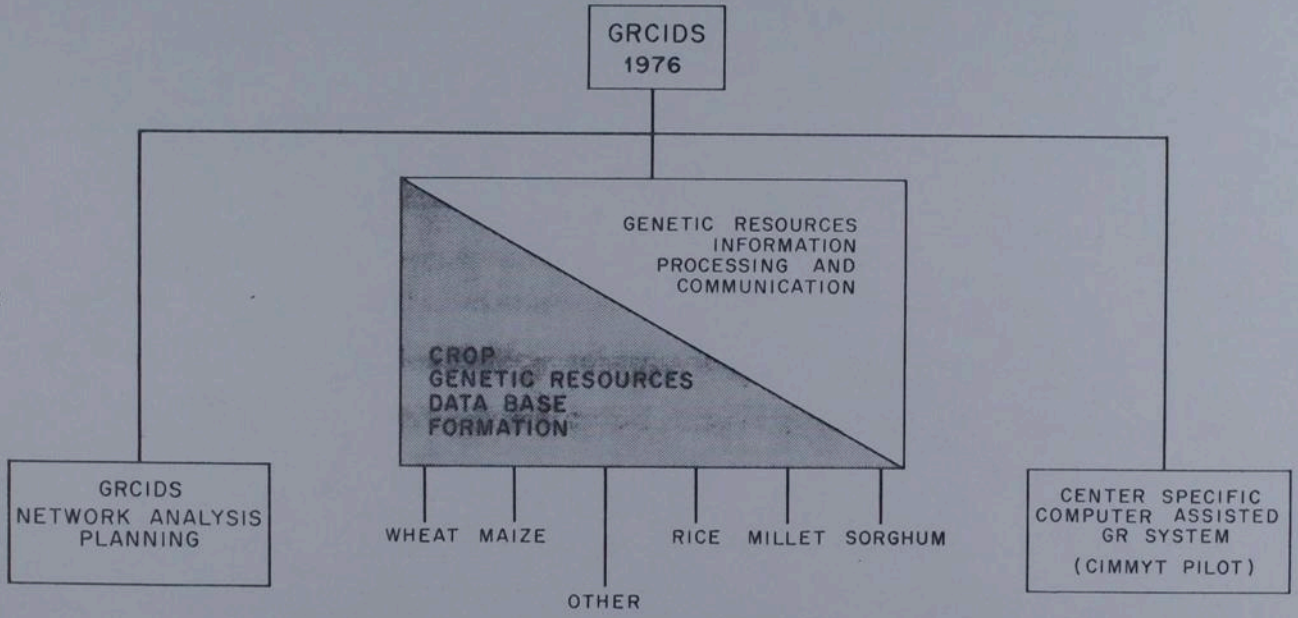


Chart 1: Major GRCIDS operations, 1976

of genetic resources data bases for the following crops: wheat, maize, rice, millet and sorghum. The primary focus of the 1976 GRCIDS project will be on these crops. Prior to the IBPGR's establishment of crop priorities, the GRCIDS team sought to work with each of the international centers on crops assigned to them. Thus, work has begun with CIP on potatoes; with CIAT on beans and cassava; with ICRISAT on peanuts, pigeon peas and chickpeas; with IITA on African Vigna; and with USDA on barley. It would not be advisable to drop this support, although it will be tertiary in the allocation of resources from the GRCIDS 1976 contract. However, if the Board and FAO should wish to add other crops to the 1976 responsibility, a revised budget can be prepared to work on any or all of the crops listed above.

Chart 2(below)shows the personnel who lead the work assigned to the GRCIDS for the first priority crops. The role of the GRCIDS team in working with each crop will be in part determined by the international crop committee and the coordinating international center. Despite the lack of international crop committees, we have begun work on all the principal crops. In so doing, we have worked with the designated crop coordinating center: maize, CIMMYT/ E. Sprague; rice, IRRI/ T. T. Chang; sorghum/millet, ICRISAT/ L. van der Maesen; potatoes, CIP/ R. R. Rowe. With respect to maize, we have also contacted Dr. William Brown, nominee to the International Germplasm Committee. For wheat (cereals), we will follow the results of the Leningrad meeting until the formation of a crop committee.

For each crop, the GRCIDS team will be available to assist the crop committee and the coordinating center to develop and implement a crop specific strategy for handling the data base formation, processing and reporting.

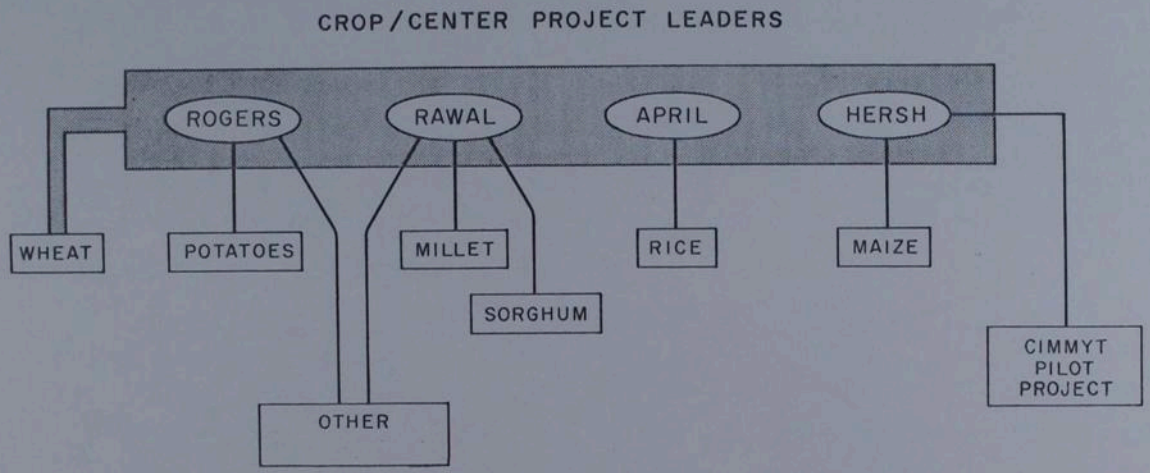


Chart 2: Crop/Center project leaders

From previous GRCIDS work, it is clear that data base formation must proceed from the individual center that has an important genetic resources collection. Often assistance must be provided at the center, to establish the necessary technical procedures to create the initial crop data base from many types of documents at the center. Assistance also assures that the data base procedures will become part of the center's data system and thus part of the continuous flow of genetic resources data, as new collections are added or new evaluations are made on existing collections. The GRCIDS team will continue working on the priority crops with centers, even if a crop committee has not been formed or if there is no coordinating center. When formed, however, the GRCIDS team will report to the committee/center as soon as possible.

To accomplish the formation of a data base at the centers using historic documents, and to establish integrated data flow procedures, center personnel should be trained and supported with technical assistance backup. The development and testing of technical assistance/training support packages is an important part of the GRCIDS 1976 project.

When a crop specific data base for a center is completed, assistance may be provided to the center to analyze data content, to reconcile data on collections with actual physical germplasm collections and to produce catalogs and other reports as may be needed. This is similar to the procedures followed for the CIMMYT maize data base which has been successfully implemented.

From the crop specific data bases developed at each center, important information can be extracted or derived to allow for more effective international communication. Complete and precise definitions of descriptors used by each center can be compiled. The crop committee may be able to suggest

descriptor synonomy and maximum common descriptor reference lists. From such lists the several center specific data bases can then be combined to form a crop specific multi-center genetic resources data base.

The GRCIDS team will also be able to assist the crop committee and crop coordinating international center by providing the communication mechanism to advise the international community on how to use the combined data base. The mechanisms would include the preparation of general purpose catalogs, reports on collection overlap (similar collections in storage at different places); and preparation of data sets for the analysis of variation/location of the material in collection to assist in exploration planning.

The GRCIDS team will also provide computer assisted data base processing to answer questions for the international crop community. This assistance will be given to centers whether or not they have access to computer resources. IBPGR/FAO committees must determine the rules governing the cost for these services. The GRCIDS contract provides funds for some responses.

Further, GRCIDS will make available the documented source code and technical manuals for the computer programs used to query and to make reports from the data base. Over the past years a number of versions of TAXIR/EXIR have been made available to genetic resources centers. These versions vary considerably. During 1976 an attempt will be made to replace all previous versions with the latest code and documentation. Also, a user's service center will be initiated for program maintenance and handling user's systems questions. The rules for distribution and installation assistance, including costs for these programs, are to be determined jointly by the Taximetrics Laboratory and the IBPGR.

Efforts must continue in the definition, use and communication of crop specific descriptors in the international network. The formation of the data bases and the data base related assistance should produce sufficient information for the crop committees to work effectively in compiling and reporting an international genetic resources reference manual on variables, characters and descriptors currently in use, in using the reference manual to create a more efficient communication network, in generating discussions from the manual on acceptable standards for reporting data, and in developing guidelines and rules for future acceptance of network standards.

It should be noted that in addressing these problems, the GRCIDS team will build on some of the work that has already been done in this area. Assistance will be solicited from those investigators who have worked in this area.

Section II: The analysis, planning and development of data/information processing and communication needs within the genetic resources network in 1976: the pilot project at CIMMYT.

The GRCIDS pilot project with CIMMYT is an attempt to enter the genetic resources work of a center at the point the center feels the greatest assistance is needed, and to move from that point to understand the genetic resources data flow and processing requirements in that center. It is also an attempt to discover the interfaces between the data flow and the Genetic Resources/Network. Jointly with CIMMYT, we will design, implement and test computer assisted programs which would make more effective the genetic resources work of the center and its role in the international network. We

will also demonstrate and test the concept of portability and compatibility of resultant computer programs within the Genetic Resources System (GRSYS) to another international center and to two large national centers.

Specifically during 1976, we will continue to work with CIMMYT in three areas, each very important to genetic resources work. First, we will develop computer assisted systems for the control and maintenance of the actual physical germplasm collections. This will include an inventory transaction system (to calculate the balance of germplasm on hand) and scheduling of viability testing and germplasm rejuvenation. Second, we will develop computer assisted genetic resources access and communication programs, with EXIR as a base, to facilitate the effective use of germplasm in storage by providing crop scientists easy access to the complex data bases describing germplasm collections. This work is extremely important in exploring the present and future effective use of genetic resources collections and in determining the bottlenecks, technical and human, which inhibit the use of these collections. Also, as part of this work, the most effective means of communicating genetic resources data will be explored with center personnel. Third, we will develop an effective and easy way to use system-defining data flow, processing and analysis of genetic resources evaluation, especially of those resources in germplasm collections. Included in these methods are reporting links which point back to the data base on collections which may be in storage at other centers.

This work will mainly be done at CIMMYT with designs and transfer aspects coordinated with IRRI, INIA of Mexico and possibly with EMBRAPA of Brasil. Attempts will also be made to examine the role of the lower cost minicomputers (64k bytes DOS minimum) in this work.

Specific program designs, or program packages which are produced will be fully documented and available to other centers. We will place product emphasis on computer assisted systems for control and maintenance of physical germplasm collections, which is very badly needed by all centers with a sizeable collection.

All the work described immediately above relates directly to the basic genetic resources functions which are part of the IBPGR mission statement: storage/maintenance, exploration, evaluation, utilization and documentation.

Since these basic areas of computer assisted methods have other closely related application at the centers as well, resources in addition to IBPGR/FAO will be sought during 1976 to continue this work.

In summary, the principal efforts of the GRCIDS team in 1976 will be to form the crop specific data bases for the priority crops. These priority crops are wheat, maize, rice, millet and sorghum; work will continue with potatoes. Specific GRCIDS personnel have been assigned crop areas in which to work. They will work with international crop committees, crop coordinating centers and national centers to assist where necessary in designing a crop strategy and in executing this strategy. A center-by-center approach will be used for the data base formation with the possibility of combining several crop/center specific reports, as required.

To accomplish these tasks and to permit adequate development of data flow procedures, training and technical assistance packages will be prepared and implemented jointly by the GRCIDS team and cooperating centers. Very close cooperation with individual centers is of exceptional importance, for two reasons: first, to understand the real working conditions at a center, and

second, to work closely with center personnel to receive and fully understand their data on genetic resources.

A computer assisted data retrieval and reporting system will be used. EXIR is the benchmark system for this purpose. Some computer resources assistance will be provided to crop committees, centers and special investigators to assist in data reporting and to some extent in data analysis. The exercise on crop specific data base formation will also provide sufficient information to assist in genetic resources network design and development.

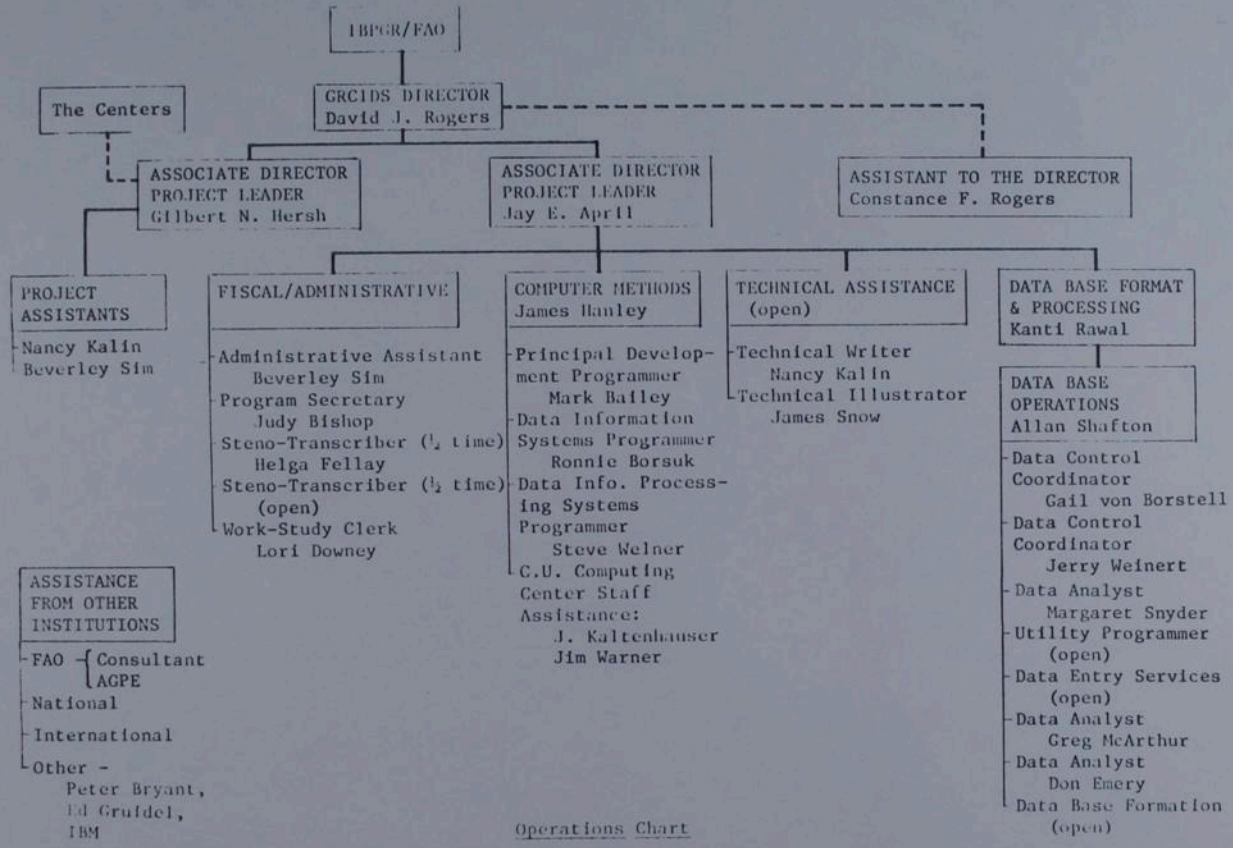
It is hoped that between 50% and 70% of the data available in current documents will be archived for each crop listed above, with primary emphasis on wheat, maize and rice.

A secondary focus, through the pilot project with CIMMYT, is on design and application of center directed computer assisted methods for the critical genetic resources functions of access, maintenance, evaluation and utilization. Development work will be joint with CIMMYT and IRRI and two large national centers.

Operations Chart

The following operations chart shows the supervision and reporting responsibilities of the positions and persons funded under the GRCIDS 1976 contract with IBPGR/FAO.

Aside from the funds provided in this contract by the FAO Regular Program ($52,500), a proposed joint work program was submitted to FAO/AGPE. If accepted, designated FAO staff members will do sustained work with the



Operations Chart

GRCIDS team on specific projects outlined in this document.

It is also possible that the GRCIDS team may be assisted by professionals from national centers. Their possible position is indicated within the chart also.

TABLE 4: demonstrates the application of resources to specific aspects of the problems addressed by the GRCIDS team, projected for 1976. Each resource is identified in the left hand column. The three project areas are: (1) crop genetic resources data base formation, (2) center specific computer assisted genetic resource systems, and (3) administration/reporting and network planning.

Resource Title	Crop Genetic Resources Data Base Formation	Center Specific Computer Assisted Genetic Resource System	GRCIDS Administration/Reporting & etwork lanning
	in man-months	in man-months	in man-months
GRCIDS DIRECTOR (D. J. Rogers)	4.5	1.5	1.5
ASSISTANT TO THE DIRECTOR (C. F. Rogers) (volunteer)			
ASSOCIATE DIRECTOR PROJECT LEADER Planning and Coordinating Center specific activities (G. N. Hersh)	7.8	3.0	1.2
ASSOCIATE DIRECTOR PROJECT LEADER Planning and Coordinating Crop Specific activities (J. E. April)	9.0	1.8	1.2
CHIEF SYSTEMS ANALYST Computer Program Design, Development Maintenance & Transfer (J. R. Hanley)	4.8	6.0	1.2
PROJECT COORDINATOR Systems Biologist (K. Rawal)	10.2	1.2	0.6
TRAINING, TECHNICAL ASSISTANCE & TRANSFER COORDINATOR (open)	10.2	1.2	0.6
DATA BASE OPERATIONS COORDINATOR (A. Shafton)	11.4	0.6	0

TABLE 4, page 2

Resource Title	Crop Genetic Resources Data Base Formation in man-months	Center Specific Computer Assisted Genetic Resource System in man-months	GRCIDS Administration/Reporting & Network Planning in man-months
PROJECT ASSISTANTS:			
Project Assistant & Technical Writer (N. Kalin)	9.6	1.8	0.6
Project Assistant & Administr. Ass't. (B. Sim)	8.4	0	3.6
Project Assistant & Data Base Formation (open)	10.8	0	1.2
DATA BASE SERVICES:			
Data Control Coordinator (G. von Borstell)	10.8	1.2	0
Data Control Coordinator (J. Weinert)	12.0	0	0
Data Entry Services-Keypunch (open)	-	-	-
Utility Programmer(Data Base Operations) (Open)	9.0	3.0	0
Data Analyst (M. Snyder)	9.6	2.4	0
Data Analyst (G. McArthur)	10.2	1.8	0
Data Analyst (D. Emory)	10.2	1.8	0

TABLE 4 - page 3

Resource Title	Crop Genetic Resources Data Base Formation in man-months	Center Specific Computer Assisted Genetic Resource System in man-months	GRCIDS Administration/Reporting & Network Planning in man-months
PROGRAMMING TEAM: Principal Development Programmer (M. Bailey)	3.6	8.4	0
Data Information Processing Systems Programmer (R. Borsuk)	3.0	9.0	0
Data Information Processing Systems Programmer (S. Welner)	3.0	9.0	0
STAFF SUPPORT: Program Secretary (J. Bishop)	8.4	0	3.6
Technical Illustrator (J. Snow)	10.2	1.8	0
Steno-Transcriber (H. Fellay)	8.4	2.4	1.2
Work-Study Clerk (open)	-	-	-
PERSONNEL TOTAL	182.10	48.90	16.90
Communication (telephone, cable, mail)	75%	15%	10%
Travel	80%	10%	10%
Computer Center	70%	30%	0%
Supplies and Equipment	85%	5%	10%
Copy/Printing	85%	10%	5%
OVERALL	71%	22%	7%
Personnel Benefits	71%	22%	7%
Space	71%	22%	7%
Overhead	71%	22%	7%
TOTALS	71%	22%	7%

TABLE 5: Summarizes man-months and budget costs for each project area

	Crop Genetic Resources		Center Specific		Administrative/ Reporting		Totals	
	man-months	Cost	man-months	Cost	man-months	Cost	man-months	Cost
Personnel Resources	182.1	$180,920	48.9	$60,120	16.9	$20,950	247.9	$261,990
Other Direct Resources	71%	$106,630	22%	$28,980	7%	$7,400	100%	$143,010
Totals		$287,550		$89,100		$28,350		$405,000

TABLE 6: a breakdown of Table 4 into a specific project area, Crop Genetic Resource Data Base Formation. This table lists by the crop, priorities established by the IBPGR for 1975. The column marked "leader" shows the GRCIDS team member responsible; the column marked "resources applied" is divided into "man months," and per cent of effort. Effort is calculated: 100% = total budget amount ($287,970) provided for this project area.

CROP GR DATA BASE FORMATION	LEADER	RESOURCES APPLIED	
		man-months	% of effort
First Priority			
Wheat	Staff	64	35
Rice	April	46	25
Maize	Hersh	27	15
Millet	Rawal	18	10
Sorghum	Rawal	18	10
Other Priority			
Potatoes	Rogers	6	3
Other pilot	Rogers/Rawal	4	2

TABLE 7: a breakdown of Table 4 for project area #2, Center Specific Computer Assisted Genetic Resources System. Per cent of effort = 100% for amount budgeted ($87,280).

CENTER	LEADER	RESOURCES APPLIED	
		Man-months	% of Effort
CIMMYT	Hersh	25	50
IRRI	April	15	30
ICRISAT	Rawal	5	10
Other:			
CIP	Rogers	2	4
IITA	Rawal/Rogers	2	3
CIAT	Rawal/Rogers	2	3

GRCIDS IV: BUDGET DETAIL

Statement of Estimated Expenditures

Category	Position	Cost IBPGR/FAO
A. PERSONNEL-PROJECT EXECUTIVES		
	GRCIDS DIRECTOR+ (D. J. Rogers 50% AY (9 mos), $2,315/month 100% summer (3 mos) $2,315/month	$17,360
	ASSOCIATE DIRECTOR PROJECT LEADER (G. N. Hersh) 12 mos, 94%, $2,000/month	22,560
	ASSOCIATE DIRECTOR PROJECT LEADER (J. E. April) 12 mos, 94%, $2,000/month	22,560
A. PERSONNEL-GROUP COORDINATORS		
	CHIEF SYSTEMS ANALYST* (J. R. Hanley) 12 mos, 100%, $1,917/month	23,000
	PROJECT COORDINATOR (K. Rawal) 12 mos, 100%, $1,583/month	19,000
	TRAINING, TECHNICAL* ASSISTANCE AND TRANSFER COORDINATOR (open) 12 mos, 100%, $1,417/month	17,000
	DATA BASE OPERATIONS COORDINATOR* (A. L. Shafton) 12 mos, 100%, $1,167/month	14,000
A. PERSONNEL-PROJECT ASSISTANTS		
	PROJECT ASST./TECHNICAL PACKAGE DESIGN* (N. Kalin) 12 mos, 100%, $917/month	11,000

Category	Position	Cost IBPGR/FAO
	PROJECT ASST./TECHNICAL PROGRAM SCHEDULING * (B. Sim) 12 mos, 100%, $917/month	$11,000
	PROJECT ASST./DATA BASE FORMATION * (open) 12 mos, 100%, $833/month	10,000
A.	PERSONNEL-DATA BASE SERVICES	
	DATA ENTRY OPERATOR * (G. A. von Borstell) 12 mos, 100%, $667/month	8,000
	DATA CONTROL COORDINATOR * (J. Weinert) 12 mos, 100%, $667/month	8,000
	DATA ENTRY SERVICES (keypunch services) (open)	4,000
A.	PERSONNEL-RESEARCH ASSISTANTS	
	UTILITY PROGRAMMER (S. Welner)	6,750
	DATA ANALYST * (M. Snyder) 12 mos, 68%, $1,100/month	9,000
	DATA ANALYST (G. R. McArthur) (grad, research asst.) 25% AY (9 mos), $900/month	2,030
	DATA ANALYST (D. Emery) (grad. research asst.) 4.5 mos, 50%, $1,050/month	2,370
A.	PERSONNEL-PROGRAMMING TEAM	
	PRINCIPAL DEVELOPMENT PROGRAMMER * (M. Bailey) 12 mos, 100%, $1,458/month	17,500
	DATA INFORMATION PROCESSING SYSTEMS PROGRAMMER * (R. Borsuk) 12 mos, 100%, $1,100/month	13,200

Category	Position	Cost IBPGR/FAO
A.	PERSONNEL-SUPPORT STAFF	
	PROGRAM SECRETARY * (J. K. Bishop) 12 mos, 100%, $750/month	9,000
	TECHNICAL ILLUSTRATOR * (J. L. Snow) 12 mos, 60%, $1,000/month	7,200
	STENO-TRANSCRIBER * (H. Fellay) 12 mos, 100%, $583/month	7,000
	WORK-STUDY CLERK (open) (for federal matching at 80%)	460
	total personnel, consultants, hourly	261,990
A.	PERSONNEL-BENEFITS	
	TIAA (noted by +) Base salary of 17,360 (5% x $14,100 plus 7% x $3,260)	930
	PERA (10.64%) Base salaries total 86,000 (10.64% x 86,000) Covers 1 July 1976 - 31 December 1976 only Salary base those positions marked with *	9,140
	total personnel benefits	$ 10,070
	TOTAL CATEGORY A (PERSONNEL, CONSULTANTS, HOURLY BENEFITS)	$272,060

Category	Position	Cost IBPGR/FAO
B. SUPPLIES AND OPERATING EXPENSE		
	COMMUNICATION (includes standard telephone equipment and installation, WATS and long distance; cables; mail)	8,800
	TRAVEL[1] (local, national, international)	32,000
	COMPUTER CENTER/DATA PROCESSING	40,000
	SUPPLIES AND EQUIPMENT (includes office and data orocessing supplies, books/subscriptions; office and data processing equipment rental; and general office equipment	11,650
	COPYING/PRINTING (includes rental of photocopier)	5,600
	SPACE (rental: 12 mos, $1,300/month)	15,600
	TOTAL CATEGORY B (SUPPLIES AND OPERATING EXPENSE)	$113,650
C. INDIRECT COSTS		
	OVERHEAD (5% Direct Costs)	19,290
	TOTAL CATEGORY C (INDIRECT COSTS)	$ 19,290

[1]Travel shall be understood as follows: These funds are to be used at the discretion of the Project Co-Directors and/or Associate Directors as budgeted and will be used for the travel of staff, consultants, or other genetic resources personnel whether employed under this contract or not, from Colorado, or to Colorado, or to other places for the purpose of carrying out the work stated in this contract. Travel shall include expenses of transportation, lodging, meals, meals for guests, hospitality, expenses for guests, etc. normally incurred while engaged in work under this contract.

GRCIDS 1976 BUDGET

CATEGORY A	PERSONNEL, CONSULTANTS, HOURLY, STAFF BENEFITS	$272,060
CATEGORY B	SUPPLIES AND OPERATING EXPENSE	113,650
	TOTAL DIRECT COSTS (CATEGORY A + CATEGORY B)	$385,710
CATEGORY C	INDIRECT COSTS	$ 19,290
	GRAND TOTAL (CATEGORIES A + B + C)	$405,000

PART III: 1977

It is difficult to write a detailed statement of work for 1977 at this time. However, we assume that the methods and level of work will be similar to 1976 with the following changes in Work Statement and in budget:

Proposed Statement of Work for 1977

a) Crops: The work begun in the 1976 GRCIDS contract on wheat, rice, maize, millet and sorghum will continue to be first priority. The IBPGR will specify other crop priorities; as these are assigned, we will begin work on them as our resources permit.

b) Computer Assisted Methods: Emphasis will be placed on program maintenance and transfer to users' computers rather than on program development.

c) Joint Work Program with FAO: The joint work program with FAO developed during 1976 will continue, with strong emphasis on GRCIDS coordination with National Centers. Depending on the availability of FAO resources, certain GRCIDS responsibilities may be assumed by FAO.

d) Training: Emphasis will be placed on training. Considerable coordinating assistance is expected from FAO (c, above). Note, however, that the budget does not contain funds for trainee expenses or support.

Budget: GRCIDS 1977

The structure of the proposed core GRCIDS budget remains about the same as in the 1976 contract with the following changes:

a) An increment in salaries and all direct costs of 10%

b) An increment in salaries owing to changes in fringe benefit structure for employees due to University of Colorado requirements.

CORE GRCIDS 1977 BUDGET REQUEST

A. TOTAL JOINTLY REQUESTED FROM IBPGR/FAO*

	1976	1977	% increment over 1976
Salaries and all direct costs	$398,000	$438,000	+10%
Personnel Fringe Benefits	11,000	28,000	+155%
TOTAL	$409,000	$466,000	+13.9%

*Since the GRCIDS Contract is written and administered by FAO, and since the FAO contributes regular program funds to the contract, FAO fiscal personnel suggested a single combined contract. We are following that recommendation here. These figures do not include, however, the FAO regular program contribution of consultants' costs, backstopping, or participation of FAO regular program staff. These FAO contributed resources will be covered in the joint Taximetrics Laboratory/ FAO work program.

B. IBPGR/FAO SHARE BREAKDOWN

	1976	1977
IBPGR	$352,000	$398,000**
FAO/AGP	57,000	67,000***
TOTAL	$409,000	$466,000

**In September, 1974, a Five Year GRCIDS Plan and projected budget was presented to IBPGR. At that time, it was very difficult to present solid figures, but at least the projection provided a measure of the level of resource needs. The projection did not take into consideration changes in fringe benefit structure for employees due to University rules. Please note that the current request is 7.8% higher than the 1974 projection.

***The FAO projection is only 2% higher than the plan presented in June, 1974.