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1611 North Kent St.
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UNITED STATES INTERNATIONAL DEVELOPMENT COOPERATION AGENCY
AGENCY FOR INTERNATIONAL DEVELOPMENT

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PROJECT PAPER

INDIA

PLANT GENETIC RESOURCES (PGR) PROJECT

(386-0513)

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USAID/INDIA

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ACRONYMS

INDIAN INSTITUTIONS

ICAR - Indian Council of Agricultural Research

IARI - Indian Agricultural Research Institute

NBPGR - National Bureau of Plant Genetic Resources

GOI - Government of India

U.S. INSTITUTIONS

ARS - Agricultural Research Service

USAID - United States Agency for International Development

USDA - United States Department of Agriculture

APHIS - Animal and Plant Health Inspection Service

GRIN - Genetic Resource Information Network

NPGRS - National Plant Genetic Resource System

NSSL - National Seed Storage Laboratory

INTERNATIONAL AGENCIES

*CGIAR - Consultative Group on International Agricultural Research

TAC - Technical Advisory Committee of CGIAR

IARC - International Agricultural Research Centers

IBPGR - International Board for Plant Genetic Resources

WINROCK Winrock International Development Institute

*CGIAR centers include: IRRI, CIMMYT, CIAT, CIP, ICRISAT, ICARDA, ILRAD, ILCA, ISNAR, IFPRI, IBPGR, WARDA

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1.0 Project Rationale, Summary and Recommendation

1.1 Rationale and Summary

Genetic diversity provides the building blocks used by plant breeders and genetic engineers to assure stable and improved supplies of food, feed, forage, and medicinal and industrial raw materials for sustaining and enhancing life on earth. The rapid advances being made in biotechnological research and development are providing new and powerful tools for expanding our ability to design plants with specific desirable characteristics. This makes the availability of the needed genetic resources all the more critical.

India is extremely rich in plant genetic resources. Great diversity in wild plants and cultivated species has evolved over the centuries in each of India's varied ago-climatic zones. However, the widespread adoption of limited numbers of improved varieties has reduced the use of traditional cultivated varieties, and agricultural and industrial expansion into wild areas has reduced the diversity in the gene pools. As a result plant genetic resources in India need to be preserved before further decreases occur.

The fourth session of the Indo-US Subcommission on Agriculture identified the conservation and management of plant genetic resources as an area of high national priority in both countries. The Indian Council on Agricultural Research (ICAR) then sought the collaboration of USAID to develop a major plant genetics resource preservation program.

At present a totally coordinated national plant genetics program does not exist. Germplasm collections remain fragmented and dispersed in various institutions throughout the country, often maintained under

unsatisfactory and variable conditions due to the lack of proper seed storage facilities. Selected lines that entered India in the past from any of the International Agricultural Research Centers (IARCs) or other crop evaluation and development centers through germplasm exchange often went directly to crop specialists and did not appear in either active or base collections. Lack of resources also prevented the plant exploration and collection program from implementing as many plant exploration missions as are needed to rescue endangered germplasm and to satisfy breeders' requests.

However, the National Bureau of Plant Genetics Resources (NBPGR) has already begun an active program with the other institutions holding germplasm, and the makings of a nationally coordinated program are already in progress.

In the fall of 1986 a plant genetics resources team from the U.S. spent six weeks in India working closely with colleagues of the NBPGR. The mission assessed the current situation by visiting all the NBPGR regional stations and a number of the ICAR and university stations. After this initial assessment, the team recommended a project to consolidate the existing germplasm working collections and to upgrade the NBPGR, enabling it to carry on further explorations and improve conservation facilities. From May to June 1987, a second plant genetics resources design team spent another six weeks with the NBPGR for the express purpose of elaborating the present project paper.

In this regard the project proposes a seven-year program to 1) inventory current collections according to viability levels and sample size; 2) provide safe storage of active and base collections; 3) form an integrated national data and research system; 4) support plant exploration and

collection, incorporating eco-geographic information as a head start on the evaluation function and on laying the groundwork for future in situ conservation, should this prove desirable; 5) promote the free exchange of germplasm between international borders by building a strong quarantine system; and 6) develop an international training capability concerning all aspects of plant genetic resources.

1.2 Recommendation

The project has been developed based on extensive ICAR/NBPGR and AID discussions and collaboration. USAID/New Delhi has reviewed the PID and draft PP and found that the project is operationally feasible and technically, socially, administratively and economically sound. The poject is consistent with and supportive of AID policy. Thus USAID/New Delhi Office of Agriculture Research and Institutional Development recommends that the project be approved by the Mission and that an AID grant of $12.5 million be authorized which will include $11.9 million for project activities and $0.6 million for program management and technical support.

2.0 Project Description

2.1 Sector Goal

The Plant Genetics Resource Project addresses in part the following broad sector goal: to preserve India's rich sources of biological diversity for use in sustaining advances in agriculture.

The Indian sub-continent comprises one of the world's megacenters in which crop plants originated and diversified. It contains primary or

rice, citrus, banana, pepper, mango, cotton, and millet. In total there are about 15,000 plant species which occur in India, of which some 160 species are of economic importance. Recognizing this heritage, India's Seventh Five Year Plan, established as an agricultural research and education priority, includes "the conservation and planned exploitation of germplasm resources of plants, animal and fisheries to broaden the (sic) genetic base for improvements."

In line with the 7th Five Year Plan's priority, this project will concentrate on the preservation of plant germplasm as an essential component of India's present and future agricultural system. By the year 2000, India will reach a population of one billion, based on current population growth of 2.2% per year. This implies the need for an additional 80 to 100 million tons of foodgrains yearly. India has met its growing food demand by expanding the area under irrigation and applying new bio-chemical technologies to expanding areas under cultivation. As resources reach their limits, maintaining or increasing yields per acre becomes critical. Scientists from a number of disciplines, including plant breeding and biotechnology, must continue to research nutrient-efficient plants, stress tolerant cultivars, and higher value crops. They will require a wide base of genetic materials from both elite (highly selected) and primitive (unselected or traditional) germplasm.

The Fourth Meeting of the Indo-US Subcommission on Agriculture identified genetic resource conservation, which should include exploring, collecting and evaluating plant germplasm, as an area of priority for joint collaboration. ICAR requested USAID/India to collaborate with it on a plant genetic resources subproject under the ongoing Agricultural Research Project (ARP).

USAID/India's FY 87 Country Development Strategy Statement (CDSS) emphasizes the support of research for continued agricultural growth. The strategy statement points out that the dramatic increase in yields of wheat and rice are the result of intensive research and are dependent on maintenance research, development of plants with increased yielding ability, and increased farm production efficiency. These inter-related activities are necessarily dependent on a wide base of plant germplasm.

USAID/India plans to emphasize growth and sustainability in the agricultural sector in its FY 89 CDSS. In particular, it will continue to support agricultural research in India. The Plant Genetics Resources Project will create the essential link between India's diverse biological resources and the ability to improve agricultural production through traditional plant breeding techniques and bio-technological innovation.

The U.S. and India realize that the sector goal of preserving India's biological diversity is essential to sustaining future agricultural growth in India and in the rest of the world.

2.2 Project Purpose

The project purpose is to develop a comprehensive national plant germplasm system to ensure the collection, preservation, evaluation, and exchange of India's plant genetic resources.

The seven year plant genetic resources program is proposed as the means to achieve this project purpose. At the end of the project the following achievements are expected:

1) The more than 100 working collections dispersed throughout India at various agricultural institutions will be inventoried, including the present NBPGR's current working collections. It is expected that through a systematic and lengthy process of regeneration or recollection, working collections of about 300,000 germplasm accessions need to be upgraded, then duplicates sent to a central base gene bank located in the New Delhi headquarters of the NBPGR. Each of the regional centers will keep their respective working collections.

2) Plant exploration and collection work will have been instituted under a "rolling" five year plan. New collections will add about 300,000 new accessions to the base and working germplasm collections over the life of the project. Exploration will focus on potentially endangered germplasm and genetically diverse species deemed important by national crop advisory committees and workshops to India's agricultural development and to mankind.

3) All information on germplasm accessions will be stored in a standardized data management system with compatible computer software and hardware that will be used by NBPGR headquarters, regional centers, and cooperative agricultural institutes and universities.

4) Technology of long-term seed and tissue culture storage will have been perfected and adapted to India's conditions.

A corollary project purpose is <u>to enhance India's regional and global capability in plant genetic resource conservation and use</u>.

The kinds of project activities leading to the achievement of this project purpose are the following:

1) A fully operating international training program, collaborating with the International Board for Plant Genetics Resources (IBPGR), and will train Indian, South and Southeast Asian, and international participants in tropical and sub-tropical germplasm exploration, collection and conservation (Annex J: Proposed Draft Memorandum of Understanding between IBPGR and NBPGR).

2) Plant germplasm will be freely available to all bona fide scientists in plant genetic resources programs.

3) An effective plant germplasm quarantine program will facilitate free movement of germplasm.

4) India will be playing a leading role in plant germplasm conferences and workshops on the regional and global levels.

5) Scientific links between the U.S. germplasm system and India's will have been established.

2.3 Project Outputs

The project outputs are tangible evidence of USAID's inputs of equipment, training, short-term technical assistance, and construction. These outputs are designed to accomplish the two project purposes through the execution of the seven year germplasm conservation program elaborated in Annex A. These outputs will include:

1) A significantly strengthened National Bureau for Plant Genetics Resources is the primary output of this project. Each of the five divisions and thirteen regional stations will receive AID inputs of equipment and overseas training and increased staffing and operating expenses from the Government of India.

2) Strengthened germplasm repositories in cooperating universities and agricultural research institutes will be linked through the ICAR to the National Bureau of Plant Genetics Resources.

3) A new headquarters building and national gene bank (with a capacity of 600,000 accessions in this base collection) will be built in New Delhi.

4) An international training center with a hostel for training Indian nationals, South and Southeast Asians, and other international participants will be built.

5) A core of plant genetic resources scientists will be capable of training other staff scientists in all functions of a national plant genetic resources system.

6) A "rolling" five year plant exploration program will be developed and revised yearly according to shifting national and international needs and priorities.

7) A "rolling" five year plan will be instituted to evaluate germplasm collections according to priorities and designs provided by Crop Advisory Committees (CACs).

2.4 Project Inputs

Both USAID/India and the Government of India will contribute resources to the Plant Genetic Resources Project.

2.4.1 USAID Project Inputs

USAID's inputs will be in the form of equipment, training, construction, and short-term technical assistance. The Government of India will contribute the extra staffing and operating expenses and a major portion of the construction costs of the NBPGR headquarters. Further pre-project inputs will be financed under the USAID Agricultural Research Project (ARP) to facilitate the absorption of this project's inputs.

1) Equipment:

The project's largest component will be research equipment (see Annex C). A major constraint in the NBPGR is the limitation of field and laboratory equipment needed to carry out the volume of activity required in each of the divisions. Provision is also made for maintenance machines and tools to keep the rest of the equipment in working order.

Equipment needs are projected against requirements to carry out the seven-year plant genetic resources program and include five years of spare parts. Equipment is divided into the following general categories:

- Laboratory equipment: essential laboratory equipment such as moisture analyzers, germination equipment, dryers, microscopes, and centrifuges are urgently needed to expand the capacity to receive, test, and prepare seed for storage.

- Field equipment: while much field work is and will continue to be labor intensive, essential items of field equipment for expanded evaluation and rejuvenation of accessories are needed. These include field machinery and small plot equipment - i.e., cultivators, harvesters, and small volume seed threshers.

- Special cold storage and refrigeration equipment: proper conservation of plant germplasm materials for medium and long-term storage requires carefully regulated temperatures and humidity conditions. This reduces the need for frequent rejuvenation and also reduces the chances for genetic loss of valuable germplasm through loss of viability. The equipment relates to such items as storage units, compressors, and emergency power units.

- Office machines and equipment: this item includes all of the usual office equipment required for the handling of massive amounts of data and for communications.

- Vehicles: this includes a limited but essential number of vehicles for field work and a mini-bus to move scientists and staff between stations.

- Shop and maintenance equipment: machine shop machines and tools to maintain the network of gene banks and other equipment listed above will be provided as is practical.

2) U.S. Training:

A second AID input will be U.S. training in specific areas of plant genetic resources research and resource management (see Annex G). The principle adopted here is to train key individuals in the U.S. who in

turn can carry out training in India. A limited number of internationally recognized plant genetic resources experts will be contracted for in-country training. In-country training is designed to increase the numbers of staff exposed to training who are in the NBPGR and affiliated institutions, thus elevating the capacity of the total system to effectively carry out its work. Short courses will be given in the following subject areas:

- Information and data management: This largely computer-oriented data base management system will facilitate networking in the system.

- Plant germplasm evaluation: Techniques of evaluation are changing and improving. Staff need to follow standard procedures to increase comparability of data.

- Plant germplasm quarantine: Similarly, new techniques for testing vegetative and seed materials are complex and critical. NBPGR will need to greatly increase capacity to handle large volumes of materials.

- Plant germplasm conservation: This includes packaging, viability testing, rejuvenation, data management, and new technology (cryopreservation is being more widely considered).

- Tissue culture technology in conservation: Related to the foregoing is the conservation of plant cells and tissues, an area of relatively high technology essential to maintaining clonal germplasm.

- Genebank management: This involves training curators and support-level staff in all aspects of genebank management.

- Germplasm exchange: Proper procedures for the movement of plant germplasm material is essential to the expanded use of genetic resources. Loss of seed is frequent during exchanges.

- Machine maintenance: The NBPGR will have trained several persons in maintenance and repair of electrical/electronic equipment such as computers, copying machines, generators, compressors, refrigeration equipment, soft X-ray machines, electronic seed counters, seed packet sealers, ultra-centrifuges, differential thermal analyzers, gel electrophoresis equipment, etc.

3) Construction:

Construction is primarily a local cost component. AID, however, will finance a portion of the new NBPGR headquarters and hostel to be located in Delhi, with the GOI supporting the balance of the construction costs.

To supplement the foreign exchange budgeted for this expenditure, USAID should make every effort during the first two years of the project to procure local currency from the Indo-US Fund, an interest-bearing local currency fund. NBPGR construction costs may qualify as a valid expenditure.

See the construction and engineering analysis (Section 6.7) for details.

4) Short-term consultancies:

Short-term consultancies in very specialized areas of plant genetic resources are budgeted here. These consultancies will be geared to in-country training of Indian scientists in areas such as tissue culture techniques and cryopreservation of germplasm. In addition, provisions are made for architectural and engineering consultants (see Annex F for details).

5) Collaborative Research:

Some of the work related to plant germplasm is best done by other specialized institutions, particularly the research agencies and universities. Collaborative research is needed in biotechnology, cryopreservation, *in vitro* preservation, phylogenic relations, seed health research and evaluation activity. The NBPGR will enter into agreement with national and international institutions to establish such cooperative projects as may be required.

6) Joint Explorations:

Joint explorations to collect germplasm in the U.S. and in India may be planned under this Indo-US collaborative project. Most of North America is rich in wild sunflower species, and indigenous material of tepary bean, jojoba, buffalo, guord, guyule, oilseed halphytes, pecan, pome and stone fruits, other hydrocarbon plants and non-tuber bearing Solanum species, can be found wild in southern and western U.S.

Similarly, the U.S. is particularly interested in germplasm collection in India in sub-tropical fruits, temperate nuts and cucumis, and other cucurbits. It is proposed that about 8 explorations of 45 days, 4 in India and 4 in the U.S., by joint teams be undertaken during the 7 years of this project.

7) Project management:

This last input will provide for an Indian management assistant, with a secretary, to help manage the flow of inputs into the project during its four initial years. They will assist the AID direct-hire project manager.

2.4.2 Government of India Project Inputs

The Government of India will contribute the following inputs to the project:

1) Scientific and administrative staffing

2) Locally purchased equipment to compliment AID equipment contribution.

3) Land and partial construction costs for the National Bureau of Plant Genetics Resources headquarters building in Delhi.

4) In-country training courses for Indian personnel of the national plant genetic resources system.

5) Recurrent operating costs for the whole national plant genetic resources system.

6) Viable equipment maintenance program.

2.4.3 Indian Private Sector Input

Another possible source of funding, although not reflected in the budget tables of this project paper, is the Indian private sector, primarily the seed manufacturers' associations. These organizations may be disposed to contribute equipment, greenhouses, or funds toward building of the National Repository building.

3.0 Summary of Project Cost Estimates (in $US '000)

Item	A.I.D. FX	A.I.D. Local	A.I.D. Total	GOI	Proj. Total
Construction					
- Building	700	1,500	2,200	3,200	5,400
- Greenhouse	450	-	450	850	1,300
Land for National Repository				4,000	4,000
Equipment (Lab, Field, Office, Vehicles)	4,500	500	5,000	500	5,500
Training					
- Local	-	100	100	100	200
- Overseas	700	-	700	-	700
Consultants	550	-	550	-	550
Admn. Support	-	-	-	150	150
Collaborative Research	350	-	350	100	450
Joint Explorations	200	-	200	100	300
Evaluation/Monitoring	250	-	250	-	250
GOI Operational Costs	-	-	-	5,000	5,000
GOI Additional Salaries	-	-	-	600	600
GOI Additional Operational Expenses	-	-	-	800	800
Subtotal	7,700	2,100	9,800	15,400	25,200
Contingency	500	200	700	-	700
Inflation	1,300	100	1,400	-	1,400
AID Project Management	600	-	600	-	600
TOTALS	10,100	2,400	12,500	15,400	27,900

Table 3.1

AID Project Cost By Input And Fiscal Year

AID INPUT	FY 88	FY 89	FY 90	FY 91	FY 92	FY 93	FY 94	FY Total
Construction	-	500	1,000	700	-	-	-	2,200
Greenhouses	100	100	250	-	-	-	-	450
Equipment	1,000	500	2,000	1,000	500	-	-	5,000
Training US	200	200	200	100	0	0	0	700
Local	-	25	25	25	25	-	-	100
Consultants	100	150	100	100	50	50	-	550
Collaborative Research	-	50	50	100	100	50	0	350
Joint Explor.	50	50	50	50	-	-	-	200
Evaluation	-	100	0	0	150	-	-	250
AID Proj. Mgt. Facility	120	120	120	120	120	-	-	600
Sub total	1,570	1,795	3,795	2,195	945	150	-	10,400
Contingency	105	121	182	154	138	-	-	700
Inflation	210	243	364	308	225	-	-	1,400
	1,885	2,159	4,341	2,657	1,308	150	-	12,500

4.0 IMPLEMENTATION PLAN

Resources set aside in the Agricultural Research Project will play a key role in setting in motion the Plant Genetic Resources Project implementation. These pre-project actions, discussed in detail below, should be followed by an AID-NBPGR consultation to adjust this project paper as needed.

The PGRP implementation plan consists of three interactive phases. First, the initiation phase will take place immediately after the project has been approved by both governments. Second, the construction phase will consist of activities that take place during the construction of the central headquarters facility and the expansion of activities begun in phase I. Third, the consolidation phase will relate to a fully operating system.

4.1 Pre-Project Actions Financed under the ARP (1987-1988)

1) ARP Funded NBPGR Management Team trip to the U.S.:

A team of NBPGR's top management staff will tour U.S. facilities dealing with a plant genetics resources system to observe details and operation of the U.S. system and to identify opportunities for further collaboration with U.S. scientists.

2) ARP Funded Data and Information Management Training:

One of the priorities of this project is to set up a nationally compatible computerized information system to store all data on plant germplasm from the various working collections around the country and the base collection at headquarters, plus data generated through evaluation and conservation research. The ARP provides funds for training two information management participants at the Germplasm Resources Information Network at the USDA, Beltsville, Maryland. In addition, a data management expert from the Beltsville facility will work with Indian computer experts in setting up an information system in India that will be tailored to Indian conditions and needs.

The establishment of an adequate data and information system in the NBPGR network is essential for consolidating the existing collections, proceeding with new explorations, and accommodating the vast amount of new data that will be generated by enhanced collection, evaluation, and conservation activities.

3) ARP Funded Plant Genetic Resources Managerial Training:

One of the requirements for implementing the PGRP is an adequate managerial capability among the present division heads and sectional leaders to handle the expanded work load resulting from the PGRP.

This training should consist of on-the-job experience at a U.S. germplasm facility in the trainee's area of responsibility. The trainees should then rotate through the various administrative divisions of the facility as temporary staff learning the techniques needed to run an efficient plant genetic resources facility.

4) ARP funded Contract to Winrock International to Establish Sources and Costs of Equipment:

The project design team and the NBPGR listed equipment to be financed under the PGRP. Sources and costs of equipment must be determined and revisions made as needed after being cleared by the NBPGR. Once sources are established, all necessary waivers should be processed by Winrock for AID and by the NBPGR. (See Annex I for currently used procedures.)

Appropriate GOI waivers such as the Not-Made-in-India Certificate should be processed with the NBPGR. A final list of foreign exchange purchases should be generated and sources established. This ARP activity is essential to accelerate the procurement of equipment once the project has been approved.

5) ARP Funded Architects, Consulting Civil and Refrigeration Engineers:

A major component in the PGRP will be an AID contribution to the building of the NBPGR headquarters and gene bank in Delhi and greenhouses and screenhouses in various quarantine station locations. It is estimated by the NBPGR that the facility holding the base collection should be designed to hold a total of 600,000 accessions. This space will not all be needed immediately, but for the first 10-20 years, the number of accessions in the base collection should approach half to three-fourths that number as the scattered active collections are duplicated in long-term storage at Delhi. The size of regional collections will vary from location to location and will be held in medium-term holding conditions.

The NBPGR has already initiated preliminary design work with the Department of Public Works of the GOI. However, given the specialized nature of gene bank construction, the ARP will fund through Winrock International consulting architects and engineers in gene bank construction and management. Specific refrigeration performance specifications required for adequate storage of germplasm should be the outcome of this consultancy. The NBPGR should weigh the issue of permanent storage facilities versus the use of modular units and the long-term operating consequences of the choice.

The project design team proposes the use of prefabricated storage modules that offer the greatest flexibility in terms of both use of space and time when the units become operational. The NBPGR will be doing

research on the comparative advantages and disadvantages of conventional cold storage facilities versus storage in liquid nitrogen tanks. Modular units will probably provide more flexibility at less cost than will built-in storage rooms.

For the regional facilities, appropriate size modules may be fitted to existing physical facilities at little or no additional cost. Fixed cold storage units have often proven difficult to maintain under proper temperature and humidity control. Sizing of these units should be determined by a reasonable estimate of the number of accessions each station intends to hold in its working collections.

The issue of whether or not the greenhouses and screenhouses should be designed and built locally must also be resolved: exacting standards are required by quarantine stations of similar function in the world today and special climate control devices are necessary. Tissue culture research on in vitro conservation of clonally propagated crops will also have exacting demands on environmentally controlled greenhouses and growth chambers.

6) ARP Funded Consultants on Tissue Culture Preservation:

The project design team recommends that a world-class tissue culture expert be contracted to give a series of seminars on the subject before any Indian trainees go to the U.S. This pre-training will provide a better working knowledge of the subject and make the U.S. study tour more profitable.

These six ARP funded pre-project actions are essential for properly staging the implementation of the Plant Genetics Resources Project. After the above actions are completed, the NBPGR should consult with USAID/India to make any necessary adjustments to this implementation plan.

4.2 Main Project Implementation Plan

The Plant Genetics Project is divided into three interacting phases. The first or initiation phase of two years will focus on making inventories and centralizing the working collections of germplasm located in various agricultural institutions outside the NBPGR network. The second phase will undertake the construction of the NBPGR headquarters while the inventorying of the first phase continues. Finally, the last three years of the project will concentrate on consolidating a fully established national germplasm system, and on functioning as an international training center for the national and international germplasm network.

4.2.1 Phase I: Initiation Phase (Years 1-2)

During the first two years of the project, the NBPGR will concentrate on consolidating the various working collections inside and outside its network of field stations. There are thirteen NBPGR and ICAR research stations in addition to various agricultural university collections. Many of these germplasm collections have been stored in

below-standard conditions. In order to establish valid collections, germination tests must be carried out on each accesssion. Collections that prove to have low germination rates will need to be regenerated or recollected. Each institute will then maintain a working collection and send a duplicate set to the base collection at the NBPGR. The NBPGR will store these accessions in its base storage facilities. These regional centers will also be outfitted with properly sized medium-term cold storage facilities.

During this phase the NBPGR will continue to mount plant explorations according to priorities set by various national advisory committees and workshops that include both private and public sector participants. Key personnel will also receive U.S. training in areas such as tissue culture preservation, evaluation (according to crop specialty), quarantine techniques, and information management. After U.S. training, the NBPGR will organize continuous in-country training sessions in the various functions associated with a national plant genetic resources system. This in-country training program will be reinforced by periodic short-term consultants from abroad.

Equipment destined for the regional research and quarantine stations will be shipped or purchased locally.

During this period, the NBPGR will also finalize the design of its headquarters that will house its central gene bank for the base collection, quarantine facilities, research laboratories, offices, and information system data base, and the hostel for the international training center in Delhi; secure the proper zoning waivers; oversee the Department of Public Works as it lets tenders for the actual construction; and proceed with construction.

4.2.2 Phase II: Construction of Headquarters (Years 3 and 4)

The second phase of this project will focus on the construction of the NBPGR headquarters. By the end of this two year period, the entire central gene bank, headquarters offices, training center, hostel, and quarantine station should be at or near completion.

Scientists who have received their U.S. training will continue the program of in-country, in-service training of other NBPGR personnel.

A second shipment of equipment destined for the new headquarters will be sent to complete the equipping of the entire system.

Phase I inventorying of the regional working collections will continue. The base collection will gradually be moved into the new facility.

At the end of Phase II, USAID and the ICAR/NBPGR should evaluate and redesign this project in the light of experience from the first four years (See section 5.0, Monitoring and Evaluation Plan.)

4.2.3 Phase III: Functioning National Plant Genetic Resources System (Years 5,6, and 7)

During this final phase, the national network should be fully established and operational. The main facility will be completed and occupied. Following appropriate testing of the seed storage facility, the base collection will be transferred to its permanent headquarters in the new facility.

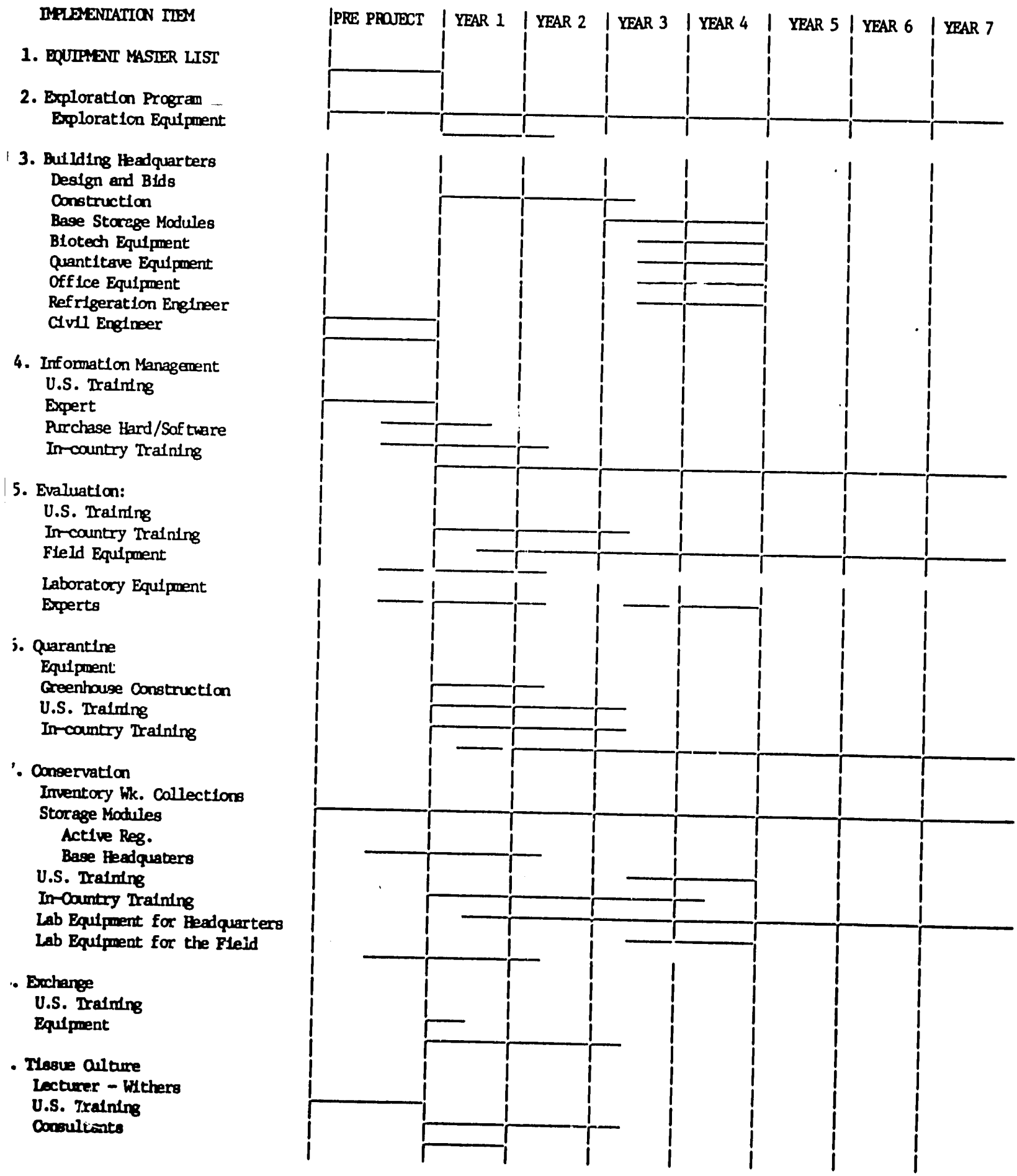
The principal regional working collections should be under proper storage and documentation (inventory and description) of all materials completed. Each of the divisions will have completed the acquisition and installation of equipment, and established its respective staff and program operations at an adequate level to deal with the expected increase in acquisitions, exchanges, and new entries in the collections. The training activities will have become fully operational.

The national plant genetic resources system should play a major role within the South and Southeast Asian sphere and function as a more active member of the international plant genetic resources community. Its international training center (ITC) should be fully operational and be functioning as a center of excellence and training scientists from all over the world.

All AID inputs, except for periodic visits by U.S. consultants, should have been completed at the beginning of this phase.

A summary of this project implementation plan is represented below:

IMPLEMENTATION PLAN FOR THE PLANT GENETIC RESOURCES PROJECT



4.3 Procurement of Equipment

Since equipment is the major component of this project, the most expeditious methods of procurement must be tried. Equipment for this project will be procured offshore and within India (Annex E). To the extent possible USAID should act on behalf of the grantee to procure the specialized equipment abroad with foreign exchange. To expedite this procurement, resources have been set aside in the ARP to contract Winrock International or any other bona fide firm to refine the equipment list, set priorities, find sources, and procure the PGRP equipment. Obligating documents (PIO/Cs) will be drawn from this project, while the procurement services rendered by the contractor will be paid from ARP funds already available. (For description of procurement procedures see Winrock model Annex K.)

Direct foreign exchance purchase of most specialized scientific equipment is the most expeditious procurement method and should be stated in the project agreement signed by the two governments.

It is expected that both sole source and third country 901 waivers will be required for some scientific equipment. The procurement contractor should be responsible for processing these waivers through USAID/India and the GOI as needed.

NBPGR will be responsible for securing the Not-Made-In-India certificate that is required to import such equipment. The NBPGR will also be responsible for arranging the duty-free entry of equipment imported under this project. If customs duties must be paid, the NBPGR must budget sufficient funds to pay this duty. It must also budget enough funds for all inland transport of this equipment, especially to the outlying regional stations.

The NBPGR will be responsible for procuring locally available equipment. Since the NBPGR must procure this equipment from its annual capital expenditure budget, it must allow for a sufficient allocation for this purpose each year. Based on reimbursement vouchers submitted to AID, AID will reimburse the GOI through the Department of Economic Affairs of the Ministry of Finance.

4.4 Procurement of Short-Term Consultants

To procure the services of short-term consultants, an IQC firm should be contracted after a blanket PIO/T for all the contemplated consultants has been issued by USAID/India. Since this is a direct dollar purchase of services, USAID/India will contract the IQC firm on behalf of the grantee.

The NBPGR will be responsible for securing all clearances from the GOI for the purchase of these services and the experts' entry into India.

Since this project establishes the NBPGR as part of an international plant genetics resources system, several international germplasm experts of renown may be required for very specialized functions. In this case, the IQC contractor may need to process a waiver to hire a third country national.

4.5 Training

Given the very specialized nature of this project's training component, it is recommended that all or most training be procured through the U.S. Department of Agriculture, Office of International Cooperation and Development (OICD), International Training Division, Washington, D.C. 20250-4300. OICD would be expected to work with the Agricultural Research Service (ARS) in identifying training opportunities best suited to the needs of this project's Indian trainees. Many of the site visits and much of the on-the-job training will take place within the U.S. germplasm system and can best be arranged through the USDA. All other training contemplated at research institutes and universities will have direct or indirect ties with the USDA.

OICD will act on behalf of the NBPGR to procure all U.S. training. Standard rates and per diems apply. The NBPGR will be responsible for securing the appropriate clearances to release trainees for their U.S. study.

4.6 Procurement of Building Construction

Although building construction is essentially a local cost component, AID will reimburse the GOI for building expenditures up to the limit of its commitment. The USAID/India civil engineer in conjunction with a local architectural firm should set up performance criteria upon which AID's reimbursement can be determined.

The NBPGR must annually budget the needed construction costs since all construction expenditures will be drawn solely from the NBPGR budget. AID will reimburse the GOI through the Department of Economic Affairs of the Ministry of Finance according to a mutually agreed upon construction and quality schedule.

4.7 Maintenance of Equipment

Under this project NBPGR laboratories and offices at headquarters and field locations will receive modern equipment. Service contracts for this equipment are not always available locally or are not satisfactory.

The NBPGR will train several persons in maintenance and repair of electrical/electronic equipment such as computers, copying machines, generators, compressors, refrigeration equipment, soft X-ray machines, electronic seed counters, seed packet sealing machines, ultra centrifuges, differential thermal analyzers, and gel electrophoresis equipment. Initially such a maintenance shop for all the stations

will be set up at the Delhi headquarters. Personnel from field stations would be trained at the headquarters repair shop so that each field station could eventually perform much of its own maintenance and repair services.

The project will provide repair shop equipment to do electrical work, sheet metal work, welding, soldering, pipe fitting, metal and wood working lathes, drills, presses, shapers, etc.

4.8 Project Management

The NBPGR plans to create a project management unit to implement this project. Up to this point in the project, administrative duties will have been spread among the five division chief scientists. The creation of the project management unit will relieve the scientists of this administrative load.

The unit will be staffed by a senior manager backed by an accounting and general services staff. The unit manager will report directly to the NBPGR director and function on the level of a deputy director. This unit will also serve as the evaluation and monitoring office for both the project and the future functioning of the national plant genetics resources system.

USAID will also create a project management unit within the agricultural division of the mission. This unit will be funded from this project. Funds are available for a five-year personal services contractor and an administrative assistant to manage the inputs of this project.

Both interfacing project management units will be responsible for the day-to-day monitoring of the transformation of project inputs into the project outputs. Program evaluation from the output level to the project purpose level will be carried out by outside experts.

5.0 MONITORING AND EVALUATION PLAN

5.1 Monitoring

The NBPGR will identify a senior staff member to coordinate and monitor project activities. Working with this NBPGR officer, the USAID/India project officer and new hire FSN with agriculture research and management experience will periodically undertake site visits and interact with the director of the NBPGR and his staff to assess project progress and assist the NBPGR in project monitoring.

NBPGR will draw up an annual work plan and budget at the beginning of each GOI budget cycle (April 1 to March 31). The NBPGR and the USAID/India project officer will jointly undertake annual reviews of project progress according to a mutually agreed upon schedule. The past year's progress will be reviewed, the following year's plan of work finalized, and the work plan for the remaining years of the project discussed and agreed upon in more general terms. This cycle will be repeated each year. The annual review will be the focal point for the NBPGR and USAID guidance of project activities, including training, construction, and equipment procurement actions to be taken. A plan will be developed for appropriate high level consultation in NBPGR/ICAR and USAID in the event untoward delay or difficulties are met.

NBPGR will establish a management unit headed by a senior staff management person. This unit will coordinate and monitor project inputs and project expenditures activities, develop annual work plans, and monitor the overall success of the project in meeting project purposes. It will ensure that annual reports are filed on time and that feedback information is provided promptly to headquarters and zonal program managers. The NBPGR should develop a standard format that will include accumulated project expenditures made over the past 12 month period.

5.2 Project Evaluation

The project will be subject to three evaluations. The first will be a minor "adjustment" evaluation made after all ARP financed start-up activities have been completed. The second will occur after the fourth year and will be a full program evaluation measured against projections indicated in the logical framework. The third evaluation will be an end-of-project program and financial evaluation. In addition, annual reviews and site visits are intended to provide information on the degree to which project inputs (training, construction, and commodities) are flowing into the project. Information generated from the annual reviews and monitoring visits will form a part of the mid-term project assessment.

The end-of-project evaluation, conducted during the 1994-1995 period, will assess the extent to which the purposes of the project and the resulting outputs were achieved. It will address the following questions: To what extent has the project assisted the GOI to create a comprehensive, national plant genetic resources network? To what extent has a safe and efficient plant germplasm quarantine system been developed? It is anticipated that independent teams will conduct the mid-term and final evaluations. The teams will involve AID staff, and NBPGR staff if deemed necessary, and specialized outside expertise mutually acceptable to the NBPGR (GOI) and USAID.

5.2.1 Output and Achievement of Purpose Questions

These questions seek to determine to what extent the strictly quantitative objectives of the project have been met and to what extent these outputs have led to a strengthened and efficient germplasm collection, evaluation, and conservation system with a fully integrated germplasm quarantine system that provides effective international exchange of germplasm and research collaboration.

1) Indicators:

Indicators for facilities development, training, technical assistance and purchase of equipment include procurement plans, contracts awarded for services and equipment, new NBPGR facilities developed at headquarters and regional stations. Greenhouse construction, the number of scientists trained in India and the U.S., and the successful completion of training under the ARP program will all be considered.

2) Data Collection Methodology:

Data will be summarized from annual monitoring reports, from the earlier project evaluation, and from administrative records maintained by the NBPGR used to assess project success. Data will include such items as funds dispersed, construction underway and completed, equipment purchased, and persons trained.

5.2.2 Users of the Information

The users of the information will be the NBPGR staff at headquarters and regional stations, the ICAR, USAID and the entire international plant genetics resources network. On the basis of analysis of the monitoring data, evaluation reports and discussions with the NBPGR, an implementation status report will be provided to the ICAR and NBPGR with recommendations for any remedial measures required.

6.0 SUMMARIES OF ANALYSES

6.1 Technical Analysis

6.1.1 Historical

The NBPGR had its origin in 1944 when a Section of Plant Introduction was established in the then Division of Botany of the Indian Agricultural Research Institute (IARI). It became a full-fledged Division of Plant Introduction at IARI in 1961. This Division was administratively separated as the National Bureau of Plant Introduction (renamed in 1977 as the National Bureau of Plant Genetic Resources, under the direct control of ICAR).

NBPGR's mandate was to: 1) coordinate the country's programs in the collection, evaluation, and preservation of plant germplasm, 2) collect and disseminate germplasm information, 3) conduct research on maintenance methodology, and 4) develop an effective quarantine system for plant germplasm entering or leaving the country. The mandate is broad; the NBPGR's physical and technical resources need extensive strengthening to effectively collect, evaluate, and conserve India's vast wealth in plant genetic resources. To be effective it must interact with a number of other agencies, including those in the private sector that use plant germplasm.

6.1.2 The Importance of Plant Genetic Resources

Plant genetic resources, in the context of a given crop, is that totality of genes available to a plant breeder for affecting heritable changes in that crop. This "genetic reach" may be restricted to members of the same species, or extend to species of the same genus, or in rare cases to members of closely related genera.

Plant genetic resources is synonymous with germplasm in that both are carriers of heritable material from one generation to the next.

Man has brought on rapid, directed evolution in the plants that provide him with food, fiber, fuel, and feed for his livestock. He has learned to manipulate germplasm and the science of genetics to tailor

crops to resist insect and disease pests, environmental pollutants or toxicants, to produce under extremes of temperature and water availability, all of which make much more efficient use of inputs to crop production.

We have all heard of the three natural resources: soil, water, and air (light and temperature), but agriculturalists and administrators of agricultural research have consistently overlooked the fourth natural resource - the renewable resource that makes it possible for man to utilize soil, water, and air to his advantage - germplasm.

With the accelerating loss of biological diversity worldwide and the related dramatic changes in environments, man is faced with the increasingly difficult task of meeting a widening range of environmental hazards with a decreasing arsenal of plant genetic resources.

Instead of administrators worrying that too much germplasm is being collected and maintained at too much cost, they should be worried about losing irreplaceable genetic resources. It will require the unselfish cooperation of all to preserve it for future generations to utilize in improving the quality of life for the inhabitants of Earth.

That is the central, long-term objective of this cooperatie Plant Genetic Resources Project being sponsored by the Governments of India and of the United States of America.

6.1.3 Anatomy of a Plant Genetic Resources System

An integrated plant genetic resources system includes most or all of the following program functions:

1) Acquisition through
   a) collection
   b) exchange
2) Evaluation
3) Conservation
4) Information Management
5) Enhancement
6) Training
7) Plant Quarantine
8) Assessment of Genetic Vulnerability of Crops
9) Program Management

Staffing	Publications
Budgeting	Public relations
Coordinating	

1) Germplasm Acquisition

a) Collection

The NBPGR, and its predecessor organizations, have an impressive history in plant germplasm exploration, collection, and exchange. Indian scientists, since the last part of the 19th century, have recognized that the country's rich diversity in agro-climatic zones and its very long history of plant selection and crop improvement have endowed the country with a rich heritage of diversity in plant genetic resources.

The native genetic resources of Indian centers of diversity are found in eight phytogeographical/agro-ecological provinces. Here a variable array of biotypes, forms, land-races, and primitive varieties of cereals, millets, legumes, vegetables, fruits, oilseeds, fibers, sugar sources, spices, condiments, and many plants with medicinal properties are found. In addition these same zones support some 320 species that are the wild or weedy relatives of crop plants. The NBPGR publication, Plant Genetic Resources - An Indian Perspective, Paroda, R.S. and R.K. Arora, NBPGR Sci. Monogr. No. 10, 1986, provides details on the genera and species involved and also reports exploration and collection activities for the years 1976-1985.

Indian agriculture, and indeed the world's agriculture, stand to benefit from the germplasm exploration and collection efforts already made within India. To continue this important but far from completed work, the resources of the NBPGR and its collaborators should be increased through this project so that timely rescue and conservation of these genetic resources can be accomplished. This activity must receive the NBPGR's highest priority.

The NBPGR has a 5-year rolling plan for exploration and collection. The project design team compliments the Bureau on this forward planning and recommends that such field work become an early component of training plans for the international training center detailed and recommended elsewhere in this Project Paper.

Vehicles, collecting equipment, and camping gear are necessary for extended collecting trips in remote areas. These collecting trips should also be used to obtain more habitat-related data and to evaluate new field collecting technology for clonal materials.

The In Vitro Committee of the IBPGR in publication AGPG: IBPGR/83/108, June, 1984, in the "Potential for Using In Vitro Techniques for Germplasm Collection," makes some very useful recommendations regarding use of in vitro methods for collecting and conserving recalcitrant seeded plants and clonally propagated plants.

The guidelines and references provide the amounts and kinds of propagules to be collected. This publication also identifies researchable problem areas that need to be addressed in the collection and conservation of clonal germplasm.

The use of in vitro techniques in field collecting significantly broadens the plant exploration and collection plans for rescuing endangered germplasm. Because clonal propagules have been difficult to collect and preserve until they could be given proper care in a laboratory, species that must be clonally propagated or which have recalcitrant seed have largely been neglected in collection and conservation activities.

The Plant Exploration and Collection Division in cooperation with the National Facility for Plant Tissue Culture Repository and the Conservation Division should work hand-in-hand on research and application of research results with these important crops.

It is also evident that there will be an impact on plant exchange and plant quarantine by developments from an expanding germplasm collection activity.

During the 10-year period of 1976-1985, the NBPGR carried out 106 collecting expeditions in six (6) phytogeographic regions designed as high priority because of wealth in genetic diversity and endangered species due to shifting land-use patterns. These regional explorations yielded 48,326 accessions. During this same 10-year period, the NBPGR mounted 69 crop-specific explorations that yielded 11,227 accessions in 23 crops and crop groups. This ambitious decade for exploration and collection in India shows a total of 106 collecting expeditions that enriched India's genebanks by 59,553 new accessions.

If this level of effort is maintained during the 7 years of this cooperative project, then we would expect a total of about 175 collecting expeditions (25-30 per year), yielding about 60,000 new accessions of species that, most importantly, heretofore have been inadequately explored. This is a worthy goal.

b) Exchange

In the decade 1976-1985, NBPGR had exchange links with about seventy different countries. Over that period those exchange partners sent India 732,990 accessions of germplasm and India sent out 45,399 accessions. The 70 countries sending germplasm to India sent an average of 10,471 accessions each. India sent these countries an average of 648 accessions each.

This imbalance is not serious. It does reflect an active free exchange program. Through this project, which will permit India to enhance its exploration and collection, its plant quarantine system, and its evaluation of germplasm accessions now in her genetic resources system, it is expected that the exchange function will also be materially enhanced.

2) Germplasm Evaluation

Because of the wide distribution, both geographically and administratively, of the elements of the NBPGR's program, it is difficult to track all evaluation activity. The project design team got the impression that considerable evaluation is going on but that much of it is focused on the immediate objectives of plant breeding projects. These objectives are frequently focused on genes for resistance to insect and disease pests or on adaptation to environments of specific production areas.

These kinds of evaluations must be done, but too often the results are not widely communicated and/or too specific to be of general use by other breeders, domestic or foreign.

Evaluation of germplasm is a never-ending process. The range of possible interactions between genotypes and environments is at this time, to all extents and purposes, infinite. No plant genetic resources system can be expected to do more in the way of germplasm characterization than

to provide reliable information on plant morphological features that have a high level of constancy across environmental variables and the general ecogeographic areas of adaptation. As for germplasm evaluation, a genetic resources system must content itself with obtaining reliable data on a crop-specific set of characteristics that is the most useful to the most breeders. This information will help a breeder select accessions of promise for his breeding program. He can then focus on the in-depth, specific evaluations for his particular breeding objectives.

The design team recommends that the NBPGR set up a Crop Advisory Committee (CAC) for each crop or crop group for which there are active breeding programs. These CACs would assist in identifying germplasm needs that could be met through exploration and/or exchange, descriptors or characteristics that should be evaluated, and deciding who among the breeders could participate in the evaluation process and at what cost.

The design team also recommends that the NBPGR, with advice from the CACs, organize a 5-year rolling plan for evaluation of germplasm accessions of each crop and reporting of results on a timely basis. These will provide the means for tracking progress and identifying future needs for staffing, equipment, and training.

It is evident that a stepped-up program of germplasm evaluation will require additional tillage and planting equipment, pollination control supplies, small plot harvesters, seed cleaning equipment, and additional technicians and laborers.

No plant genetic resources system is apt to have a sufficient budget to permit evaluation of germplasm of all crops simultaneously. Priorities will have to be set which will be the basis for scheduling sequential evaluation research of a few crops at a time. When evaluation has been completed on one set of crops, the funds would be rolled-over on another set of crops, leaving some funds behind for evaluation of new accessions as they come into the working collection.

3) Germplasm Conservation

Of all the functions that comprise a plant genetic resources system, conservation is often the weakest link. This situation is usually not the fault of scientists and managers in germplasm conservation posts but rather a matter of budgets. Seed and clonal germplasm conservation facilities and equipment have high initial costs. Operations and maintenance costs are also high in comparison with those of other functions in the germplasm system.

While some of these costs may be avoided or reduced through prudent management decisions and actions, the savings will not be large if safety of the germplasm remains the primary objective.

Consolidation of facilities, equipment and staff appears to offer the most hope for effecting significant cost reductions. There is no *a priori* requirement (unless it is an administrative one) that active

collections be located at a station or stations where breeding research on that crop is being done. Breeders are usually very busy with their own research and often are not interested in getting involved in germplasm evaluation and conservation matters even though their knowledge of the biology of the crop would be valuable to both functional areas.

Aggregating working collections of a crop or crop group could require a full-time, well trained curator rather than several part-time curators and could reduce the number of sets of seed storage units and back-up generators. Equipment such as seed dryers, seed germination cabinets, seed cleaners and counters could be materially reduced along with equipment maintenance costs. All of this implies more efficient, careful control of collections and greater security of valuable germplasm.

The possible additional costs of shipping requested seed samples to breeders from these consolidated collections would probably be much less than that of equipping and maintaining an excessive number of active gene banks.

The NBPGR has informed us of plans to begin aggregating some of the working collections to achieve better coordination and reduce conservation costs. Such consolidation will be preceded by inventories of the collections involved and an assessment of quantity and quality of seed in each accession. Those accessions having ample seed of good germination levels will be divided to provide a sample for the base collection at New Delhi, if needed.

The Director, NBPGR, has plans in hand for sending a team consisting of an engineer and a gene bank manager to each location to assist in the assembling and operation of key seed storage units. This foresighted planning is commendable and should minimize difficulties in putting the new units into effective use.

There is no question as far as the design team is concerned about the need for adequate, reliable seed storage facilities at locations responsible for working or base collections of seed-propagated crops. The needed size of such modules and the size of stand-by generators to insure continuous operation of the modules must be carefully reexamined before the project actually gets underway and in the light of prepared aggregation of collections.

Germplasm collections are classified under two categories according to their current status in a plant genetic resources system. Those accessions that are readily available for use by plant breeders or other users of germplasm are maintained in "active" or "working" collections. An active collection is similar to a checking account in a bank - it is available for withdrawal as needed. The other category of collections is called a "base" collection. A base collection is similar to a savings account in a bank. These "funds" stay in the bank and are withdrawn only to start an active collection or to replenish an accession that has become exhausted to a level where it is no longer representative of the original accession in terms of genetic composition. Breeders draw upon

active collections for their germplasm needs. Active collections draw upon base collections and new acquisitions to have germplasm of current use to breeders.

Active collections are maintained in seed storage facilities where the recommended storage environment is 5°C and 30% (or lower) relative humidity. Seed to be placed in an active collection should be dried to 5% moisture, then hermetically sealed in vapor-proof foil bags. This storage environment will permit retention of viability levels in excess of 80% for 15-20 years for most seeds sown as field crops. This preservation mode is called medium-term storage.

Base collections of seed consist of accessions that have an initial germination rate of 90% or higher, seed moisture of 5-7% and 500g. or more of seed. The seed is stored in vapor-proof foil bags, hermetically sealed and stored at -20°C. This storage environment should permit most seed to be stored for 50-100 years without significant loss of viability. This preservation mode is called long-term storage.

Research and pilot studies are in progress in the United States to evaluate and test assumptions regarding life span and genetic integrity of seed of many species subjected to liquid nitrogen storage for a range of periods of time. Research also is evaluating the use of a number of different cryoprotectants to reduce damage to the seed during the immersion process. Costs involved with this storage mode are being

documented, but more experience is needed before this type of system is recommended for general use. The NBPGR, under this project, will undertake research to evaluate seed storage in liquid nitrogen as an alternative for India to environmentally controlled seed storage modules of the conventional type.

Clonal germplasm is also maintained in active or working collections. These can take the form of clonal repositories (also called field gene banks) where a number of individuals of each accession are maintained in orchards established in agro-ecological habitats to which the species are well adapted. Many germplasm biologists consider these to be active collections only and not qualified to be called base collections. Or, for some crops, the maintenance mode may be storage of roots, rhizomes, tubers, corms, bulbs at temperatures maintained above freezing ($5^{o}C$ to $10^{o}C$) and humidity controlled to prevent dessication or rotting.

Recent and on-going research has demonstrated that clonal germplasm, of at least some crops, can be stored in active collections in the form of leaf tissue, stem cuttings, callous tissue, pseudo embryos, and meristems. Too, research now suggests that some clonal germplasm can be conserved <u>in vitro</u> under cryopreservation. This latter preservation mode may permit its recognition as meeting all requirements of base collections.

Under this project NBPGR will be undertaking research to evaluate the feasibility level and technology needed to conserve clonal germplasm in a cryopreservation mode.

Conservation biology as it relates to seed and clonal germplasm still requires a great deal of research, but because conservation is costly, it attracts the attention of budget-conscious lawmakers and administrators. However, research into all aspects of germplasm conservation is needed if costs are to be minimized while safety and genetic integrity of these irreplaceable resources is improved. Security of the germplasm must be the first consideration. We cannot risk the loss of genetic diversity, especially when we know so little about the nature and extent of that diversity. This paradox can only be mitigated through an efficient, integrated national plant genetic resources system that defines and emphasizes program priorities, protocols and practices that work to assure safety of genetic resources at least cost. This project on plant genetic resources will materially assist India in developing such an integrated national system. Necessary facilities and equipment for germplasm conservation and research on improved methods of conservation are many and costly. Conventional seed storage modules and back-up generators to insure their continous operation cost $60,000 to $100,000 per set, depending on size of the storage module.

In addition, seed germination chambers, seed drying rooms, continuous recording temperature/humidity sensors, microscopes, electronic seed moisture analyzers, stainless steel cryopreservation tanks, etc., are all essential to safe, efficient operation of seed conservation facilities.

Research on conservation of clonal germplasm also requires sophisticated facilities and equipment. Environmentally controlled greenhouses and growth chambers, cryopreservation tanks, low temperature microtomes, microscopes, precision weighing devices, transfer chambers, and ultracentrifuges are all expensive and all essential.

4) Information Management

Information management is the "central nervous system" of a plant genetic resources system. It is the principal communication link among all participants in the system. Information management must be staffed with information specialists who also know the capabilities of computer hardware and software and the compatibilities or non-compatibilities among them. The objective is, of course, to have compatible hardware and software throughout the system.

A computerized information system must be programmed to accommodate data bases in the following fields:

- taxonomy and nomenclature
- association of identifier numbers where more than one accessioning system has been in use
- passport data
- characterization and evaluation descriptors, rating scales, and data
- location in the system
- maintenance data and schedules
- user requests and response records
- inventory of quantity and quality of seed in each accession
- germination testing history and schedules
- regeneration schedules
- patterns of use of accessions

Information management must be designed and controlled from Bureau headquarters. If outlying stations are permitted to design and implement their own systems, they will surely not be inter-compatible to a desirable degree. NBPGR should plan its data management system for germplasm in such a way as to link into the global germplasm information network.

The design team recommends that information management be given division status, if possible. An information management division would have line responsibility for seeing that the information needs of all NBPGR units, including management, were being met in a timely, effective manner and in accordance with Bureau policies and priorities.

The design team also recommends that even before the project officially begins USAID/India provide training funds for two NBPGR staff members to spend four months together at the Germplasm Resources Information Network (GRIN) headquarters at Beltsville, Maryland, and some time at several remote sites in the GRIN system to gain instruction and hands-on experience in a national information management system with a central data-base management group. These trainees would then be expected to train information specialists in the NBPGR network.

Perhaps several months later it would be highly desirable to have a GRIN headquarters staff person spend 6-8 weeks in the NBPGR helping to modify a GRIN-type system to fit India's requirements.

Meanwhile, USAID/India and NBPGR staff should be assessing the availability in India of computer hardware/software packages and maintenance contracts.

5) Germplasm Enhancement

This function involves cytogenetic/genetic research on moving desirable genetic traits from exotic germplasm into improved lines having good agronomic characteristics. Some prefer to call this activity "pre-breeding." The objective is to provide breeders with germplasm pools that give them new sources of genes and combinations of genes that will permit them to achieve the phenotypic expressions needed to meet their breeding objectives and at the same time contribute to reduction of genetic vulnerability of the crop to biotic and abiotic stresses that may characterize large, uniform production areas where monoculture is the rule.

This research opportunity is usually well received in departments of botany, genetics, and plant breeding in agricultural universities. Carefully chosen problems in germplasm enhancement can be attractive subjects for M.S. and Ph.D theses.

While this function facilitates the use of genetic diversity in breeding programs and will ultimately become more and more essential in plant genetic resources programs, it can be deferred until necessary funding is available through the GOI budget process. It should be given high priority in future budget requests of the NBPGR.

6) Training

Germplasm biology and management of germplasm functions are not subjects generally available through college curricula. Specialized training, in addition to basic education in the biological sciences, is needed for most scientists and technicians seeking careers in a modern, integrated plant genetic resources system.

Training in biological and computer laboratories is abundantly available and can have direct application in genetic resources programs. However, training opportunities are very limited for the field aspects of exploration/collection, evaluation, and conservation.

Countries such as India that are endowed with rich sources of plant genetic resources distributed over ecogeographically diverse areas are in an enviable position to provide training in those field aspects of germplasm biology. The fundamentals of in situ conservation, evolution gardens, and in-depth ecogeographic studies are yet to be articulated through any training courses.

The design team has proposed to the NBPGR that it develop training courses emphasizing, but not restricted to, field oriented aspects of plant genetic resources work and implement these plans through an international training center (ITC) at NBPGR headquarters in New Delhi. It is envisioned that such a training center would be largely self-supporting through tuition fees, sponsorships, and grants-in-aid. Consideration should also be given to establishing graduate degree programs at IARI in cooperation with the NBPGR.

Training facilities would require a lecture room equipped with audio-visual aids and one or more demonstration laboratories; field exploration and collecting would require such equipment as jeeps, collecting equipment and supplies, camping equipment, cameras, binoculars, and plant presses.

For students attending the ITC to take full advantage of their limited time in New Delhi, it is recommended that a small hostel, accommodating up to 35 students, be constructed near NBPGR headquarters on the IARI campus at Pusa. This would also reduce the need for high per diem allowances while students are in Delhi.

Training in field exploration/collection could start within two years. Other courses could be added as planning and demand dictate.

7) Plant Quarantine

Plant germplasm is widely exchanged among countries and all countries benefit from such exchanges in terms of crop improvements leading to remarkable increases in food production. But exchanges between genebanks also increase the risk of exchanging pathogens, weeds, and insects. So that germplasm exchanges can continue uninterrupted - and even be expanded - all donor and receiver countries must institute safeguards against sending or receiving infected or infested germplasm samples. Effective, non-destructive measures are available for greatly reducing this risk while improving the survival rate of germplasm in the quarantine process.

To improve quarantine services and safeguards, research is needed on: reliable methods for detection of infected or infested germplasm accessions; safe, rapid, and effective methods of destroying pathogens and insects in all life-cycle stages, viruses latent and expressed, and plant nematodes in plant material or in accompanying soil or packaging; and research on improved technology for rescuing the germplasm involved and getting it to the requesting scientist as quickly as possible.

Such research requires modern, specialized equipment such as environment-controlled glasshouses, screenhouses and growth chambers, soil sterilizers, fumigation tanks, soft X-ray equipment for non-destructive examination of seed and other plant parts, heat therapy equipment, pesticide applicators and safety equipment, and post-entry quarantine greenhouses and nurseries.

Quarantine scientists and technicians require specialized training in identification of native plant pathogens, insects, nematodes, viruses, weeds and these same categories of organisms that are not known to occur in their country but are known to be destructive of crop health and yields elsewhere. They also have to become familiar with known, effective controls and eradication methods for these potential invaders.

8) Assessment of Genetic Vulnerability of Crops

When more and more plant breeders use the same basic germplasm in developing new varieties of a given crop, that crop in a given production area can become uniformly vulnerable to attacks by disease and insect pests. This provides a situation conducive to rapid development of such pests to an epidemic level. Or the varieties may be rather uniformly susceptible to abiotic stresses such as drought, temperature extremes, soil pH, and aluminum toxicity.

If, however, farmers in a given production area grow a number of equally productive but differing varieties, the various gene combinations will confer resistance to the same common pathogens, insects, nematodes, and viruses. The region as a whole will not then suffer devastating, epidemic-level losses. Teams of knowledgeable crop breeders or crop advisory committees should periodically review the varietal makeup of a crop in a production area of a uniform crop ecology to assess the genetic vulnerablility of that crop to insects and diseases known to occur in the area and to have the potential for epidemic-level spread.

The NBPGR is aware of the need for periodic assessment of genetic vulnerability in at least selected major crops.

6.2 Financial Analysis

AID funds are never directly disbursed to the executing agency. The executing agency usually will set budgets, then spends rupees according to the levels established in the Five Year Plan. The executing agency then submits reimbursement vouchers to AID, which in turn reimburses the Department of Economic Affairs of the Ministry of Finance.

The National Bureau for Plant Genetics Resources derives its planned budget allocations through the ICAR's plan submission to the Government of India's Planning Commission. The Government of India thus finances all activities of ICAR through 1) outright grants-in-aid and 2) receipts of the Agricultural Products Cess Fund. In order to give the ICAR a degree of operational flexibility and speed in project implementation, the GOI allots a lump sum grant to the Council every year. The Council can economize on certain items and reappropriate funds for other purposes within its charter, as long as the total outlays do not exceed the approved outlays in the Five Year Plan.

6.2.1 USAID/NBPGR Plant Genetics Resources Project under India's Seventh Five Year Plan (1985-1990)

The timing of this project paper is excellent because it coincides with the GOI's mid-term review of the Seventh Five Year Plan. The financial projections in this project require higher levels of ruppee participation by the ICAR. Consequently, ICAR will have the opportunity to account for the higher outlays needed during this review period.

The Plant Genetics Resources project, which is administered by the NBPGR, is one of 194 such schemes funded by ICAR under the Seventh Five Year Plan. The scheme calls for "the strengthening of the activities of the National Bureau of Plant Genetic Resources relating to collection, maintenance, documentation, utilization and conservation of germplasm resources." The total projected funding levels proposed to carry out the scheme during the Seventh Plan are as follows:

Rupees in Lakhs

	Plan	Non Plan
A. Recurring Expenditures:		
a. Pay Allowances	101.88	270.00
b. T.A.	5.00	5.00
c. Contingency	80.00	95.00
Total (A)	186.88	370.00
B. Non-Recurring		
a. Equipment	71.94	-
b. Works	166.00	-
c. Land	-	-
d. Vehicles	20.50	-
e. Library Books	4.00	-
f. Livestock	-	-
g. Others	-	-
Total (B)	262.44	-
TOTAL (A&B)	449.32	370.00

The actual approved Seventh Five Year Plan level was set at Rs. 394 lakhs (39,400,000) or U.S.$ 3,126,984 for the five year period. The total sanctioned level for the year 1987-1988 is Rs. 926,900. The shortfall occuring between the proposed budget and the actual sanctioned budget can be made up through foreign aid grants, and this is encouraged.

6.2.2 The Plant Genetics Resources Project under the Eighth Five Year Plan (1990-1995)

Toward the end of the second implementation year of the PGRP, the NBPGR will be required to begin extensive planning for the Eighth Five Year Plan. This presents a good opportunity to commit the ICAR to the expenditures required for the five remaining years of the PGRP. As projected in the implementation plan, the Eighth Plan will coincide with the full-scale construction of the central gene bank and the drawing together of a national germplasm system after relatively high levels of equipment and manpower training have entered the system. The result will be higher demands for new levels of recurring expenditures to add to the present ones.

Projected resources required under the Eighth Plan are indicated on the financial tables in section 3.0.

6.2.3 Budgeting Procedures for Institutes and Universities Other Than the NBPGR

Much of the activity during the course of this project will involve upgrading and consolidating some 121 regionally located germplasm collections scattered throughout India in various agricultural institutes and universities. The NBPGR's role among these ICAR and non-ICAR institutions is to coordinate this task. In some cases, it does not have direct responsibility or control over these collections or institutes. The work in each existing collection will require operating funds; it is therefore imperative that the following procedures be followed to ensure adequate funds to carry out this germplasm work in institutes outside the NBPGR network.

1) For ICAR Institutes:

ICAR, through guidelines issued by the NBPGR, should instruct all of their germplasm-holding institutes to include working capital in their annual budgetary submissions to carry out the germplasm consolidation work. The budgetary submission should account for adequately trained staffing to carry ut such work or for covering NBPGR training costs in Delhi.

2) For Non-ICAR Institutes:

The ICAR director-general should establish the same budgeting procedures with the heads of these institutes.

3) NBPGR should also include in its annual budgetary submission a line item for a technical assistance fund. This fund should enable NBPGR to assist technically these other institutes in setting up storage facilities and in evaluating their present germplasm holdings. The fund should be flexible enough to allow the NBPGR director to absorb some of the operating costs relating to the germplasm activities should an emergency or unforeseen costs arise.

6.2.4. Financial Management

The NBPGR will establish a full project management unit responsible for the bulk of the financial planning. A senior manager will report directly to the NBPGR director, and under this manager will be an accountant and a bookkeeper. Critical to this planning is the timely submissions of the yearly budgets that take into account the additional infusion of the AID project inputs. Other planning functions linked to this project are: 1) planning for the higher spending levels that will be required in the Eighth Five Year Plan to satisfy the increased operating and staffing costs of a fully operating national germplasm system; 2) planning for costs such as customs duties and inland transportation for the equipment of U.S. origin; 3) processing AID reimbursement vouchers and accounting documents; 4) securing waivers (Not-Made-In-India certificates, and duty-free status for scientific equipment); and 5) operating expenditure feedback to the NBPGR director.

6.2.5 Audit Procedures

NBPGR will implement the project under the overall guidance and supervision of ICAR, a semi-autonomous research institution established by the Government of India. The annual budgets of ICAR as well as its various satellite institutions, including the NBPGR, are part of the GOI plan and budget processes. They are subject to the contracting, payment verification, and audit procedures and guidelines prescribed by the Government of India for such institutions. As repeatedly asserted in USAID's submissions of 'Mission Financing Policy and Procedures', USAID has reasonable assurance, based on its thirty-odd years' experience, that the GOI and its institutions have the necessary financial and management capability to implement projects.

ICAR has been actively involved in the implementation of various AID projects and is currently carrying out several AID-financed development activities under the Agricultural Research Project (386-0470). Although USAID has had no association with the NBPGR, the fact that the project will be initiated and implemented thorugh, and under the broad supervision and guidance of ICAR is enough assurance of a smooth operation. Project reimbursements, as usual, will be made to the Ministry of Finance, Government of India, which reviews and endorses ICAR/NBPGR vouchers for reimbursement. ICAR and NBPGR are both subject to the normal GOI audit processes. This project, like all other AID projects, will have the standard audit provision that will allow the AID inspector general to exercise his right to audit the project operations, but no separate funds are being earmarked for non-federal audit purposes.

Methods of Implementation and Financing

Method of Implementation	Method of Financing	Approximate Amount (U.S. $000)
Construction -		
HC local contracts	HC Reimbursement	$2,650
Equipment -		
HC local contracts	HC Reimbursement	3,000
AID contracts/POs	Direct Pay/L. Com.	2,000
		5,000
Training - PIO/Ps	Direct Pay	700
HC local contracts	HC Reimbursement	100
		800
TA - Short-Term Consultants	Direct Pay	550
Collaborative Research	Direct Pay	400
	HC Reimbursement	150
		550
Evaluation/Monitoring	Direct Pay	250
AID Project Management	Direct Pay	600
Contingency & Inflation	.....	2,100
	TOTAL	12,500

6.3 Economic Analysis

The project does not have a predictable investment-return cycle. Given its nature, it is not possible ex ante to quantify its economic benefits. The benefits of germplasm collection are directly manifested in varietal improvement - in the development of crop varieties with desirable characteristics such as high yield, resistance to moisture stress and to pests and diseases. As these varieties are increasingly used, the benefits pass on to farmers and consumers. Broadly speaking, the larger the collection of germplasm, the greater the chance that economic gains will be substantial. But there is no certainty that the collection, however large, would contain the germplasm that would lead to successful synthesization into superior varieties. Ex ante assessment of benefits from projects with uncertain outcomes such as this can be made only on a priori grounds. Such qualitative assesments are made on the basis of evidence of role played in the past by germplasm collections in crop improvement. Some such estimates have shown that as much as 50% of the increase in yields are due directly to genetic improvement.

Exotic germplasm has received widespread attention in recent years for its role in setting off the Green Revolution in India. The development of short-stemmed wheat varieties from the dwarfing gene of Norin 10 has been well documented as has the development of dwarf rice IR-8 at the International Rice Research Institute. Their introduction in India in the mid-sixties led immediately to agricultural growth and modernization. However, indigenous

germplasm has played an equally important role in India by providing suitable material for crossing and developing a large number of popular high-yielding varieties. Rice improvement programs in India, for instance, employed hundreds of indigenous varieties in crosses with the dwarfs TN-1 and IR-8 to produce selections, such as Jaya, with high yield potential.

Because of their narrow genetic base, the new varieties of cereals tend to be increasingly vulnerable to pests and diseases. The strategy needed to tackle this ever present risk of crop disaster involves breeding varieties with genes for resistance taken from wild relatives of these crops and their traditional cultivars. This is essentially a strategy of risk insurance and requires an adequate stock of germplasm. The economic value of such a strategy only becomes obvious during times of crop disaster and emergency, and the payoffs are often very great. The importance of preserving genetic diversity and expanding the available stock of indigenous germplasm for this purpose is demonstrated by the case of the Indian pearl millet breeding program in the early seventies after the popular varieties became susceptible to mildew and ergot. Back crossing with Indian sources, Indian scientists were able to develop varieties with good resistance to both diseases.

Substantial gains can be realized directly from germplasm collections; however, it is not clear what part of the benefit is attributable to an investment in germplasm conservation. It is simply a given that germplasm is an essential and integral component of agricultural research and development, and a sustainable agricultural system cannot exist without it.

The project's economic justification is the same set of considerations that justify investment in agricultural research. Briefly, these are: 1) Organized agricultural research is an important part of the process of modernizing agriculture throughout the world; it results in crop improvement and in the increase in the production of food and fibre. 2) Its benefits flow to the farmers initially in the form of reduced per-unit-costs of production and greater income; but benefits ultimately move to the consumers in the form of lower real prices of agricultural products. 3) Agricultural research has proved to be highly productive, instances of failure notwithstanding. The rates of return on investment in agricultural research, as a number of ex post studies have shown, have been greater than the normal rates of return from investment in many physical capital projects. This has been established for developed countries. Some studies indicate that the rates of return from investments in agricultural research are even higher in developing countries, suggesting an under-investment in this area. Estimates for India show rates of return varying between 40 and 70 percent (R.E. Evensen and Dayanath Jha). Widening the Indian research base by enhanced collection of germplasm and other related activities would ensure that these rates of return are sustained over time.

The benefits of this project will extend beyond India's frontiers to the international research centers around the world and to other countries through free germplasm exchanges. The National Bureau of Plant Genetics Resources has so far received germplasm from about seventy-five

countries over the last ten years; it has also provided germplasm to about fifty-two countries including the developed countries of Canada, United States, United Kingdom, West Germany, France, Japan, Sweden, Switzerland, and Denmark. The use of Indian germplasm for crop improvement and in risk reduction is well known.

6.4 Social Soundness Analysis

The benefits accruing from the Plant Genetics Resources Project can be analyzed in terms of various segments of the population, in terms of the short - and long-term benefits, and in terms of various structural levels: individual, group, institutional, and the population at large.

6.4.1 Benefits to the Population at Large

The demands placed on the Indian agricultural sector by the food requirements of an already large and rapidly growing population are well known. This project, by preserving the existing diversity of germplasm and facilitating new germplasm acquisitions, will result in plant varieties with higher yield and greater pest resistance. Thus the project will contribute not only to a greater quantity and variety of food supply for India as a whole but to a reduced vulnerability of that supply to dissemation by disease, insect pests, or environmental crises. Thus, the ultimate beneficiaries are the consumers of India who will profit from improved crop varieties through larger supplies of locally produced food that is free from disease and pests and with even improved nutritional value and quality.

6.4.2 Benefits to the Farmers

To the extent to which the project leads to higher yielding and more disease-resistant varieties, it will improve the well being of the agricultural producers.*/ One of the objectives of germplasm research is the tailoring of new crop varieties to fit a multitude of different environments. As this goal is achieved, farmers throughout India will be increasingly able to maximize production, given their specific geographic location and size of holding. In addition, increasing yields provides greater employment opportunities for the rural populations.

As farmers adopt new, high-yield varieties, traditional varieties are discarded and often lost. Hence, another emphasis of this project is to salvage traditional plant genetic resources as these varieties may have many genetic characteristics that will be of use to future breeding programs.

6.4.3. Benefits to Indian Professionals and Institutions

The most direct beneficiaries of this project will be the agricultural scientists in India and their institutions, both public and private, who are qualified for and interested in acquiring and using new germplasm to improve plants. Many cooperating institutions and scientists will participate in the proposed germplasm network.

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*/ Change of this sort tends to increase the range of crop options available to the individual farmer.

India's capability in collecting and evaluating its genetic resources will thereby be strengthened, and it will acquire the knowledge to perform quality research in this field independently.

6.4.4 Benefits to U.S. Institutions and to Indo-US Relationships

U.S. institutions and their researchers also benefit from field work opportunities and germplasm evaluations carried out by the NBPGR. Linkages will be established between U.S. and Indian scientists and such linkages are expected to continue far beyond the project period.

The project also establishes mechanisms for collaborative research between high-level U.S. and Indian scientists and thus is highly consistent with Mission strategy to focus on science and technology development projects as opposed to resource transfer projects. The GOI supports this project in a similar vein.

6.4.5 Benefits to Women

In India women carry out the bulk of the agricultural tasks. To the extent that high-yielding varieties and pest-resistant crops make a woman's work more productive, these developments lead to increased well-being of her household.

The resources of women in research science in India will be drawn upon and broadened through this program. The participation of women in the scientific community varies from country to country. Women in science will contribute by participating in this new program as research scientists, laboratory managers, and technicians. Presently, the NBPGR employs four women technicians and 16 professional female staff members. They will contribute their scientific expertise and technical skill as well as their understanding of India's problems. The project will also promote the development and growth of the pool of women in science through the various exchange and training aspects of the program components.

6.5 Institutional/Administrative Analysis of the NBPGR

6.5.1 Legal Status

The NBPGR is a constituent body of the ICAR, an autonomous agency established by the Royal Commission on Agriculture in 1929 as a registered society having its own rules and by-laws. In 1965, ICAR was reorganized to become the central body for coordinating, directing, and promoting all agricultural research and education in India. It has a governing body or council whose president is the Minister of Agriculture. The chairman of the council is the director general of ICAR. He also serves as the Secretary of the Department of Agricultural

Research and Education of the Ministry of Agriculture, thus providing a direct linkage to the ministry. Through a series of committees, ICAR maintains linkages with state institutions and universities. Policies, programs, and budgetary matters must be reviewed and approved by the Council of ICAR. This system has enabled the Government of India to plan highly coordinated and integrated national agricultural research strategies.

6.5.2. Financial Status

The amount of the Sixth 5 year Plan budget that was actually utilized was approximately Rs. 300 lakhs as shown in the accompanying table, less than half of the sanctioned level. The proposal submitted for the Seventh Plan (1985-1990) totals Rs. 1,019.23 lakhs, of which Rs. 200 lakhs were provisionally designated for construction of the National Repository. According to information available, the actual NBPGR allocation for the period totals approximately Rs. 400 lakhs. Approximately half of the approved amount is for non-recurring expenditure. The increase in recurring costs up to the end of the Seventh Plan will accommodate a part of the anticipated increase in staff costs associated with the project.

Sl. No.	Head	VI Plan Actuals		VII Plan Requirement		
		Plan	Non-Plan	Plan	Non-Plan	Total
1.	Pay and Allowances	29.55	132.21	101.88	270.00	371.88
2.	T.A.	2.15	1.41	5.00	5.00	10.00
3.	Recurring Cost	53.33	21.88	80.00	95.00	175.00
4.	Non-Recurring					
	a. Works	29.18	-	166.00	-	166.00
	b. Land	0.10	-	-	-	-
	c. Equipment	20.36	0.31	71.94	-	71.94
	d. Vehicles	9.99	0.01	20.50	-	20.50
	e. Library Books	2.07	0.28	4.00	-	4.00
	f. Livestock	0.06	-	-	-	-
	g. Others	3.77	0.17	-	-	-
	TOTAL	150.56	156.27	449.32	370.00	819.32
Assistance for the establishment of National Repository facilities				200.00		200.00

The NBPGR has not yet been authorized the Rs. 200 lakhs for capital costs during the present 5 year plan; however, AID's stated contribution to this building project is expected to leverage a greater amount toward the building.

Yearly Plan

Sl. No.	Head	Actual 1984-85	Proposed outlay for VII Plan 1985-86	1986-87	1987-88	1988-89	Total
I.	Main Institute						
1.	Pay and Allowance	1.65	9.65	21.09	23.54	24.66	80.59
2.	T.A.	0.70	0.80	0.90	1.00	1.10	4.50
3.	Recurring Cost	15.00	12.00	12.00	13.00	13.00	65.00
4.	Non-Recurring						
	a. Works	21.00	45.00	40.00	40.00	20.00	166.00
	b. Equipment	19.15	15.26	18.00	18.00	-	70.41
	c. Vehicle	2.50	8.00	-	-	-	10.50
	d. Land	-	-	-	-	-	-
	e. Others (Books & Furniture)	-	.60	.70	.80	.90	3.00
	TOTAL	60.00	91.31	92.69	96.34	59.66	400.00
II.	Assistance for the Establishment of National Repository Facilities	-		100.00	100.00	-	200.00

6.5.3 Organizational Pattern

The National Bureau on Plant Genetic Resources is an entity that operates under the Crop Sciences Division of the Indian Council for Agricultural Research. The director of the NBPGR is in charge of administration and research management and reports to the director general of ICAR through the Crop Sciences deputy director general. A National Policy and Planning Committee on Genetic Resources under the chairmanship of the director general of ICAR provides guidelines and establishes priorities related to the national agricultural objectives. The NBPGR operates through five basic divisions, namely: 1) germplasm exchange; 2) plant quarantine; 3) plant exploration and collection; 4) germplasm evaluation; and 5) germplasm conservation. In addition, there are three attached national programs: The National Facility for Plant Tissue Culture Repository; Medicinal and Aromatic Plants; and Underutilized Plants.

Administratively, the NBPGR operates as a self-contained unit. Its headquarters is on the campus of the ICAR's Indian Agricultural Research Institute (IARI) at Pusa, New Delhi. Each of the division directors and program staff of the NBPGR, except those located at the regional stations, are also at the Pusa facility. Also, the NBPGR has its own administrative offices including personnel, budget, and records.

The NBPGR, by virtue of the fact that it has been assigned responsibility for the national plant genetic resource system, has authority and responsibility to coordinate and supervize the programs of all institutions where germplasm collections are maintained. There are over 121 active collections held. These locations belong to three types of institutions: first are those locations directly in the NBPGR structure; second are those within the ICAR (i.e., the All-India Coordinated Crop programs); and third are a number of universities and other institutions where plant breeding, plant genetic, or germplasm work takes place.

ICAR makes provision in the budgets of those institutions to support the germplasm work for which they have been assigned and agreed to assume responsibility. The NBPGR may provide certain specific assistance for such items as equipment, or consultation, but these institutions are responsible to the NBPGR for the proper care of the germplasm with which they have been entrusted. The NBPGR is in the process of having all of these collections rejuvenated and having duplicate fresh material sent to the base storage center for long-term storage (thus the urgency to complete that facility).

Furthermore, the NBPGR is gradually implementing a process for the concentration of working collections both within each plant species and also among plant species. This will, in the future, assure the proper care of plant germplasm. To further strengthen that process, the NBPGR will undertake a series of training programs to upgrade its own staff and those of the affiliated institutions of the system.

6.5.4 Delegation of Authority

The NBPGR has been given the responsibility and authority by the ICAR to coordinate, supervise, and implement actions relating to all matters on plant germplasm management for the GOI. This authority is exercised through the director general and the council of ICAR. The director of the NBPGR and his staff supervise, conduct, and coordinate all activities related to germplasm acquisition, exchange, collection, evaluation, preservation, quarantine, and data management. The five division directors of the NBPGR provide guidance in their respective areas to all affiliated institutions, as well as oversee the work in these areas in the NBPGR.

There are no superfluous lines of authority. Each division director manages his program and reports directly to the director of the NBPGR. A management committee periodically meets to review program directions and accomplishments and provides input to the functioning of the Bureau. Similarly, the director of the NBPGR has ready access to the director general of ICAR.

The NBPGR interacts with a number of programs of other ICAR institutes. These relationships are established by definition of the NBPGR mandate, which is to coordinate all activities relating to plant genetic resources at the national and international level. These interagency programs are working well. The NBPGR has full authority to implement its programs, and this capability has been important in implementing the NBPGR mandate.

6.5.5 Management Capability

The accomplishments of the NBPGR during the past two years under the leadership of its director have been impressive. Each of the locations visited exhibited considerable activity in building and ground maintenance, laboratory organization, field plot activity and there was general enthusiasm about the NBPGR. Staff are highly motivated by the director, who has gained the respect of his colleagues through his management style and his obvious leadership capability. Facilities at headquarters have been visibly improved with the build-up of storage facilities, labs, equipment, etc. Old buildings have been remodelled to accommodate offices and laboratories; the field station facilities have become operational for the conduct of evaluation and quarantine activities; seed materials have been assembled, and data processing has improved. Excellent relations have been established with other crops programs at the national level and with international agencies.

Evidence of the growing role of the Indian NBPGR in international affairs is examplified in the following points.

1) The International Board on Plant Genetics Resources has determined to locate their representative for the South Asia region in India (at NBPGR).

2) NBPGR (India) has been designated by the IBPGR to be responsible for the global base collection for seventeen plant species and for the back-up collections of four species.

3) India has become a major resource in germplasm conservation, exchange, research, and training for other countries of the region, especially the SAARC nations.

4) Staff of the NBPGR participate more frequently in international seminars and in training programs as instructors.

5) The Director is a member of a U.S. National Research Council, Board on Agriculture study group on Managing Global Genetic Resources.

6.5.6 Staffing

1) Actual Staffing:

The design team recommends that scientific staff positions be increased and level off at approximately 140 within the course of the project. The total number of staff will be adequate to carry out the NBPGR programs, if the sanctioned positions are filled during the term of the project. The director is adding professional staff within his authorized levels only as such staff can be effectively used. The quality of the staff is generally high, including a considerable number of advance degree holders and a goodly (± 17%) percentage of young professional women. The design team also recommends that the technician/scientist ratio be increased from the present level of approximately .08 to 1.8 - 2.0.

Actual Staffing Pattern at NBPGR

Division	Ph.D	M.S.	B.S.	Technicians
Administration	1	-	-	1
Exchange	2	4	-	3
Exploration	4	8	-	3
Evaluation	17	24	-	11
Quarantine	10	7	-	7
Conservation	2	4	-	2
Tissue Culture	6	3	-	1
Medicinal Plants	1	-	-	-
Under Util. Plants	1	-	-	
Guar	-	1	-	-
Totals	44	51		28

2) Additional Vacant Sanctioned Posts:

Forty-two additional posts at the scientist level (Ph.D and M.S.) and 18 technician posts have been sanctioned during the current five year plan and are expected to be filled.

Division	Scientists	Technicians
Exchange	Nil	1
Exploration	11	-
Evaluation	9	3
Quarantine	5	2
Conservation	3	-
Tissue Culture	11	11
Medicinal Plants	-	-
Under Util. Plants	-	-
Guar	3	1
Total	42	18

6.5.7 Training Needs

The project does not envision training at the postgraduate level. Indian institutions provide excellent post graduate training at the Masters and Ph.D. level. However, specialized training and experience by professionals in areas directly related to germplasm conservation - i.e., collection, evaluation, preservation, quarantine, etc., is needed, and the project makes provision for such training.

Related to staffing and training is the matter of consultancies. The project does not envision large components of consultancies; rather a small number of specialists in very defined areas is recommended. To carry out cooperative US/India projects, a modest number of individuals is proposed for clearly defined activities. This will strengthen US/India collaboration, a feature clearly desired by Indian scientists and their U.S. counterparts. The project emphatically does not suggest the need for technical assistance staff. It would be a mistake to have any long-term (one year or more) foreign experts on assignment to the NBPGR under this project.

6.5.8. Purchasing

The NBPGR will establish an administrative unit whose primary function will be the operation and fiscalization of accounts, purchasing, inventory, and related activities relevant to the project. The initiation of purchasing procedures will follow the guidelines established for USAID/GOI projects (See Annex I). The NBPGR will initiate purchase requests in accordance with lists and priorities established in the project document. All purchased items will enter the Stores section for appropriate entering in inventory and then be dispatched to the responsible scientist in the NBPGR system.

6.6 Political Soundness

India has a policy of free exchange of germplasm material, as does the U.S., but both countries have some exceptions. Both countries have certain political constraints limiting exchange to certain countries. The U.S. and India do not require free exchange of material held by private companies. Generally, channels are open to the exchange of publicly held germplasm and for the collection of indigenous plant materials.

In the past, the U.S. has experienced some problems in getting materials out of India. In part this has been due to bureaucratic procedures as well as to the inability of the system to respond. That situation is expected to improve considerably as a result of an improved capability to obtain, prepare, and despatch samples. A major constraint to India has been the lack of funds to cover shipping costs.

India's policy is one of free exchange. India has no embargoes on specific crops, but there are political embargoes against specific countries. India recognizes the advantages of having access to other countries' germplasm and believes in the concept that genetic resources are mankind's heritage.

6.6.1 Strategic Importance of India

India has many naturally occurring plant species of actual and potential importance to itself, to the U.S., and the world. The plant (and animal) species represent a rich genetic resource that must be protected. They include food, medicinal, forage, forest, and ornamental species, many of which have not been adequately collected or evaluated. Under a system of free exchange, it is to the U.S.' and the world's advantage that India develop the capacity to explore, collect, monitor, conserve, and evaluate these genetic resources. Just one broadly useful gene could more than compensate for the total investment in a national germplasm system.

6.6.2 India's Regional Role in S.E. and South Asia, and the U.S. Interest in this Development

The Asian region, including South and Southeast Asia, has an enormous number of plant species. It is also the region of the world with the highest density of human population. This is not a casual relationship. A major strategic element in the peace and security of the region is food production. In the past two decades, modern agricultural technology and investment in irrigation and infrastructure have had a dramatic impact on agricultural output in most countries in South and Southeast Asia, but of these, India has been the most striking. To maintain the level of growth required for the future, India will need to assure the stability of its agricultural research system.

India's regional role can be exemplified by the recently held SAARC seminar on genetic resources. Participant countries, particularly those with a rudimentary national germplasm system or none at all, will look increasingly to India as the source of technical collaboration in this area. India's familiarity and similarity to the ecology and culture of other countries of the region gives it a decided advantage over any other country in assisting its neighbors.

6.6.3 India's Global Role in Plant Genetic Resources

There is little doubt that India will play a major role in the global effort to conserve and use plant genetic resources. Outside of the developed countries, and excluding China, India has the largest human population and perhaps the greatest concentration of scientific talent in agriculture, as well as a wealth of genetic resources matched only perhaps by Brazil. It is expected that India, Brazil, and Indonesia on the part of the developing world will have considerable influence in the international dialogue on genetic resources. Their points of view will be watched closely by the other developing nations. In part, their positions on international issues will be influenced by the quality and strength of their own national programs. We can expect their role in North-South issues to increase.

6.7 Construction and Engineering Analysis:

An important component of this project is AID's contribution to the construction of the NBPGR central headquarters and the base collection gene bank. The NBPGR has already worked with the Central Public Works Department of the GOI to draw up preliminary design plans in order to seek a re-zoning of the land site from agricultural use to administrative building use. This rezoning procedure is expected to be completed by September 1987.

Unlike normal construction projects, this building is highly specialized and should be based on the experience of other gene banks in the world. The design team is of the opinion that the construction of such a unique building cannot be handled like an ordinary public works project where undue delays and uneven building quality are the norm. The NBPGR's experience with the Central Public Works Department has so far resulted in great delays, even at this early stage of design, due mostly to competing building priorities within the government public works division.

A preferred alternative would be to confer the design and engineering to a private Indian architectural and engineering firm that would consult closely with the NBPGR and other internationally known gene bank managers and designers (of which there are very few). Although potentially a sensitive issue, the director general of the ICAR is empowered to confer the A & E design work to the private sector.

After the detailed design and plans have been completed, they may be turned over to the Central Public Works Department for the normal bidding procedures. The private A&E firm should be retained to supervise the entire construction project until the end.

Bidding and construction procedures will follow the standard practices of the CPWD. Bids are invited from all those contractors registered with the CPWD and are based on established, standard CPWD schedules on specifications and rates. The Tender Committee of the CPWD reviews the bids and the lowest responsive bidders are awarded the contract. If all bids are too high, the CPWD reserves the right to repeat the bidding process. Construction supervision would be carried out jointly by the PWD engineer and the private A&E firm.

Working closely with the local A&E firm, USAID representatives will make field visits to ensure that the construction is being carried out in accordance with the agreed design and specifications.

6.7.1 Construction Cost Estimates of the NBPGR Master Plan

The following preliminary construction cost estimates were drawn up by the USAID civil engineer in conjunction with the CPWD architectural and engineering offices. The total cost is currently estimated at $10 million, including liberal inflation adjustments, and is solely based on the preliminary design plans of area use submitted to the Delhi District Authority for the re-zoning procedures.

The plan covers a ten acre piece of land on the PUSA campus of the IARI. Roughly one-third of the land area is devoted to the headquarters and gene bank, another third to 100 personnel housing units, and the last third to future expansion area.

AID will jointly finance the headquarters and gene bank with the GOI. This construction will also include the international training center facilities and lecture halls. The rest of the construction - i.e., personnel housing - will be phased in slowly according to the needs of the NBPGR and the availability of funds from the GOI.

Construction and Engineering Analysis

TENTATIVE COST ESTIMATE AND AREAS PROPOSED FOR CONSTRUCTION OF PLANT GENETICS PROJECT

S.No.	Description	Total Area in m^2	Cost per m^2 1/	Total Cost Rs.
1.	Main PGR Airconditioned	9,700	5,625 2/	54,562,500
2.	Main PGR Non-Airconditioned Complex	1,050	3,060 3/	3,213,000
3.	Residential Area	7,580	2,500	18,950,000
4.	Other Miscellaneous Work (at lump sum rate)			
a.	Main Electrical Central/Sector panel	-	-	300,000
b.	Electrical substation & equipment	-	-	2,000,000
c.	D.G. Set (2 Nos.) & compressed air plant	-	-	1,000,000
d.	Gas-pipe line	-	-	1,600,000
e.	S.T. Service	-	-	1,000,000
f.	Special power requirement	-	-	300,000
g.	Lifts (4 Nos.)	-	-	2,400,000
h.	Compound Lighting	-	-	200,000
i.	Compound Wall - average width 1 1/2' and height 10'	1000mtrs.	4,000	4,000,000
	Total	18,330	-	89,525,500

Total construction cost	Rs. 89,525,500
Added inflation at 40% for four year	35,810,200
	Rs.125,335,700
	@ Rs. 12.50 = $ 1)
	$10,026,856

1/ Base 1987 estimate
2/ Includes Rs. 125 per sq/meter for fire alarm system
3/ Includes Rs. 60 per sq/meter for fire alarm system

NOTE: Cost of furnishing and equipment has not been included in the above estimate.

6.8 Environmental Analysis

6.8.1 Background

The PGR PID stated that in the Mission's opinion the project qualified for categorical exclusion from further environmental action as per AID's environmental proceedures set forth in 22 CFR 216.2 (c) (i) (ii) and 216.2 (c) (2) (ii). The rational for this decision pointed out that the project would preserve India's plant genetic resources and significantly enhance environmental protection through preservation of important wild and cultivated species. AID/W in State 212053 informed the Mission that an initial environmental evaluation would be required to address environmental concerns regarding proposed storage facility construction and possible movement of pests and pathogens involved in germplasm exchange. Thus the following discusses these concerns.

6.8.2 Construction of Storage Facilities

The ICAR has provided the NBPGR land on the premises of the IARI for construction of a new NBPGR headquarters including base seed storage facilities. The land is currently used for field research. Early generation and advanced lines of various crops are grown on this land during the cropping seasons. During the off season the land is fallow. The land has been set aside for development as part of the IARI master plan. Potential negative environmental impact although not anticipated will be assessed during planning and monitored during construction of these facilities.

6.8.3 Pest and Pathogen Movement

Exchange of seed and plant parts involves the potential risk of introducing plant pests and pathogens into countries or regions where they previously had not existed. The function of an effective plant quarantine system is to ensure the safe (pathogen and pest free) and rapid exchange of plant germplasm. The international movement of germplasm is fundamentally important to crop improvement research and increased agriculture productivity. It is one of the purposes of this project to significantly strengthen the plant quarantine capabilities of the NBPGR. This capability will help insure that unwanted pests and pathogens do not enter India and that germplasm sent from India will be pest and pathogen free. Thus, strengthen the NBPGR plant quarantine capabilities as envisioned in this project should help protect India's flora and plant habitats.

7.0 SPECIAL COVENANTS

1. NBPGR will establish and staff an administrative support office under the Director NBPGR replete with the professional and support staff required.

2. The GOI will process exemption certificates and duties for equipment procured under the project.

3. The GOI will provide the site for the NBPGR headquarter facilities.

4. The GOI will process nominations of project funded participants for overseas training and to attend international meetings.

5. Participants trained under the project will continue to work in the services of the Grantee on appropriate project related activities for a period of time designated by the GOI in its standard requirements for persons receiving training.

6. NBPGR will provide administrative support for purchase of local equipment.

7. GOI will provide appropriate government clearance for consultants and technical experts.

8. NBPGR will assure private sector research organizations access to accessions in the NBPGR system.

9. ICAR through NBPGR guidance will insure that institutions holding germplasm collections are provided sufficient working capital for germplasm consolidations and maintenance.

AGENCY FOR INTERNATIONAL DEVELOPMENT

PROJECT IDENTIFICATION DOCUMENT FACESHEET (PID)

1. TRANSACTION CODE: A (A = Add, C = Change, D = Delete) — Document No. — Document Code

2. COUNTRY/ENTITY: INDIA

3. PROJECT NUMBER: 386-0513

4. BUREAU/OFFICE: ASIA/NEAR EAST — A. Symbol: ANE — B. Code: 03

5. PROJECT TITLE (maximum 40 characters): PLANT GENETIC RESOURCES

6. ESTIMATED FY OF AUTHORIZATION/OBLIGATION/COMPLETION:
- A. Initial FY: 87
- B. Final FY: 91
- C. PACD: 94

7. ESTIMATED COSTS ($000 OR EQUIVALENT, $1 =)

FUNDING SOURCE	LIFE OF PROJECT
A. AID	14,850
B. Other U.S. 1.	
B. Other U.S. 2.	
C. Host Country	4,600
D. Other Donor(s)	
TOTAL	19,450

8. PROPOSED BUDGET AID FUNDS ($000)

A. APPROPRIATION	B. PRIMARY PURPOSE CODE	C. PRIMARY TECH. CODE 1. Grant	C. PRIMARY TECH. CODE 2. Loan	D. 1ST FY 87 1. Grant	D. 1ST FY 87 2. Loan	E. LIFE OF PROJECT 1. Grant	E. LIFE OF PROJECT 2. Loan
FN	111	000		3,000	-	14,850	-
TOTALS				3,000	-	14,850	

SECONDARY TECHNICAL CODES (maximum 6 codes of 3 positions each)

| 968 | 958 | 978 | | | |

10. SECONDARY PURPOSE CODE

SPECIAL CONCERNS CODES (maximum 7 codes of 4 positions each)

A. Code	R/AG	TECH				
B. Amount	19,450	19,450				

PROJECT PURPOSE (maximum 480 characters)

The purpose of the project is to: 1) implement fully operational germplasm storage facilities; 2) enhance existing germplasm collection; 3) implement a computerized germplasm information system; 4) improve India's plant germplasm quarantine system and 5) provide for international research collaboration through scientific exchange.

RESOURCES REQUIRED FOR PROJECT DEVELOPMENT

Staff: Project Officer and three person design team

Funds: The funding will be provided fromthe Agriculture Research Project (386-0470) for the design team.

ORIGINATING OFFICE CLEARANCE

Signature: Owen Cylke

Title: Director USAID/NEW DELHI

Date Signed: MM DD YY

18. DATE DOCUMENT RECEIVED IN AID/W, OR FOR AID/W DOCUMENTS, DATE OF DISTRIBUTION: MM DD YY

PROJECT DOCUMENT ACTION TAKEN

S = Suspended
A = Approved
D = Disapproved
Co = Conditionally Approved
DD = Deferred Decision

17. COMMENTS

ACTION APPROVED BY

Signature

Title

19. ACTION REFERENCE

20. ACTION DATE: MM DD YY

PLANT GENETIC RESOURCES
PROJECT IDENTIFICATION DOCUMENT

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ACRONYMS

AR/ID	Agricultural Research and Institutional Development
ARP	Agricultural Research Project
CDSS	Country Development Strategy Statement
CGIAR	Consultative Group for International Agricultural Research
GOI	Government of India
IARC	International Agricultural Research Resources
IBPGR	International Board for Plant Genetic Resrouces
ICAR	Indian Council for Agricultural Research
NAS	National Academy of Science
NBPGR	National Bureau of Plant Genetic Resources
SAARC	South Asian Association for Regional Cooperation

1.0 Program Factors

1.1 Conformity with Recipient Country Strategy

USAID/India is proposing a seven year project entitled, "Plant Genetic Resources". The goal of the project is to assist the Government of India (GOI) in the conservation and preservation of the genetic diversity of important plant species, many of which represent India's biological heritage. In so doing, the project will preserve a natural resource base, which comprises an integral part of global plant genetic resources and which will be drawn upon for crop improvement in sustainable agricultural systems.

The project's purpose is threefold. It will provide GOI with a mechanism to support a comprehensive, national plant genetic resources network interactive with the developing international network for conservation of plant genetic resources. The project will strengthen, enhance, and coordinate institutional capabilities and research activities required for conserving, collecting and evaluating plant genetic resources. Secondly, it will provide for the exchange of these genetic resources by developing a safe and efficient plant germplasm quarantine system. Finally, it will assist India in attaining a prominent role within the international community participating in the free and open exchange of germplasm.

These goals and purposes will be implemented through five major output categories: (1) implementing a fully operational and efficient system of germplasm storage facilities, (2) enhancing germplasm collections by acquiring, evaluating and utilizing plant genetic resources, (3) developing a computer-based information network for germplasm resources, (4) improving India's plant germplasm quarantine system to insure the rapid dissemination of pathogen and insect-free germplasm while facilitating the international exchange of germplasm, and (5) organizing international research teams for professional enhancement and training in areas such as cryopreservation and micropopagation.

The Plant Genetic Resources Project is consistent with the national agricultural interests and policies of India. The concern for the preservation of India's natural resources has been emphasized by the GOI, in its seventh "Five Year Plan". This plan identifies the conservation of plant, animal and fish germplasm resources as a priority area in the field of agricultural research. These activities are being emphasized in order to provide a broader genetic base for future crop improvements. In response to this emphasis on conservation, the Indian Council of Agricultural Research (ICAR) recently created a National Bureau on Resource Conservation. The Bureau is responsible for collecting and conserving plant, animal, and fish resources which are being threatened by their exploitation and loss of habitat. Within this Bureau, the responsibility for collecting and conserving India's plant resources has been placed with the National Bureau for Plant Genetic Resources (NBPGR). This confirms the prominent attention given by the GOI to conserving its indigenous biological diversity and specifically its extant plant genetic resources.

The Fourth Meeting of the Indo-US Subcommission on Agriculture identified genetic resource conservation, which would include exploring, collecting and evaluating plant germplasm, as an area of priority for joint collaboration. ICAR requested USAID/India to collaborate with it on a plant genetic resources subproject under the ongoing Agricultural Research Project (ARP). In this regard, a subproject design team submitted a document in October 1986, which generated considerable mutual interest. However, the funding level of the activities described in that report were considered too large to be included within scope of ARP. The team's document served as a focal point for subsequent discussions between USAID and NBPGR. These discussions led to the consideration of a new project being proposed in this PID.

Finally, the Director of NBPGR has been selected as an official member of the Subcommittee for Plant Genetic Resources within the three year study on, "The Global Management of Plant Genetic Resources." This study is being sponsored by the National Academy of Science (NAS) through its Board on Agriculture. The importance of India's relationship to the international germplasm exchange community is reflected by this key position within the NAS study. India has also been delegated by the International Board for Plant Genetic Resources (IBPGR) for holding the primary base germplasm collections for nine plant species and as the back-up base collection for four species. Further support of India's regional and international role in germplasm was emphasized at the recent South Asian Association for Regional Cooperation (SAARC) meeting. Here both the Director of NBPGR and the Director General of ICAR emphasized their plans for India's plant genetic resource network to serve as a nodal system for Southeast Asia.

1.2 Relationship to the CDSS

The FY 1987 CDSS emphasizes the need to achieve agricultural modernization by interalia indentification of research opportunities which support accelerated agricultural growth and by creating more effective natural resource management. The strategy statement points out that the development and utilization of improved varieties has dramatically increased yields in crops such as wheat and rice. These advances are research-intensive; dependent upon maintenance research, development of increased yield potentials, and increasing production farming efficiency on a per acre basis. These inter-related activities are all germplasm-based technologies which can be made more efficient if a national system exists for collecting, evaluating, preserving and disseminating newly identified sources of germplasm to applied crop improvement programs.

In addition, reference should be made to the Mission's evolving Agricultural Strategy which will emphasize resource sustainability factors. The proposed Plant Genetic Resources Project will fit within this strategy in two ways. First, a part of USAID's future emphasis will focus on sustainable agriculture. Tailoring crop varieties to fit a multitude of different environments requires the effective mobilization of plant genetic resources. Second, USAID will continue to support agricultural research, particularly the use of modern biotechnology within India's public and private agricultural research systems. Plant germplasm is an important interface between a country's biological resources and the potential for improved agricultural production through technological innovation.

In summary, the Plant Genetics Resources Project is an important part in USAID's plans. The project is an essential link between current CDSS objectives of production, research, and natural resource management and new initiatives to deal with sustainability issues in agricultural development, to support biotechnology research and global A.I.D. objectives to conserve global biological diversity.

2.0 Project description

2.1 Perceived Problem

By about the year 2000 India will reach a population of one billion, based on current population growth of 2.2% per year. This implies the need for an additional 80-100 million tons of foodgrains. In the recent past, India has met its growing demand for food primarily by the application of new bio-chemical technologies to an expanding area under irrigation. As these resources reach their practical limits, greater emphasis will be placed on research needed to maintain and increase yields per acre. Programs are beginning to be targeted towards the production of nutrient-efficient plants, stress tolerant cultivars, and higher value crops. To achieve these goals, scientists from a number of disciplines, including plant breeding and biotechnology, must have access to new sources of genetic variation from either elite (highly selected) or more primitive (unselected or traditional) germplasm.

The Indian sub-continent comprises one of the world's megacenters from which crop plants originated and diversified. This Old World Center contains either primary or secondary sites of origin for at least twenty crops; including rice, citrus, banana, pepper, mango, cotton and millet. In total there are about 15,000 plant species which occur in India, of which about 160 species are of economic importance. Of this total diversity, NBPGR has targeted useful agri-horticultural and agri-silvicultural plants and their relatives as a natural resource base which must be efficiently collected, maintained, and evaluated. These collections will serve as one source of genetic material for basic plant research and applied crop improvement programs within India and

throughout the world. Of equal value to these indigenous collections is the system which India has begun to develop for efficiently receiving, evaluating and distributing raw germplasm and improved varieties from other countries.

International exchange of germplasm has increased dramatically over the past few decades. The necessity of a modern, efficient national quarantine system for germplasm is a priority if India is to increase its participation in these exchanges. For with the flow of germplasm across international boundaries comes the risk of spreading crop pathogens and other pests. The NBPGR has been delegated the responsibility for quarantine review of all plant germplasm either imported or exported by India for research purposes.

This arrangement must provide for the expeditious examination, salvaging and movement of seed and clonal materials in and out of India. It is essential that an effective balance must be struck between those eagerly awaiting the release of plant introductions and the time required to minimize the risk of introducing potentially dangerous crop pests and pathogens. This type of system will prevent quarantine regulations and procedures from becoming a major bottleneck in germplasm exchange.

Coupled with this ability to receive, disseminate and utilize germplasm is the need to preserve and protect it from loss which can occur through disruption of natural habitats, improperly maintained collections, and the abandonment of traditional landraces by farmers as they switch to improved varieties. Thus preservation of plant genetic resources will be increasingly important not only to India, but to the world at large as greater emphasis is placed on the conservation of biological diversity. India's plant genetic resources are an integral part of it's total biological diversity, being important in both the genetic and species variability components. The significance of this variation is such that the IBPGR has targeted India's regional plant collection trips as "top priority" for the immediate future.

2.2 Project Goal and Purpose

The goal of this project is to assist the GOI in the conservation and preservation of India's biological diversity. As stated previously, this is an area of great importance to GOI. The project's goal will focus on conserving both indigenous and exotic plant genetic resources of agricultural importance. This will preserve valuable plant germplasm for mankind's use while helping to prevent further loss of endangered species. In so doing, the project will creat a valuable collection of plant genetic resources which can be drawn upon by scientists for future crop improvement. In this way, it becomes a base for sustainable agricultural systems which can increase agricultural efficiency and production. This ability is essential for India if it is to keep pace with its growing population.

The purpose of this project is threefold. First, it provides GOI with the means to complete a comprehensive, national plant genetic resources network which will strengthen, enhance and coordinate the facilities and research activities required for conserving, collecting, evaluating and exchanging plant genetic resources. USAID/India will work directly with NBPGR, through ICAR, as it is India's nodal institution with responsibility for establishing a comprehensive, national plant germplasm system. In this regard, the project provides direct support to germplasm collections under the purvue of NBPGR and will indirectly assist collections held independently at various univerisites or institutions by developing the Bureau's base collection. NBPGR was created in 1976 and is composed of five divisions responsible for plant exploration, germplasm collection, plant quarantine, germplasm evaluation and germplasm conservation. These divisions are unified by the mandate of the NBPGR which is to: (1) coordinate the country's programs in the collection and evaluation of germplasm, (2) collect and disseminate germplasm information, (3) conduct research on maintenance methodology and (4) develop and implement effective quarantine procedures for plant germplasm.

The second purpose is to provide for the exchange of these genetic resources by developing a safe and efficient plant germplasm quarantine system. Finally, it will assist India's participation in the international community supporting germplasm exchange. This project provides USAID the opportunity to support the development of a system which will become a source of national, regional and global importance. Additionally, U.S.- based participation, as envisioned in this project, will help facilitate India's commitment to the reasonable and free exchange of its germplasm with the rest of the world. A decision to adopt a national policy of open exchange has been emphasized in a draft Memorandum of Understanding with IBPGR. This decision will have have far-reaching impact throughout the developing world. It will be a credit to the United States to have been chosen as a partner in the development of such an open plant genetic resource system.

The purpose will be achieved through five major project outputs: (1) implementation of fully operational, efficient germplasm storage facilities, (2) enhancement of existing germplasm collections by acquiring, evaluating and utilizing plant genetic resources, (3) implementation of a computerized germplasm information system which will link the collections into a network, (4) improvement of India's plant germplasm quarantine system to insure the rapid dissemination of pathogen and insect-free germplasm for international exchange, and (5) provision for international research collaboration through scientific exchange. Where appropriate, training in management development and administrative support will be provided for within these outputs. The details of these categories comprise the following PID sections.

These categories have been developed to support the acquisition (direct exploration and collecting, or through exchange with other countries), evaluation, conservation and utilization of germplasm of crops and their wild relatives indigenous to India and of exotic

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introduction. This includes major crops of national and regional importance for food, feed, fiber, drug and industrial raw materials. Continuing improvement of these crops necessitates as wide a range as possible of genetic diversity to be maintained in gene banks as germplasm collections. These plant genetic resouces must be collected and maintained while they are still present to guarantee a ready and adequate range of genetic diversity for improving and protecting a given crop. Man cannot afford to base his future food supply on 12-15 major crops. Shifts in environmental diversity patterns over time dictate that alternative sources of food, feed and fiber must be available in a timely manner. No organism can outlive its food supply and man is no exception to that dictum. It is recognition of these basic facts that NBPGR's mandate, which this project is designed to support, includes the collection and preservation of crop species and their wild relatives. If collection and preservation decisions are to be prioritized in terms of available storage space, then this decision should be NBPGR's to make and respected by USAID.

2.3 Expected Achievements

The projected accomplishments will build upon and enhance existing facilities, expertise, and programs within the NBPGR in order to provide India with a comprehensive, national plant genetic resources network. Upon the project's completion, the following outputs will have been achieved:

1. A fully operational and efficient system of germplasm storage banks. This would include the initiation and/or finalization of construction of two different types of facilities. One would provide for the national, base collection of seed and vegetatively propagated samples obtained from international exchange, introductions, and regional collections. This facility will be placed at NBPGR Headquarters in New Delhi and is designed to provide for long-term storage, i.e. at least 50 years. The second type of facility is designed to house the working or active collections for a period of 5 to 15 years. These facilities are located at the regional centers throughout India.

2. Improve germplasm collections by emphasizing the acquisition, evaluation and utilization of plant genetic resources. This includes exploration trips and increasing and expanding the effort required for the evaluation of the existing collections.

3. Implementation of a computerized germplasm information system. This is an essential component of a centrally coordinated program through which regional centers form a network with NBPGR headquarters. It will provide information on crop descriptors, accession numbers, passport data, seed amounts and other data as required.

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4. A fully integrated plant germplasm quarantine system which will provide the means for effective, international exchange of germplasm. Improved quarantine facilities and technologies will provide for the timely entry of germplasm, rapid detection of infested material, and provision of healthy material for dissemination. The project will improve the system's coordination and develop non-destructive tests for pathogen and insect pest detection. It is expected that the India model will provide experience tansferable to other countries, including the U.S.

5. International research collaboration. This will be accomplished through scientific exchange, enhancement of existing professional disciplines, and training provided through collaboration with internationally recognized scientists. This will include studies in clonal propagation, maintenance methodology, quarantine and various aspects related to germplasm; such as collection, evaluation and preservation. Various consultancies are anticipated to interact with specialists from IBPGR, National Seed Storage Lab and other institutions. This will include the encouragement of new Indo-US scientific collaboration and germplasm exchange.

2.4 Project Outline and How It Will Work

The program will be implemented by completing the functional steps grouped within each of the five major project categories. It is understood that the PID does not attempt to present these in detail, but does provide a time frame for the implementation of each facet of the project.

2.4.1 PROJECT IMPLEMENTATION OUTLINE

OUTPUTS	YEAR OF IMPLEMENTATION						
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
I. Storage facilities.							
A. National Base collection	----------	----------	----------	----------	----------		
B. Regional/working collections			----------	----------	----------	----------	----------
II. Germplasm system							
A. Acquisition/exchange	----------	----------	----------	----------	----------	----------	----------
B. Evaluation	----------	----------	----------	----------	----------	----------	----------
C. Utilization			----------	----------	----------	----------	----------
III. Information system							
A. Consultation team		------			----------		
B. Design of system			----------				
C. Purchase hardware and software				----------			
IV. Plant germplasm quarantine activities							
A. Physical plants			----------	----------	----------	----------	----------
B. Lab support and equipment			----------	----------	----------	----------	----------
C. Technician training			----------	----------	----------	----------	----------
V. International research collaboration							
A. Maintenance methods							
1. Conventional preservation	----------	----------	----------	----------	----------	----------	----------
2. Cryopreservation					----------	----------	----------
B. Micropropogation		----------	----------	----------			
C. Germplasm expertise							
1. Evaluation	----------	----------	----------	----------	----------	----------	----------
2. Utilization	----------	----------	----------	----------	----------	----------	----------
3. Conservation	----------	----------	----------	----------	----------	----------	----------
4. Data Management	----------	----------	----------	----------	----------	----------	----------
5. Biosystematics					----------	----------	----------

3.0 Factors Affecting Project Selection and Further Development

3.1 Social Considerations.

The direct beneficiaries of this project will be the agricultural scientists in India and their institutions, both public and private, who are qualified for and interested in acquiring and using new germplasm to improve plants. The ultimate beneficiaries are the farmers and consumers of India who will profit from improved crop varieties through larger supplies of locally produced food which is free from disease and pests. Many cooperating institutions and scientists will participate in the proposed germplasm network.

India's capability in collecting and evaluating its genetic resources will thereby be strengthened and it will acquire the knowledge to perform quality research in this field independently. Finally, U.S. institutions and their researches also benefit from field work opportunities and germplasm evaluations carried out by the NBPGR. Linkages will be established between U.S. and Indian scientists and organizations that are expected to continue beyond the project period.

Women in developing countries will participate and contribute substantially in all levels of the Plant Genetic Resources Project. As women farmers grow at least 50 percent of the world's food (in parts of Africa over 90%), they will be the beneficiaries of the improved methods and technologies developed.

The resources of women in research science in India will be drawn upon and broadened through this program. The participation of women in the scientific community varies from country to country. Women in science will contribute by participating in this new program as research scientists, laboratory managers, and technicians. Presently, NBPGR employs four women technicians and 16 professional female staff members They will contribute their scientific expertise and technical skill as well as their clear understanding of their very specific country problems. The program in turn will aid in the development and growth of the pool of women in science through the various exchange and training aspects of the program components.

3.2 Economic Considerations

3.2.1 Justification of Investment and Economic Analysis

This "Plant Genetic Resources Project" is designed to implement both USAID and the GOI's agricultural policy and strategy by assisting the NBPGR to develop a national plant germplasm system interactive with the developing international network for the conservation of plant genetic resources. This objective will be achieved by developing specific enhancements to the existing system as described in section 2.0-2.4. This project will strengthen the capabilities of Indian scientists working with plant germplasm while allowing for the development of professional relationships among scientists worldwide.

Improved plant varieties with higher yields and resistance to biological and environmental stress can increase production by approximately 50-100% and thus render benefits far greater than the development cost of this project. An efficient, well maintained, comprehensive germplasm network is the starting point for most crop improvement research. Because of the nature of the activity, traditional economic analysis would not be useful. USAID does note that comprehensive economic studies of national research systems and of specific crop research programs show extremely high returns to investment. USAID is investigating both recurrent and GOI's implementation costs for the project. These will be discussed in the PP.

3.2.2 Economic Assessment of Plant Genetic Resources

Quite often the value of genetic and natural resources is not assessed until they become scarce or endangered. In the past, genetic resources have been considered open to free exchange until they begin to prove their usefulness in an economic sense. A single gene can provide a major contribution to agricultural production of significant economic importance. For example, the Norin 10 dwarfing gene provided the basis for the Green Revolution by imparting short stature to wheat. This prevents these varieties from lodging when provided with high amounts of fertilizer to increase yield. There are also economic assessments of the benefits derived by humanity from plant life in general, such as: photosynthetic fixation of solar energy, production of biomass in terms of food, medicines and raw materials, cycling of essential nutrients, enriching the soil, and the regulation of temperature and climate, to name but a few.

Plant breeders draw upon germplasm collections on a regular basis, searching primarily for resistance to diseases, pests and tolerance to adverse soils and climates. It has been estimated that this type of germplasm utilization, as well as that derived from more elite sorces of germplasm, has accounted for increasing agricultural production in the United States alone totalling about $ 1 billion per annum. Of this total, a reasonable estimate of the contribution of wild or primitive germplasm to agricultural production would be about $ 114 million.

It is worth examining the costs of maintaining these genetic resources at the present time. It is estimated that approximately $14 million was spent in the U.S. on plant genetic resources work in 1985. Worldwide the figure rises to around $60 million annually. Most of this is spent in developed countries and this reflects the urgent support needed to provide adequate collection and storage facilities in the developing countries. This presents a positive balance sheet, in an economic sense, as related to the conservation of genetic resources.

A final approach to be mentioned here concerns risk insurance. As farmers adopt more advanced, high yielding varieties and monocultural farming systems, their risks are extended in term of susceptibility to disease epidemics. This can occur because of the genetic uniformity necessary for modern varieties. These uniform crops, if attached by a newly evolved race of pathogen, can be "genetically vulnerable". The only way to keep the "genetic edge" on such events is by providing breeders with an accessible source of new genetic material. Thus, germplasm collections are the farmer's insurance against unforeseen threats to his crop production. Newly imparted resistance to disease pressures has already been worth millions of dollars in production.

3.3 Relevant Experience with Similar Projects

Although USAID/India has not developed prior projects similar to the one proposed, A.I.D. itself does provide core funding to the Consultative Group for International Agricultural Research (CGIAR) which holds many of the world's gemplasm collections. The importance of these collections at the international centers is evident to mission agricultural officers as many have toured and/or worked at these facilities. They understand the importance placed upon the varietal development which originates from these centers and the importance of the germplasm collections to these breeding programs.

In addition, the IBPGR has a regional office in Bangkok and has coordinated many collection trips throughout Asia. The significance of India's national germplasm heritage has been mentioned in previous sections. IBPGR has recognized this fact and placed top priority on collection trips within India.

3.4 Proposed Implementing Agency

The National Bureau for Plant Genetic Resources (NBPGR), was created by ICAR. Its charge is to meet national requirements for plant germplasm including collection, evaluation, documentation, quarantine and conservation related to agri-horticultural crops.

Therefore, its mandate is to act as a service organization for the various on-going crop improvement programs by way of enriching existing genetic variability. NBPGR scientists undertake inter-disciplinary research activities related to plant genetic resources. The NBPGR is also responsible for the import and export of seed/plant material for research purposes and also coordinates plant germplasm quarantine activities.

It fulfills the following objectives at the national and international level:

1. To plan, conduct and to coordinate exploration and collection of plant genetic resources in India and abroad.

2. To carry out and coordinate exchange of genetic resources of agri-horticultural plants and their relatives within India and from abroad, for use in crop improvement programmes in the country, and also for direct introduction.

3. To attend to quarantine inspection (both laboratory examination and post-entry growing on tests) of germplasm and planting material under exchange through the NBPGR, and to conduct research supportive to quarantine operations.

4. To evaluate and characterize available germplasm of agri-horticulture plants and to coordinate such activities at the NBPGR's Regional Stations; to prepare and/or help in the publication of inventories/catalogues of plant genetic resources.

5. To maintain 'base' and 'active' collections of genetic resources of specific crops and plants in the form of seed and other planting material through periodic plantings as well as in short and long-term storage under controlled termperature and humidity.

The NBPGR has 13 in-house and associated facilities nationwide including Headquarters at Delhi, 6 regional stations, an experimental farm, and other ICAR centers. The NBPGR has 5 divisions: (1) Germplasm Exchange; (2) Plant Quarantine; (3) Plant Exploration and Collection; (4) Germplasm Evaluation; and (5) Germplasm Conservation. Seperate from these divisions, it supports two "All India Coordinated Research" projects, one on Under-Explored Plants and the other on Medicinal and Aromatic Plants. Total expenditures of the Bureau were approximately US$1.0 million in FY-85.

The NBPGR conducted 23 germplasm explorations in 1985 and introduced 85,000 germplasm collections which includes bulk shipment of seed from the IARCs for regional testing from 43 countries that year. The National Repository holds over 50,000 accessions of germplasm and that figure is increasing rapidly.

With a very active Director, Dr. R.S. Paroda and the support of Dr. N.S. Randhawa, Director General of ICAR, the NBPGR's activities are expanding rapidly. It is coordinating and involving itself in activities begun by State Agricultural Universities. The NBPGR had 97 permanent and 188 temporary professional employees in the Class I to Class IV category at the end of 1985. While there are some vacancies, this is not a severe problem.

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Generally pre-eminent experts from the U.S. who have visited NBPGR and its stations are impressed by staff quality, management direction, institutional momentum and the Bureau's staff desires to draw from more knowledgeable sources to round out its capacity to do its job. USAID believes the implementaion of this project will be successful and the project will achieve its purpose.

3.5 AID Support Requirements and Capability

The AR/ID Office has two USAID direct hire professional staff, one JCC agriculture research administrator and one FSN professional program specialist as well as an institutional contractor with Winrock International. Winrock has one senior professional staff member (Dr. Guy Baird) and three administrative support staff in India and one senior professional staff in the Rosslyn VA office to coordinate US based activities. In addition, AR/ID is currently recruiting an additional Senior FSN at the Ph.D. level with extensive research and management experience.

The PP will examine in detail support requirement capabilities. However it is anticipated that with the addition of a FSN professional to the AR/ID staff a significant (i.e. 50%) portion of his/her time could be devoted to project implementation and monitoring. The current ARP project manager will be available to assist in project development and implementation. The PP will also analyze the need for contract support for administrative and logistical requirements included expanding Winrock capabilities.

3.6 Estimated Costs and Methods of Financing

3.6.1 Estimated Costs

The following table presents the Mission's best estimate of the project's financial needs in level of magnitude.

USAID/GOI BUDGET EXPENDITURES
(US $ 000)

ITEM	AID FX	AID LOCAL	AID TOTAL	GOI CONTRIBUTION	PROJECT TOTAL
Construction:					
Building	700	1,500	2,200	2,200	4,400
Greenhouse	450		450	850	1,300
Equipment: Lab	5,000		5,000	500	5,500
Field	1,250		1,250	250	1,500
Training:					
Local		100	100	100	200
Overseas	700	-	700	-	700
Adm. Support	150		150	200	500
Collaborative Research	400		400	250	900
Eval./Monitoring	250	-	250	-	250
GOI Salaries	-	-	-	600	600
GOI Operating Expenses	-	-	-	800	800
Other	200	-	100	-	100
Contingency	500	200	700	-	700
Inflation	1,300	100	1,400	-	1,400
TOTAL	10,800	1,900	12,700	5,750	18,450,000

3.6.2 Methods of Financing

Generally, all expenditures asociated with donor projects, whether financed by donor agencies or the GOI have to pass through GOI's budget. The GOI insists on this in order to protect the integrity of its budgeting process. Donors can directly fund training and a limited amount of technical assistance "off budget".

For "in budget" expenditures the recipient GOI agency, in this case the NBPGR of ICAR, submits reimbursement vouchers to the GOI Ministry of Finance (MOF). The MOF reimburses ICAR for its budgeted expenditures, less any advances it has made, and submits a claim to USAID for payment of agreed upon USAID expenses. If the claim is in order, USAID reimburses the GOI. While there appears to be no net gain to NBPGR, in fact the NBPGR would not have received the necessary funding from the government without the project. This is because the project itself has provided NBPGR with a priority claim on outside (donor) resources.

During PP design USAID will consider the suitability of disbursing against agreed upon achievements or performance. While it is too early to list specifics or even decide if this approach is feasible USAID has been extremely pleased how the performance disbursement plans in the 'MP Minor Irrigation' project have energized that activity. USAID will have to be certain that using the performance payment method of financing in this project would likely result in improved NBPGR performance or other measurable benefits.

3.7 Design Strategy

The project's design strategy will follow the outline of activities shown in section 2.4 and the budgetary guidelines presented in section 3.6.1. Provisions for the monitoring and evaluation of the project's design implementation are found in the next section. It is expected that the PP will synthesize all of these individual projections into a substantial project design.

3.7.1 Monitoring and Evaluation

Procedures for monitoring and evaluation will be developed in detail during preparation of the project paper. However, it is envisioned that an annual workplan would be prepared by NBPGR at the beginning of the project quantifying activities to be completed during the subsequent 12 month period. The plans would in turn be reviewed at an annual workshop and a report would be prepared outlining progress and problem areas. Workplan for the next 12 month period would be developed and agreed upon during the workshop.

USAID/New Delhi AR/ID staff will periodically monitor project progress through visits to NBPGR headquarters and field station locations. In this regard, AR/ID is currently in the process of hiring an additional FSN at the Ph.D level with extensive agriculture research and management experience. This person could be made available to assist in project monitoring. In addition the PP design team will consider the need of additional assistance for this important task. NBPGR will identify a senior staff member to coordinate and monitor project activities.

Regarding evaluation, it is anticipated that the PP will include provisions for a mid-term evaluation to examine project progress and a final impact evaluation. Information developed from annual reviews and monitoring visits will provide useful data in the evaluation process.

3.8 Recommended Environmental Threshhold Decisions

India is a rich source of biological diversity. It is one of the major centers of origin of many important plant species that include rice, pigeonpea, black gram, green gram, jute, mango, banana, citrus, egg plant and many medicinal and aromatic plants. Biological diversity is an important natural resource for all countries. It is fundamentally important in crop improvement efforts leading to increased agriculture productivity. Once this biological diversity is lost, it cannot again be regained.

The Plant Genetic Resources project is aimed at ensuring against plant genetic resource loss in India where many plant species originated. USAID in undertaking this project is embarking on a major effort to develop a nationwide network that has the capability to collect, evaluate and preserve major temperate, subtropical and tropical plant species, and preserve biological diversity. Therefore, the project is categorically excluded from further environmental action as per AID's environmental procedures set forth in 22 CFR 216.2(c)(1)(ii) and 216.2(c)(2)(ii).

3.9 AID Policy Issues

We have yet to determine the exact modes of contracting for goods and services to be used in this project. Due to the possibility that considerable coordination of technical assistance will be required, we will be looking at the possibility of using some type of institutional contract. The problem will be to identify clearly appropriate institutional requirements within AID guidelines (i.e. 8-A and Gray Ammendment considerations) that meet the needs of Indian in the 1980s. Even more difficult will be to identify necessary expertise in this area from a very narrow worldwide base.

Second, the proposed project does not contradict AID PD-15 which concerns itself with policies designed to achieve food security. The Agency wishes not to "support the production of agricultural commodities for export by developing countries when the commodities would directly compete with exports of similar U.S. agricultural commodities." This project is in agreement with this statement because much of the germplasm conserved is indigenous to India and does not compete with U.S.-based production. Germplasm accessions of crops such as corn, wheat, rice and soybeans kept in the NBPGR system would be available for use by American crop scientists. Thus, there should be no adverse effect on US exports as a result of this project. Also, the exchange of U.S. private sector, proprietary germplasm is <u>not</u> part of this project.

Finally, it should be emphasized that the proposed project will do much to conserve and protect India's biological diversity. Conservation such as this is a recognized, global mandate of AID. In this regard, the project reflects the concepts presented in State 150862 concerning environment and natural resources guidance to AID worldwide.

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Annex 'B'

LOGICAL FRAMEWORK

SECTOR GOAL	INDICATOR	MEANS OF VERIFICAITON	ASSUMPTION
To preserve India's rich sources of biological diversity for use in sustaining advances in agriculture	- Plant genetics resources being collected, stored and used.	- GOI budget flows for genetic preservation	GOI continues to support genetic resources priority area.
	- Animal & fish genetic resources researched and preserved	- AID donor flows into India in the genetic resources	
	- Continued use of germ-plasm for increased agricultural yields by plant breeders		

PROJECT PURPOSE I	END-OF-PROJECT INDICATORS	MEANS OF VERIFICAITON	ASSUMPTION
To ensure the collection, preservation, evluation, and exchange of India's important plant genetic resources	- Inventory of 122 collections completed - working collections 300,000 accessions in good order	- Through computerized info system	- GOI continued support thorugh 7th & 8th five year plans of receiving costs.
	- Base collections 600,000 accessions in Delhi	- Visits to gene banks throughout country	- NBPGR maintains good working relations with other ICAR or non ICAR institutions
	- Plant exploration collect 300,000 accessions	- NBPGR records	- Other ICAR institutes adequately staffed
	- All accessions stored in national germplasm info/ data system		
	- Tissue culture storage techniques perfected		
	- Clonal collections in place		
	- Continuing 5 year exploration program		

PROJECT PURPOSE II	END-OF-PROJECT INDICATORS	MEANS OF VERIFICAITON	ASSUMPTION
To enhance India's regional and global role in Plant Genetic Resource conservation and use	- Fully operating international training program training 56 Asian and S. Asian and international participants	- On spot verification in New Delhi	- Indo-US political relations remain friendly
	- Free international exchange of plant germplasm within international gene bank network	- Training Center training program	- Indo-South Asian relations remain friendly
	- India playing role in plant germplasm conferences and workshops on regional and global level	- IBPGR records	- India enforces free exchange of germplasm
	- Established scientific links between U.S. and India		

PROJECT OUTPUTS	MAGNITUDE OF INDICATORS	MEANS OF VERIFICAITON	ASSUMPTION
1. Strengthened NBPGR Headquarters operations	- All five divisions strengthened	- Site visits	- All AID and GOI inputs arrive in timely manner
	- Regional stations strengthened with gene banks	- NBPGR records	
2. Strengthened regional network	- Adequate staffing throughout system		- Construction is of good quality
	- GOI/ICAR budget support		
3. New headquarters building and national gene bank	- One headquarter without module gene storage facility		
4. International training facility with hostel	- One facility with lecture halls and hostel for 40 participants		
5. Quarantine stations for seed exchange	- 3 stations in Delhi, Hyderbad, Andaman		
6. Trained plant genetic scientists capable of training all NBPGR staff	- 50 trained scientists training more than 300 Indian locals and other International students		

PROJECT OUTPUTS	MAGNITUDE OF INDICATORS	MEANS OF VERIFICAITON	ASSUMPTION
1. EQUIPMENT			
a. Scientific lab	]	- AID invoices	- Project in adequately funded
b. Field equipment	]$5.0 million	- Procurement documents	
c. Special cold storage units	]	- On-site verified - Bills of loding	- GOI processes "not-manufactured in Indian
d. Office machines	]	- NBPGR documents	- GOI clears customs
e. Vehicles			
2. U.S. TRAINING	60 scientists	- PIO/P and USDA/OICD/ITC document	
3. CONSTRUCTION OF HEADQUARTERS	20 million - local cost to construction	- On-site visits by civil engineer	- GOI processes plans
4. CONSULTANTS	$700,00 - specialized engineers, civil engineers, scientists, teachers		

ANNEX C

(1) COUNTRY CHECKLIST

Listed below are statutory criteria applicable generally to FAA funds, and criteria applicable to individual fund sources: Development Assistance and Economic Support Fund.

A. GENERAL CRITERIA FOR COUNTRY ELIGIBILITY

1. FAA Sec. 481 (h) (1); FY 1985 Continuing Resolution Sec. 528. Has it been determined or certified to the Congress by the President that the government of the recipient country has failed to take — No.

adequate measures or steps to prevent narcotic and psychotropic drugs or other controlled substances (as listed in the schedules in section 202 of the Comprehensive Drug Abuse and Prevention Control Act of 1971) which are cultivated, produced or processed illicitly, in whole or in part, in such country or transported through such country, from being sold illegally within the jurisdiction of such country to United States Government personnel or their dependents or from entering the United States unlawfully?

2. FAA Sec. 481 (h) (4). Has the President determined that the recipient country has not taken adequate steps to prevent (a) the processing,

No.

in whole or in part, in such country of narcotic and psychotropic drugs or other controlled substances, (b) the transportation through such country of narcotic and psychotropic drugs or other controlled substances, and (c) the use of such country as a refuge for illegal drug traffickers?

3. FAA Sec. 620 (C) . If assistance is to a government, is the government liable as debtor or unconditional guarantor on any debt to a U.S. citizen for goods or services furnished or ordered where (a) such citizen has exhausted available legal remedies and (b) the debt is not denied or contested by such government? No.

4. FAA Sec. 620 (e) (1). If assistance is to a government, has it (including government agencies or subdivisions) No.

taken any action which has the effect of nationalizing, expropriating, or otherwise seizing ownership or control of property of U.S. citizens or entities beneficially owned by them without taking steps to discharge its obligations toward such citizens or entities?

5. FAA Sec. 620 (a), 620 (f), 620 (D); FY 1985 Continuing Resolution Sec. 512 and 513. Is recipient country a Communisty country? If so, has the President determined that the assistance to the country is important to the national interests of the United States? Will assistance be provided to Angola, Cambodia, Cuba, Laos, Syria, Vietnam, Libya, or South Yemen? Will assistance be provided to Afghanistan or Mozambique without a wiaver?

No. No assistance will be provided to these countries.

6. FAA Sec. 620 (j). Has the country permitted, or failed to take adequate measures to prevent, the damage or destruction, by mob action of U.S. property?	No.
7. FAA Sec. 620 (l). Has the country failed to enter into an agreement with OPEC?	N/A
8. FAA Sec. 620 (o); Fishermen's Protective Act of 1967, as amended, Sec. 5. (a) Has the country seized, or imposed any penalty or sanction against, any U.S. fishing activities in international waters?	(a) No.
(b) If so, has any deduction required by the Fishermen's Protective Act been made?	(b) N/A
9. FAA Sec. 620 (q); FY 1985 Continuing Resolution Sec. 518. (a) Has the government of	(a) No (b) No.

recipient country been in default for more than six months on interest or principal of any AID loan to the country? (b) Has the country been in default for more than one year on interest or principal on any U.S. loan under a program for which the appropriation bill (or continuing resolution) appropriates funds?

10. FAA Sec. 620 (s). If contemplated assistance is development loan or from Economic Support Fund, has the Administrator taken into account the amount of foreign exchange or other resources which the country has spent on military equipment? (Reference may be made to the annual "Taking

N/A.

into Consideration" memo: "Yes, taken into account by the Adminstrator at time of approval of Agency OYB." This approval by the Administrator of the Operational Year Budget can be the basis for an affirmative answer during the fiscal year unless significant changes in circumstances occur.)

11. FAA Sec. 620 (t). Has the country severed diplomatic relations with the United States? If so, have they been resumed and have new bilateral assistance agreements been negotiated and entered into since such resumption?

No.

12. FAA Sec. 620 (u) What is the payment status of the country's U.N. obligations?

India has made its Annual Payment to meet its U.N. obligations.

If the country is in arrears were such arrearages taken into account by the AID Administrator in determining the current AID Operational Year Budget? (Reference may be made to the Taking into Consideration memo.)

13. FAA Sec. 620A; FY 1985 Continuing Resolution Sec. 521. Has the President determined that the country (a) grants sanctuary from prosecution to any individual or group which has committed an act of international terrorism? Has the government of the recipient country aided or abetted, by granting sanctuary from prosecution to, any individual or group which has committed or is being sought

(a) No

(b) No

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by any other government for prosecution for any war crime or act of international terrorism?

14. <u>ISDCA of 1985 Sec. 552 (b)</u>. Has the Secretary of State determined that the country is a high terrorist threat country after the Secretary of Transportation has determined, pursuant to section 1115 (e) (2) of the Federal Aviation Act of 1958, that an airport in the country does not maintain and administer effective security measures? No.

15. <u>FAA Sec. 666</u>. Does the country object, on the basis of race, religion, national origin or sex, to the presence of any officer or employee of the U.S. who No.

is present in such country to carry out economic development programs under the FAA?

16. FAA Sec. 669, 670. Has the country, after August 3, 1977, delivered or received nuclear enrichment or reprocessing equipment, materials, or technology, without specified arrangements or safeguards? Has it transferred a nuclear explosive device to a non-nuclear weapon state, or if such a state, either received or detonated a nuclear explosive device? (FAA Sec. 620 E permits a special waiver of Sec. 669 for Pakistan). — No.

17. FAA Sec. 670. If the country is a non nuclear weapon — N/A

state, has it, on or after August 8, 1985, exported illegally (or attempted to export illegally) from the United States any material, equipment, or technology which would contribute significantly to the ability of such country to manufacture a nuclear explosive device?

18. ISDCA of 1981 Sec.720. Was the country represented at the Meeting of Ministers of Foreign Affairs and Heads of Delegations of the Non-Aligned Countries to the 36th General Assembly of the U.N. of Sept.25 and 28, 1981, and failed to disassociate itself from the communique issued? If so, has the President taken it into account? (Reference may be made to the Taking into Consideration memo.) N/A

19. FY 1985 Continuing Resolution. If assistance is from the population functional account, does the country (or organization) include as part of its population planning programs involuntary abortion? No.

20. FY 1985 Continuing Resolution Sec. 530. Has the recipient country been detemrined by the President to have engaged in a consistent pattern of opposition to the foreign policy of the United States? No.

B. FUNDING SOURCE CRITERIA FOR COUNTRY ELIGIBILITY

1. Development Assistance Country Criteria

FAA Sec. 116. Has the Department of State determined that this government has engaged in a consistent pattern of gross violations of internationally recognized human rights? If so, can it be demonstrated that contemplated assistance will directly benefit the needy?	No.

2. Economic Support Fund Country Criteria — N/A

FAA Sec. 502 B. Has it been determined that the country has engaged in a consistent pattern of gross violations of internationally recognized human rights? If so, has the

country made such significant improvements in its human rights record that furnishing such assistance is in the national interest?

3M (2) PROJECT CHECKLIST

Listed below are statutory criteria applicable to projects. This section is divided into two parts. Part A. includes criteria applicable to all projects. Part B applies to projects funded from specific sources only: B.1. applies to all projects funded with Development Assistance loans, and B.3. applies to projects funded from ESF.

CROSS REFERENCES: IS COUNTRY CHECKLIST UP TO DATE? HAS STANDARD ITEM CHECKLIST BEEN REVIEWED FOR THIS PROJECT?

A. GENERAL CRITERIA FOR PROJECT

1. FY 1985 Continuing Resolution Sec. 525; FAA Sec. 634 A. Describe how authorizing and appropriations committees of Senate and House have been or will be notified concerning the project.	A Congressional Notification will be forwarded to Congress prior to obligation of the subject project.
2. FAA Sec. 611 (a) (1). Prior to obligation in excess of $500,000 will there be (a) engineering, financial or other plans necessary to carry out the asistance and (b) a reasonably firm estimate of the cost to the U.S. of the assistance?	Yes.
3. FAA Sec. 611 (a) (2). If further legislative action is required within recipient country, what is basis for reasonable expectation that	N/A

such action will be completed in time to permit orderly accomplishment of purpose of the assistance?

4. FAA Sec.611 (b); FY 1985 Continuing Resolutin Sec. 501. If for water or water related land resource construction, has project met the principles, standards, and procedures established pursuant to the Water Resources Planning Act (42 U.S.C.1962, et seq.)? (See AID Handbook 3 for new guidelines.) — N/A

5. FAA. Sec 611 (e). If project is capital assitance (e.g., construction), and all U.S. assistance for it will exceed $1 million, has Mission Director certified and Regional Assistant Administrator taken into — Yes.

consideration the country's capability effectively to maintain and utilize the project?	
6. FAA Sec. 209. Is project susceptible to execution as part of regional or multilateral project? If so, why is project not so executed? Information and conclusion whether assistance will encourage regional development programs.	No.
7. FAA Sec.601 (a). Information and conclusions whether projects will encourage efforts of the country to: (a) increase the flow of international trade; (b) foster private initiative and competition; and (c) encourage development and use of cooperatives, and credit unions, and savings and loan associations; (d) discourage	(a) N/A (b) Yes, in providing germplasm to private sector (c) N/A (d) N/A (e) Yes, especially agricultural research and crop improvement (f) N/A

monopolistic practices; (e) improve technical efficiency of industry, agriculture and commerce; and (f) strengthen free labor unions.

8. FAA Sec. 601 (b). Information and conclusions on how project will encourage U.S. private trade and investment abroad and encourage private U.S. participation in foreign assistance programs (including use of private trade channels and the services of U.S. private enterprise).	Free availability of germplasm will encourage U.S. private sector to develop activities in crop improvement both in India and the U.S.
9. FAA Sec 612(b), 636(h); FY 1985 Continuing Resolution Sec. 507 . Describe steps taken to assure that, to the maximum extent possible, the country is contributing local currencies to meet the cost of contractual and other services, and foreign currencies owned by the U.S. are utilized in lieu of dollars.	The GOI will finance 50 to 55 percent of all project costs including local currencies for contractual and other services.

10. FAA Sec. 612 (d) . Does the U.S. own excess foreign currency of the country and, if so, what arrangements have been made for its release?	Yes, such funds will not be used to finance project related costs but will be used for other appropriate jointly agreed purposes.
11. FAA Sec. 601 (e). Will the project utilize competitive selection procedures for the awarding of contracts, except where applicable procurement rules allow otherwise?	Yes.
12. FY 1985 Continuing Resolution Sec. 522. If assistance is for the production of any commodity for export, is the commodity likely to be in surplus on world markets at the time the resulting productive capacity becomes operative, and is such assistance likely to cause substantial injury to U.S. producers of the same, similar or competing commodity?	N/A.

13. FAA 118 (c) and (d). Does the project comply with the environmental procedures set forth in AID Regulation 16. Does the project or program take into consideration the problem of the destruction of tropical forests?	Yes.
14. FAA 121 (d). If a Sahel Project, has a determination been made that the host government has an adequate system for accounting for and controlling receipt and expenditure of project funds (dollars or local currency generated therefrom)?	N/A.
15. FY 1985 Continuing Resolution Sec.536. Is disbursement of the assistance conditioned solely on the basis of the policies of any multilateral insititution?	No.

16. ISDCA of 1985 Sec. 310. For development assistance projects, how much of the funds will be available only for activities of economically and socially disadvantaged enterprises, historically black colleges and universities, and private and voluntary organizations which are controlled by individuals who are black Americans, Hispanic Americans, or Native Americans, or who are economically or socially disadvantaged (including women)?

Contracts for goods and services will be awarded on a competitive basis to the maximum extent practicable. Such organizations and individuals will be encouraged to participate.

B. FUNDING CRITERIA FOR PROJECT

1. Development Assistance Project Criteria

a. FAA Sec. 102 (a), 111, 113, 281 (a). Extent to which activity will (a) effectively involve the poor in develop-

(a) The project will assist in the development of improved agricultural crops which will increase

b. FAA Sec. 103, 103 A, 104, 105, 106. Does the project fit the criteria for the type of funds (functional account) being used?	Yes.
c. FAA Sec. 107. Is emphasis on use of appropriate technology (relatively smaller, cost-saving, labor-using technologies that are generally most appropriate for the small farms, small businesses, and small incomes of the poor)?	Yes, especially regarding agricultural inputs.
d. FAA Sec. 110 (a). Will the recipient country provide at least 25% of the costs of the program, project, or activity with respect to which the assistance is to be furnished (or is the latter cost-sharing requirement being waived for a "relatively least developed country")?	Yes.

e. FAA Sec. 122 (b). Does the activity give reasonable promise of contributing to the development of economic resources, or to the increase of productive capacities and self-sustaining economic growth?	Yes.
f. FAA Sec. 128 (b). If the activity attempts to increase the institutional capabilities of private organizations or the government of the country, or if it attempts to stimulate scientific and technological research, has it been designed and will it be monitored to ensure that the ultimate beneficiaries are the poor majority?	Yes.

g. FAA Sec. 281 (b). Describe extent to which program recognizes the particular needs, desires, and capacities of the people of the country; utilizes the country's intellectual resources to encourage institutional development; and supports civil education and training in skills required for effective participation in governmental processes essential to self-government.	The project addresses the need for increased food production and will support research in particular problem areas of plant genetic resource preservation and safe exchange. Institutional development will be fostered insofar as the implementing agency, the Indian Council for Agricultural Research, and its institutions, will acquire a strengthened capacity to design and execute an effective plant genetic resources system.

2. Development Assistance Project Criteria (Loans Only)

a. FAA Sec. 122 (b). Information and conclusion on capacity of the country to repay the loan, at a reasonable rate of interest.	N/A

b. FAA Sec. 620 (d). If assistance is for any productive enterprise which will compete with U.S. enterprises, is there an agreement by the recipient country to prevent export to the U.S. of more than 20% of the enterprise's annual production during the life of the loan? N/A.

3. Economic Support Fund Project Criteria

a. FAA Sec. 531 (a). Will this assistance promote economic and political stability? To the maximum extent feasible, is this assistance consistent with the policy directions, purposes, and programs of part I of the FAA? N/A

b. FAA Sec. 531 (c). Will assistance under this chapter be used for military, or paramilitary activities? N/A

c. ISDCA of 1985 Sec. 207. Will ESF funds be used to finance the construction of or the operation or maintenance of, or the supplying of fuel for, a nuclear facility? If so, has the President certified that such a country is a party to the Treaty on the Non-Proliferation of Nuclear Weapons or the Treaty for the Prohibition of Nuclear Weapons in Latin America (the "Treaty of Tlatelolco"), cooperates fully with the IAEA, and pursues nonproliferation policies consistent with those of the United States? N/A

d. FAA Sec. 609. If commodities are to be granted so that sale proceeds will accrue to the recipient country, have Special Account (counterpart) arrangements been made?	N/A

Annex D

I N D I A

PLANT GENETIC RESOURCES PROJECT

(386-0513)

Certification Pursuant to Section 611 (e) of
The Foreign Assistance Act of 1961, as Amended

I, Richard N. Blue, principal officer of the U.S. Agency for International Development in India do hereby certify that in my judgement the Government of India has both the financial capacity and the human resources to carry out, utilize and maintain this project effectively. This judgement is based upon the analysis contained in the Project Paper, as well as the successful maintenance and utilization of projects in India previously financed or assisted by the United States.

_____

Richard N. Blue,
(Acting) Mission Director, USAID/India

_____

Date

ANNEX E

PLANT GENETICS RESOURCES PROJECT EQUIPMENT LIST

Sl. No.	ITEM	UNITS	APPROX. COST US $	TOTAL COST
1	Vehicles			
	a. Jeep for exploration	6	10,000	60,000 (LC)
	b. Utility Van	1	9,000	9,000 (LC)
	c. Mini-bus (25 seator Evaluation Dir	1	25,000	25,000 (LC)
2	Exploration Kit	9	1,000	9,000
3	Stereobinocular microscope	16	2,000	32,000
4	Movie video camera with accessories with VCR/TV	1	5,000	5,000
5	Seed storage rooms to be operated at a temp. of -20 C (10 rooms 20'x100')	10	50,000	500,000
6	Infrastructure for module shelves/ suitable shelving structure	10 units	10,000	100,000
7	Emergency back-up generators 25 KVA, 65 KVA, 135 KVA	6	10,000	60,000
		3	16,000	48,000
		1	25,000	25,000
8	Controlled temperature (15 - 20 C) humidity (15 -20%) equipment for seed drying and packaging (15' x 20')	2	25,000	50,000
9	Temperature controlled walk-in gerinination rooms (10' x 12') one each for 20,25,30 C and alternating 20-30 c	3	10,000	30,000
10	Seed germinators (cabinet type)	21	2,000	42,000
11	Microbalance (0.1 mg accuracy)	1	7,500	7,500
12	Mettler Analytical balance 0.1 mg. accuracy	5	1,875	9,375
13	a. Top pan balances 0.1 g accuracy b. Mettler	9	1,500	13,500

Sl. No.	ITEM	UNITS	APPROX. COST US $	TOTAL COST
14	Moisture determination balance	2	2,000	4,000
15	Soft X-Ray machine, film reader and film processor	1	10,000	10,000
16	High temperature drying oven	8	1,000	8,000
17	Thermogradient plate with water bath	2	11,000	22,000
18	Electronic seed counters	8	3,000	24,000
19	a Ultra cold freezer (-75 c)	1	7,000	7,000
	b Deep freezer (-20 c)	4	1,000	4,000
20	Seed blower	10	2,000	20,000
21	Seedburo minivac small lot thresher and cleaner	19	750	14,250
22	Hygrothermograph	10	500	5,000
23	Microcomputers with printer, hard disc and softwares	20	6,000	120,000
24	Bar coding and reader	1	1,000	1,000
25	Vitascope	1	6,000	6,000
26	Seed packet sealing machine	8	900	7,200
27	Vaccum head seed planter	6	1,500	9,000
28	Humidity guides	20	16	320
29	PIX Box Image processor - analyser	1	6,000	6,000
30	Accelerated aging cabinets	4	4,000	16,000
31	Automatic seed analyser	1	10,000	10,000
32	Microwave oven	7	500	3,500
33	Ro-tap testing seive shaker	1	2,000	2,000

Sl. No.	ITEM	UNITS	APPROX. COST US $	TOTAL COST
34	Digital automatic moisture tester	18	2,000	36,000
35	Electronic colour sorter	1	5,000	5,000
36	Vaccum cleaner	4	500	2,000
37	Magnetic Separator	3	3,000	9,000
38	Seed cleaner lab. cleaning and grading machine type LA-LS	1	1,500	1,500
39	Copenhagen tanks	2	8,000	16,000
40	Digital Thermometer and relative humidity	19	1,000	19,000
41	Photocopying machine/plane paper copier	21	4,000	84,000 (LC)
42	Heavy duty photocopier	1	17,000	17,000
43	Washing Apparatus	2	5,000	10,000
44	Compund Microscope	6	1,200	7,200
45	Vaccum drying oven	1	3,000	3,000
46	Seed drying cabinets (Munters)	16	5,000	80,000
47	Vaccum fumigation 1000 lt. capacity with accessories	3	20,000	60,000
48	Vaccum fumigation 500 lt. capacity with accessories	2	8,000	16,000
49	Fumigation Chamber (portable) steel	1	10,000	10,000
50	Miscellaneous fumigation equip. like dispensors, fumiscope, detectors, interferometer, gas masks	5	2,500	12,500
51	High speed ultra centrifuge with three rotors, accessories	3	40,000	120,000
52	Ultrasonic equipment (Exp. Model)	1	3,000	3,000

Sl. No.	ITEM	UNITS	APPROX. COST US $	TOTAL COST
53	Serological Lab. equipment	4	20,000	80,000
54	Soil Sterilizer	4	10,000	40,000
55	a. Plant propagation ventillated insect proof glass house (30'x40' with propagation equip like misters watering device etc. (cost of material)	4	10,000	40,000
	b. Growth chamber	3	10,000	30,000
56	a. Screen House (25' x75') with 40 mesh alluminium screen and corrugated fibre glass material	6	15,000	90,000
	b. Screen house (30' x 60') locally made	3	12,000	36,000
57	Quarantine glass house (10' x15') with climate control and phyto-sanitary features	30	8,000	240,000
58	Virus indexing glass house (10' x 30')	5	15,000	75,000
59	Glass house (30' x 60') with climate control	4	25,000	100,000
60	a. Glass house (30'x60') locally made for evaluation work	2	25,000	50,000
	b. Polyhouse (30' x60')	2	10,000	20,000
61	Heat chamber for thermotherapy	2	20,000	40,000
62	Differential thermal analyser	1	23,260	23,260
63	Cryenco liquid nitrogen container			
	a) large size	3	6,000	18,000
	b) small portable	2	1,975	3,950
64	Cytophotometer with accessories	1	60,000	60,000
65	Cold room (4 c) small	1	23,650	23,650
66	Amino acid analyser	1	20,000	20,000
67	Percival incubator LVL model	1	12,500	12,500

Sl. No.	ITEM	UNITS	APPROX. COST US $	TOTAL COST
68	Edgegard hood laeminar flow cabinet	1	9,842	9,842
69	Tissue culture room (small unit)	1	19,685	19,685
70	Polytron microgrinder	1	10,000	10,000
71	Buchi waterbath rota evaporator	1	11,810	11,810
72	Gyrotary Shaker G-2 Table top model	1	10,000	10,000
73	Mettler balance (0.001 mg. and .000 mg)	1	3,500	3,500
74	Gallon kemp orbital incubator	1	15,000	15,000
75	IEC Centre N refrigerated Centrifuge	1	23,650	23,650
76	Fischer vers bath	1	10,000	10,000
77	Stereo zoom microscope	1	7,000	7,000
78	Microtome (Low temp.)	1	10,000	10,000
79	Portable UV Lamp long and shortwave	1	10,000	10,000
80	Media dispensing units	3	3,000	9,000
81	Lyophilizer	3	6,000	18,000
82	Small mill/grinder	1	10,000	10,000
83	Chromatographic chamber (all glass) set of six	6	1,000	6,000
84	Micropipets (all sizes) 1 set	1set	4,000	4,000
85	Microcomputers with accessories	1	5,000	5,000
86	Camera Nikon 35 mm SLR with zoom and wide angle lenses accessories plus	14	1,000	14,000
87	Electronic typewriter with facility for memory	1	1,500	1,500
88	Rain shelter,	2	15,000	30,000

Sl. No.	ITEM	UNITS	APPROX. COST US $	TOTAL COST
89	Dehumidifier	4	6,000	24,000
90	Refrigerated type airconditioner	5	2,000	10,000
91	Leaf area meter	3	2,000	6,000
	a. Medium term storage module (large)	2	50,000	100,000
	b. Back-up generator for large modules	2	16,000	32,000
	c. Medium term storage modules (small) (30,000 accessions)	7	30,000	210,000
	d. Back-up generators for small storage modules	7	10,000	70,000
92	Rotary evaporator	2	5,000	10,000
93	PH Meter	8	300	2,400
94	Colour graphic plotter	1	2,000	2,000
95	Software	1	2,000	2,000
96	Uninterrupted power supply system SKVA for the computer system	1	20,000	20,000
97	Rotovator	3	2,000	6,000
98	Rolling cultivator	9	500	4,500
99	Tractor			
	Medium Size	1	10,000	10,000 (LC)
	Small Size	2	3,000	6,000 (LC)
100	Rototiller	2	600	1,200
101	Nursery or test plot thresher	9	2,700	24,300
102	Hand held planter	24	60	1,440
103	Bundle thresher	7	2,000	14,000
104	Tractor mounted sprayer	3	2,000	6,000
105	Trolley mounted sprayer	8	1,000	8,000
106	Seedburo M2 BC Cleaner	7	2,000	14,000

Sl. No.	ITEM	UNITS	APPROX. COST US $	TOTAL COST
107	Precision garden seeder (seedburo) model 1000 B	7	100	700
108	Garden cultivator (Seedburo model 6000 B)	8	750	6,000
109	Air blast seed cleaner	2	600	1,200
110	MSA Camp II Pesticide respirator	16	25	400
111	Cage material for pollination control (Nylon material from georgia)	200 cages	300	60,000
112	Programme freezing controller cryomed model 1010 A with microcomputer	1	78,750	78,750
113	Off-set printer	1	6,000	6,000
114	Distilled water maker	1	2,950	2,950
115	Mist chamber, CTCRI, Trivandrum	2	2,000	4,000 (LC)
116	Maintenance Workshop			
	Battery charger			400
	Portable drill machine			80
	Benchvise			8,000
	Power Press			12,000
	Milling Machine			12,000
	Shaper Machine			3,000
	Rolling Machine			12,000
	Lathe Machine			10,000
	GRAND TOTAL			4,019,292

ANNEX F

TECHNICAL ASSISTANCE (SHORT-TERM)

Sl. No.	Short Term Consultants	Person months						
		ARP	88	89	90	91	92	93
1	TISSUE CULTURE							
	Cryopreservation		1					
	Tissue Culture	1	1					
	Biosystematics		1					
2	GERMPLASM EXCHANGE							
	Plant Introduction Officer		1					
3	CONSERVATION							
	Genebank Management		1	1				
	Refrigeration Engineer	1						
4	QUARANTINE							
	Greenhouse/civil engineer	1		1		1	1	
	Plant quarantine expert		1	1	1			
5	EXPLORATION		1					
6	DATA/INFO. MANAGEMENT	1	2					
7	EQUIPMENT CONSULTANT	1						
8	CONSULTING ARCHITECT ENGINEERS FOR BUILDING		3	3	3	3		
9	MISCELLANEOUS		2	2	2	2	2	
	TOTAL PERSON/MONTHS	5	14	8	6	6	3	

TOTALS:

ARP = 5 @ 12,000 = $ 60,000

PGRP = 37 @ 12.000 = $444.00

Annex G

NBPGR/US TRAINING PROGRAM

TRAINEES			TRAINING MONTHS 1988	1989	1990	1991	1992	$ 000 COST
		A. Quarantine Training						
2	-	Virus Indexing Serology	5	5				
1	-	Seed borne bacterial detection and serology			2		2	
1	- -	Nematology, regulatory taxonomy, survey methodology	2				2	
2	-	Entomology, taxonomy detection		3		3		
1	-	Pesticide application and safety	3					
2	-	Taxonomic mycology, methods treatment and detection	3		3	3		
	-	Advanced program Mgt. for pest analysis, biological decision making, germplasm quarantine operation						
3		(pathologist, entomologist nematologist)	3		3	3		
1	-	U.S. Sugarcane Quarantine facility (SBI, consultants) Sr. Scientists)		1				
13			16	9	8	9	4	

Total Trainees:rt 13x2,500 = 32,500
Training months:46 x 3,800 =174,800

207,300

207.3

TRAINEES		TRAINING MONTHS 1988	1989	1990	1991	1992	$ 000 COST
	B. Tissue Culture						
1	- Cryopreservation	2					
2	- In Vitro culture	3	3				
	- Bioseotanatus (Cyto-genetical and Biochem aspects)						
1	- University of Illinois		3				
1	- Cryobiology Cornell University			3			
1	- Biotechnolgy (Isozyme, and enzyme restriction, IVA/RNA cloning recumbenant DNA technology, gene transfer) Michigan State		3				
1	- Crop evolution and use of wild species Iowa State			3			
7		5	9	6			
	Total 8 trainees 7 x rt @ 2500 = 17,500 22.5 t/m x 3800 = 76,000 93,500						93.5
	C. Exploration (Technique) Taxonomic training						
3		1	1	1			
	3 x rt @ 2500 = 7,500 3 x 3800 = 11,400 18,900						18.9

TRAINEES				TRAINING MONTHS 1988	1989	1990	1991	1992	$000 COST
		D. Evaluation Training							
2	-	Small green cereals: (wheat barley, rice, oats, rye, triticale)	(ST&T)	1	6				
2	-	Pulses (beans, peas, lentils, chick peas)	(ST)	1		3			
2	-	Temperate to sub tropical Tubers (potato, sweet potato yams, cassava)	(ST&T)		1	6			
1	-	Vegetable Root Crops (carrots, turnips, beet radishes)	(T)			3			
1	-	Brassica Vegetable, 1 Brocolli, Cauliflower, cabbages)	(T)	4.5					
1	-	Large Cereals (maize, sorghum, sweet sorghum, millets)	(T)	6					
2	-	Temperate tree fruit crops (apples, pears, peaches, almonds, apricots, plums etc.)	(T)	4.5	4.5				
1	-	Vine Crops/Forage Crops	(T)	3					
2	-	Oilseed Crops	(T)	3			3		
1	-	Peanuts	(T)			4.5			
1	-	Cucurbits (cucumbers, melons, squashes, gourds)	(T)	3					
1	-	Chemical evaluation	(T)	3					
2	-	Disease & Pest evaluation	(T)		3	3			
19		Total Eval. Trainees = 19		29.0	14.5	19.5	3		

Training to be - 3 months (T)
Study Tour - 1 month (ST)
Total Evaluation Trainees = 19
Total Trainees:rt 19x2,500 = 47,500
Training months:66 x 3,800 =250,800

Total Evaluation Training 298,300

298.3

TRAINEES		TRAINING MONTHS 1988	1989	1990	1991	1992	$ 000 COST
	E. Conservation						
2	- Tour of gene banks in U.S.	2					
2	- Conservation Training at	3					
1	- Technical training Engineer Cold Storage						
1	- Post doctoral 1 gene bank mgt.			12			
1	1 seed aging			12			
7	Total trainees: 7	5		24			
	7 x rt 2500 = 17,500 9 t/m x 3800 = 34,200 2 yr. x 18,000 = 36,000 57,700						57.7
	F. Exchange						
1	- Study tour of U.S. facilities 1 senior scientist						6.3
1			1				
	G. Information Management						
1	1 operator 1 rt x 2500 = 2,500 2 x 3800 = 7,600	2					
1	10,100						10.1
	H. Misc. Training						
4	4 x 2500 = 10,000 4 x 3800 = 16,200	2					
4	26,200	2	2				26.2
55	GRAND TOTAL	60	37	59	12	4	718.3

Annex 'H'

Current Germplasm

Collections Throughout India

June, 1987

Germplasm collections maintained by various ICAR Institutes Universities/Coordinated Projects/Centres.

Institutes/Centres	Crop-diversity maintained
1. S* Central Rice Research Institute, Cuttack	Rice (15,740)
2. S Division of Genetics, IARI, New Delhi.	Wheat (15,000) Indigenous - 1437 Barley - 5000
3. S Punjab Agricultural University, Ludhiana.	Wheat (4000)
4. S Project Coordinator, Sorghum, Hyderabad.	Sorghum (1,000)
5. S Project Coordinator, Barley, Karnal.	Barley (8,000)
6. S Project Coordinator, Millets, Pune	Finger millet(4480), Kodo millet (1095), Foxtail millet (1905 and 2491 at Nandyal), Prosomillet(581, 1169 at Dholi), Barnyard millet (882,985 at Vivekananda Parvatiya Krishi Anusandhan Shala, Almora).
7. C Central Potato Research Institute, Shimla	Solanum tuberosum: tuberosum types (626) andigena types, (228 tubers), semi-wild and wild tuberiferous Solanum spp.(191).
8. C S Central Tuber Crops Research Institute, Trivandrum.	Cassava (1289) Sweet potato (733) Dioscorea esculenta (97), D.alata (213), D.rotundata (370), Taro/ Colocasia (311), Xanthosoma (64) Elephant foot yam (96), Yam bean (11), Coleus (64), Winged bean(25).
9. C Project Coordinator, Tuber crops CTCRI, Regional Centre, Bhubaneshwar.	Cassava (267), Sweet potato(100) Colocasia (14), Elephant foot yam (21), Dioscorea alata (30), Dx D.esculenta and others (6).
10. C Rajendra Agricultural University, Dholi	Sweet potato (468), Colocasia (40), Pachyrhizus/Sweet yam (37), Cassava (18) Winged bean (28) and others (31)
11. C Andhra Pradesh Agricultural University, Rajendra Nagar, Hyderabad.	Cassava (38), Sweet potato (53), Colocasia (21) and others (10).
12. C Tamilnadu Agricultural University, Coimbatore	Cassava (109), Sweet potato (65), Colocasia (8), Elephant foot yam (10), Coleus (10), Dioscorea alata and other spp. (19).

* S seed

** C clonal

Jorhat Agricultural University	Cassava(25),Sweet potato(30) Colocasia(12),Amorphophallus and Dioscorea spp.(12).
14. C Bidhan Chandra Krishi Viswa Vidyalaya,Kalyani	Cassava(12),Sweet potato(42) Colocasia(11),Sweet yam(11) Dioscorea,Amorphophallus and others (12).
15. S Project Coordinating Millet	Finger millet (4490),Foxtail (1951),Little millet(644) Prosomillet (577),Barnyard millet (816)Kodo millet (965) Barnyard (50)
16. C Kerala Agricultural University Trichur	Cassava (72),Sweet potato(31) Colocasia Dioscorea spp.(14) and others (7)
17. C University of Agricultural Sciences,Bangalore,Station Ullal,Karnataka.	Cassava (11),Sweet potato (38 Colocasia (6)
18. C Konkan Krishi Vidyapeeth, Dapoli	Cassava (16),Sweet potato (55) Colocasia (10),Elephant foot Yam (14),Dioscorea alata and D.bulbifera (19).
19. C ICAR Research Complex,Shillong (for North Eastern Hill Region)	Cassava (10),Sweet potato(14) Colocasia (10),Dioscorea(6).
20. C Central Plantation Crops Research Institute,Kasargod	Coconut (97),Exotic (97) Indigenious (35)
21. S CPCRI Station,Vittal	Arecanut(172) Cashew(172) Cacao (82)
22. S CPCRI Station,Andamans	Coconut (24)
23. S CPCRI Station,Shantigodu	Cashew (~~[illegible]~~),Exotic(121) Indigenious (6)
24. S CPCRI Station,Palode	Oil Palm (7)
25. C+S CPCRI Station,Calicut	Nutmeg(301),Black pepper(~~260~~ 236), Ginger (127),Turmeric(~~[illegible]~~ 184), Cloves (152),Cinnamon (~~[illegible]~~ 170).
26. C+S CPCRI Station,Apangala Indian Institute of Horticultural Research,Bangalore.	Cardamom(210),Greater Cardamom (14). a) Fruit crops: Banana(172), Citrus (71),Grapes(636),Mango (120),Pineapple(25),Papaya(20) Pomegranate(38),Guava(19), Watermelon (49),Muskmelon(191) Annona spp.(13)and others(20). b) Vegetable crops: Amaranth (53),Bittergourd (84),Bottle-gourd (166),Cucumber(9), Pumpkin,(72),other Cucurbits (8),Brinjal(70),Tomato(900) Cabbage (53),Capsicum(854) Carrot (188),Cauliflower(77) Radish(26),Cowpea (180) Dolichos(223),Garden pea (300).

	French bean(34),Lima bean(30) Okra (26),Winged bean(116), Onion(171),Garlic(36)and others (11). c)Medicinal plants:Catharanthus roseus(11),Jasminum(39),Patchouli (12),Solanum spp.(10),Dioscorea and others (8), d)Ornamental plants: Bougainvillea (119),Chrysanthemum(180),Gladiolus (120),Hemerocallis(34),Hippeastrum (55),Orchids(102),Roses(464),China aster(21),Gloriosa spp.(4).
27.5 Directorate of Oilseed Research,Hyderabad	Groundnut(5,876),Rapeseed-Mustard (14,576),Safflower(11,394),Linseed (2,805),Sesame (3,184),Niger(1,036) Castor (1,250),Sunflower (760)+ 150 accessions in post-quarantine).
28.5 Project Coordinator, Sunflower,Bangalore	Sunflower(644),wild Helianthus spp.(6).
29.5 Project Coordinator (Rapeseed-Mustard),Hisar (maintained by 15 cooperating research centres.)	Brassica spp.(14,259),Oilseed Brassicae (4000)
30.5 Project Coordinator (Safflower)(maintained by 12 different centres).	Safflower (8240)
31.5 National Research Centre for for Groundnut,Junagadh.	Groundnut (8855)Arachis spp.(20)
32.5 Central Institute for Cotton Research,Nagpur	Gossypium arboreum (1455)gGossypium Herbaceum (340),G.hirsutum(3700) G.barbadense (289),wild Gossypium spp.(27)Perennial cottons (110) Hybrids polyploids and others (225) Landraces (22).
33.5 CICR Subcentre,Coimbatore	G.hirsutum(2000),G.barbadense(280) Gossypium wild spp.(11),Landraces(4)
34.5 CICR Subcentre,Sirsa	G.hirsutum(1400),G.arboreum(100)
35.5 Project Coordinator,Cotton Coimbatore	G.Hirsutum(3300),G.barbadense(205) G.arboreum(850),G.herbaceum(20)
36.C Sugarcane Breeding Institute Coimbatore	Sugarcane clones (3590), S.Officinarum (754)and natural hybrid,S.barberi (43),S.Sinense(29) S. robustum (140),S.spontaneum(489) S.Narenga (235)
37.5 Central Tobacco Research Institute,Rajamundry.	Tobacco (1091),including Nicotiana rustica

38. S Project Coordinator, Medicinal and Aromatic Plants, New Delhi and other centres	Opium poppy(355), Senna(40) Periwinkle(26), Rauvolfia (43) Vetiver (31), Palmarosa(30), Isabgol (11), foxglove (17), Geranium(4) Patchouli(4).
39. S Vivekananda Parvatiya Krishi Anusandhan Shala, Almora ~~Bombhal~~	Rice (1500), Wheat (1700), Barley(260), Maize (300), Minor millets(- Finger millet (3,000) Barnyard millet (900), Foxtail millet (800), Proso millet (50) Amaranths (500), Black gram (80) Greengram (125) Horse gram (9) Soybean (55), French bean (150) Tomato (30), Chillies (20) Peas (100).
40. S Central Arid Zone Research Institute, Jodhpur	Pomegranate (20), Jojoba (20) Datepalm(15), Custard apple(8) Pearlmillet (1250), Italian millet (96), Prosomillet (64), Guar(1200) Moth bean (1100), Mung bean (80) Horse gram (25), Sesame (190) Ragi(100), Brown sarson (10) Groundnut (26), Pasture grasses- Lasiurus, Cenchrus, Dichanthium and others (410).
41. S Jute Agricultural Research Institute	Hibiscus (585), Ramie (54) Sunhemp (70), Flax (66)

Table 3i : Germplasm holdings in spices at various centre in India.

Crop	Centres	No.of germplasm accessions
42. S + Black Pepper	NRCS, Calicut	236 cv
	Panniyur	215
	Sirsi	21
	Chintapalli	27
43. C + Ginger	NRCS, Calicut	120
	Pottangi	85
	Solan	25
	Vellanikkara	21
44. C + Turmeric	NRCS, Calicut	184
	Pottangi	151
	Solan	47
	Vellanikkara	59
	Jagtial	14
45. C Cumin	Jobner	200
	Jagudan	157
46. S Fennel	Jobner	120
	Jagudan	182

? Cardamom	NRCS, Calicut (Appangala)	226 and 13 related taxa
	Pampadumpara	71
	Mudigere	74
	Yercaud	12
	Gangtok	25
? Coriander	Jobner	400
	Jagudan	301
	Guntur	505
	Coimbatore	230
? Fenugreek	Jobner	115
	Jagudan	170
	Guntur	34
	Coimbatore	399
Nutmeg	NRCS Calicut	303*
Clove	—do—	152*
Cinnamon	—do—	170

The genetic variability available in the country in these crops are neglig These are only progenies from certain mother trees

Table 1 a. Germplasm collections at the centres of the All India Coordinated Research Project (AICRP) on Arid Zone Fruits

Centres	Ber	Pomegranate	Date palm	Custard-apple	Fig	Aonla	Bael	Others
53. C Abohar	-	-	32	-	-	-	-	-
54. C Anatapur	4	19	-	9	5	-	-	-
55. C Aruppukottai	11	9	-	6	1	5	-	20
56. C Bawal	40	2	-	-	-	-	-	-
57. C Bikaner	-	-	27	-	-	-	-	-
58. C Faizabad	30	3	-	-	-	10	13	6
59. C Bangalore (IIHR)	6	39	-	-	6	-	-	-
60. C Jobner	10	30	-	-	1	-	-	1
61. C Jodhpur (CAZRI)	63	36	20	11	-	3	5	-
62. C Mundra	-	-	6	-	-	-	-	-
63. C Rahuri	83	38	-	19	5	-	-	-
64. C Sardarkrushinagar	19	30	-	-	-	9	-	3

*Phalsa, jamun, karonda, Carissa grandiflora, Cordia myxa

Table 1. Germplasm holdings in Palms, Cashew and Cacao at CPCRI Centres.

Crop	Centre	No. of accessions	
		Exotic	Indigenous
Coconut C	99 Kasaragod	62	35
	100 Andamans	24	6
Arecanut S	101 Vittal	29	55
Oil Palm S	102 Palode	6	-
Cashew S	103 Vittal	5	156
	104 Shantigodu	-	121
Cacao C	105 Vittal	82	-

Table-6: Genetic stocks in various genetic resource centres in India

Organi-zation	Centres	Number of genetic stocks maintained					
		G.hirsutum	G.barbadense	G.arboreum	G.herbaceum	Wild species/ perenn-ials,etc.	Total
PAU	Ludhiana	2525	-	1380	-	30	3935
HAU	Hissar	643	-	427	-	20	1090
SUA	Sriganganagar	200	-	50	-	-	250
PKV	Akola	479	-	242	-	100	821
MPKV	Rahuri	684	-	-	-	10	694
MKV	Parbhani	-	-	1200	200	10	1410
GAU	Surat	300	120	120	160	150	850
JNKVV	Indore/Khandwa	100	30	-	-	-	130
TNAU	Coimbatore	724	113	-	-	20	857
TNAU	Kovilpatti	478	-	342	-	-	820
APAU	Guntur	307	30	-	-	-	337
APAU	Nandyal	-	-	220	25	-	245
UAS	Dharwad	300	100	-	60	20	480
CICR	Nagpur	3700	294	1455	390	173	6012
CICR	Coimbatore	1950	120	150	-	20	2240
CICR	Sirsa	500	-	70	-	10	580
	Total	12,890	807	5,656	835	563	20,751

Table 1 b. Germplasm collections at different centres (other than AICRP on Arid Zone Fruits)

Centres	Ber C	Pomegranate C	Custard-apple C	Fig C	Aonla C	Bael C	Others* C
65. C Allahabad	6	-	4	-	6	-	-
66. C Anand	5	3	2	-	13	-	2
67. C Bahadurgarh	41	-	-	-	-	-	-
68. C Bangalore (UAS)	-	24	7	1	-	-	-
69. C Basti	7	-	-	-	3	8	-
70. C Bichpuri (Agra)	4	18	-	1	2	-	2
71. C Coimbatore	5	13	-	-	-	-	-
72. C Delhi (IARI)	39	-	-	-	-	-	-
73. C Godhra	4	4	-	2	3	1	2
74. C Hisar	79	47	-	-	4	2	2
75. C Hyderabad	5	14	-	3	-	-	1
76. C Jodhpur (NBPGR)	27	11	1	-	1	-	5
77. C Junagadh	7	1	2	1	-	-	2
78. C Kanpur	3	-	-	-	3	4	12
79. C Karnal (IARI)	8	-	-	-	-	-	-
80. C Ludhiana	34	19	-	-	-	-	-
81. C Paria (Gujarat)	7	-	-	-	-	-	-
82. C Patharchatta	25	2	-	1	5	6	2
83. C Phagli (NBPGR)	3	8	-	-	-	-	-
84. C Raya (Jammu)	5	18	-	-	-	-	-
85. C Saharanpur	11	1	-	1	6	4	-
86. C Sangareddy	-	-	19	-	-	-	-
87. C Solan	-	37	-	-	-	-	-
88. C Udaipur	13	18	12	2	6	-	1
89. C Yercaud	-	43	6	10	-	-	7
15							

*Phalsa, karonda, mulberry, tamarind, jamun, Carissa edulis, C. grandiflora, Cordia myxa

	Centre	Pigeon pea	Mung bean	Urd bean	Bengal Gram	Field pea	Lentil	Raj-mash	Lath-yrus	Cow-pea	Moth bean	Rice bean	Horse gram	Bak-la	Gwar
90. S	Jobner										1100				
91. S	S.K. Nagar	1040	860	52	145					1200	141				1491
92. S	Kanke		83	159											
93. S	Berhampur(W.B.)	200	300	130	600	40	650		25						
94. S	Raipur		6 rabi	18rabi					925						
95. S	IARI	190													
96. S	Derol GAU	109			55										
97. S	Bangalore									1346			500		
98. S	Pattambi		22	29						530					
		5924 (6000)	7515 (8000)	4254 (5000)	11291 (12000)	1743 (2000)	4468 (5000)	988 (1000)	950 (1000)	5016 (5000)	1241 (1300)	245 (250)	875 (1000)	345 (400)	1491 (1500)

Note: 1. Above figures include several germplasm lines which may be common at different centres

2. Complete information on the availability of germplasm at many of the voluntary centres has not yet been received.

Annex '9'

NATIONAL BUREAU OF PLANT GENETIC RESOURCES

NEW DELHI-110012

EXPLORATION PLAN FOR 1987

Exploration programme planned at the Headquarters (Division of Plant Exploration & Collection)

Scientist's name	Month	Areas to be surveyed	Emphasis to be given (crops)
Sh. S. Mauria (with ICRISAT)	March/April	North Bihar and Eastern Uttar Pradesh	Pigeon pea.
Sh. Umesh Chandra & Sh. [redacted]	April	North-Western and eastern parts of Madhya Pradesh (Sarguja, Ambikapur, Raigarh Bilaspur & Raipur districts)	Legumes, vegetables and medicinal plants (*Psoralia corylifera*)
Dr. M.N. Koppar	April	North-western Uttar Pradesh (plains - Meerut, Saharanpur Aligarh and adjoining areas)	Wheat and other crops
Sh. Umesh Chandra (GBPUA&T, Majhera, Garampani, Nainital, & NDUA&T, Faizabad)	May	Tarai region of Uttar Pradesh (Nainital, Bareilly, Sitapur, Lakhimpur, Bahraich, Gonda, Basti, Gorakhpur & Deoria districts)	Cucurbits and other vegetables
Dr. M.N. Koppar Sh. [redacted] (with IIHR, Bangalore)	May	Western Ghats	Jackfruit & other crops
Dr. M.N. Koppar (to be combined with Shri K.C. Pant, Khowali)	June	Upper ranges of Chamoli and Pithoragarh District.	Wheat mainly

7.	Dr. R.K. Arora (with FC, HAAP)	July	Hasanagar and adjoining areas of Uttar Pradesh	Vetiver
8.	Sh. S. Maurya (with IGFRI; GBPUAET, Ranichauri; NBPGR, Bhowali-Technical hand)	September	Uttar Pradesh (Kumaon & Garhwal)	Temperate forage legumes & grasses (wild, semi-domesticate and related types; also native cultivated types)
9.	Dr. N.N. Koppar (with ICRISAT)	September	Madhya Pradesh and adjoining Uttar Pradesh	Pearl millet
10.	Sh. . Maurya (with ICRISAT)	Sept./October	North-western sub-himalayan region - Sirmur and adjoining parts	Sorghum, millets.
11.	Sh. Umesh Chandra & Sh. [redacted]	November	Bastar and Raipur	Cucurbits, brinjal(vegetables) and other crops
12.	Dr. N.N. Koppar (with ICRISAT)3	November/	Parts of Madhya Pradesh and adjoining southern Uttar Pradesh	Groundnut
13.	Dr. R.K. Arora (with CRRI, Cuttack)	November/	North-eastern region - Arunachal Pradesh	Rice mainly

(i) One special exploration in consultation with CARI, Port Blair to be planned to Andamans and Nicobar islands (CTCRI, CPCRI for tuber and plantation crops collection respectively to join).

B. **Exploration programme of Regional Stations & Exploration Base Centres**

Regional Station, Shimla

14.	Dr. R.D. Joshi (with HPKVV, Palampur)	April/May	Larji and Khanag valley, District Kulu (HP).	Multi-crop - wheat, barley, lentil, pea, vegetables etc.
15.	Sh. N.K. Gautam	April/May	Kinnour and Nichar areas	Multicrop - maize, wheat, barley, vegetables and *Allium* spp.
16.	Dr. D.S. Rathore (with CIHHP, Lucknow)	May	Parts of Orissa	Mango
17.	Dr. D.S. Rathore (with IIHR, Bangalore)	July/August	Pangi valley(Chamba district)	Pome and Stone fruits
18.	Sh. N.K. Gautam	September/ October	Una District	Multi-crop - paddy, legumes and vegetables especially cucurbits and Solanums.
19.	Dr. D.S. Rathore (with IIHR, Bangalore)	November	Arunachal Pradesh	Citrus

Regional Station, Bhowali

20.	Dr. K.S. Negi	May	Milam valley, Pithoragarh District montaineous region	Rice, maize, millet and vegetables
21.	Sh. K.C. Pant (Dr. M.N. Koppar is joining him for wheat collection) (with GBPUA&T, Ranichauri)	June	Remaining parts of Upper ranges of Chamoli & Pithoragarh	Multi-crop - wheat, barley, oilseeds.
22.	Sh. K.C. Pant	June/July	Northern part of Pithorgarh	Multicrop - (wild & cultivated *Allium* spp.)
23.	Sh. K.C. Pant Sh. B.N. Singh	September/ October	Almora district - Upper regions of Kumaon	Wild relatives of medicinal plants (*Valeriana wallichii* and *Swertia chiravala* may be given emphasis)
24.	Sh. K.S. Negi	October/	Parts of Dehradun, Pauri/ Tehri Garhwal Himalayas.	Rice, maize, minor millets, vegetables.

Regional Station, Akola

25.	Sh. T.R. Lokanathan	April	Solapur, Gulberga, Bidar and Osmanabad	Multi-crop - Oilseeds, pulses and vegetables.
26.	Sh. T.R. Lokanathan	September	Parbhani, Nanded and Tavatmal	Multi-crop
27.	Dr. D.P. Patel	October	Nasik, Dhulia, Jalgaon, Buldana and Aurangabad.	Multi-crop (including vegetables)
28.	Dr. D.P. Patel (with NRCS, Calicut)	December	Goa, Ratnagiri and Mangalore etc.	Wild Pepper spp., Cardamomum spp. and Myristica spp.

Regional Station, Jodhpur

29.	Dr. D.C. Bhandari	April/May	Jalore, Sirohi, Udaipur and Dungarpur	Multi-crop - Wheat, barley, cucurbits etc.
30.	Dr. D.C. Bhandari	September/ October	Pali, Bhilwara, Chittargarh and Banswara	Multi-crop - millets, pulses, vegetables.
31.	Sh. D.P. Chopra Sh. B.N. Singh	October	Ahmedabad, Bhavnagar, Amreli, Junagarh, Jamnagar and Rajkot	Multi-crop - including medicinal plants Coleus spp. & Urginea spp.
32.	Dr. D.C. Bhandari	October	Kutch, Banskantha, Sabarkantha and Mehsana	Legumes, groundnut and vegetables.
33.	Dr. D.C. Bhandari Sh. S.K. Verma	November	North - western Rajasthan	Minor fruits including Ber

Regional Station, Trichur

34.	Sh. V.K. Muralidharan	April	Parts of Tamilnadu - South Arcot, Pondicherry and Thanjavur.	Rice, millets and grain legumes
35.	Sh. V.K. Muralidharan (with CTCRI, Trivendrum)	September/	Tumkur, Kolar, Bangalore, Mandya and Mysore	Rice, minor millets vegetables and tuber crops.
36.	Sh. K.C. Velayudhan	October	Ramanathapuram and Tirunellveli	Sorghum, paddy and millets
37.	Sh. K.C. Velayudhan (with CRRI, Cuttack)	November/ December	Kerala - Cannanore, Kazhikode, Palghat, Trichur etc.	Rice - both wild and cultivated
38.	Sh. V.K. Muralidharan (with CPCRI, Kasaragod a and MRCS, Calicut)	December	Wynad plateau	Wild ginger, *Piper* etc.

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i) For Vetiver collection - sites to be located

ii) Trichur station to undertake collection of *Catharanthus roseus* (with N & A.P. Unit, Bangalore) for salt tolerant habitats.

Regional Station, Shillong

39.	Dr. R.D. Sharma	Mar./April	Meghalaya and Assam	Oilseeds - brassicas
40.	Dr. R.D. Sharma (with ICRISAT)	September/ October	Assam plains	Sorghum
41.	Dr. D.K. Hore (with CICR, Nagpur and JARI, Barrackpore)	September/ October	Mikir hills and Assam plains	Cotton and jute
42.	Dr. D.K. Hore (with PC, MAAP; CTCRI)	October/ November	Garo hills and adjoining areas, parts of Nagaland	Medicinal plants, tuber crops
43.	Dr. D.K. Hore (with NRCS, Calicut, CPCRI, Kasaragod)	December	Parts of Meghalaya	*Piper* spp - cultivated and wild types and Zingiberacere.

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* One exploration to north- eastern region for M & AP to be planned by Headquarters/Reg. Station, Shillong

Base Centre, Cuttack

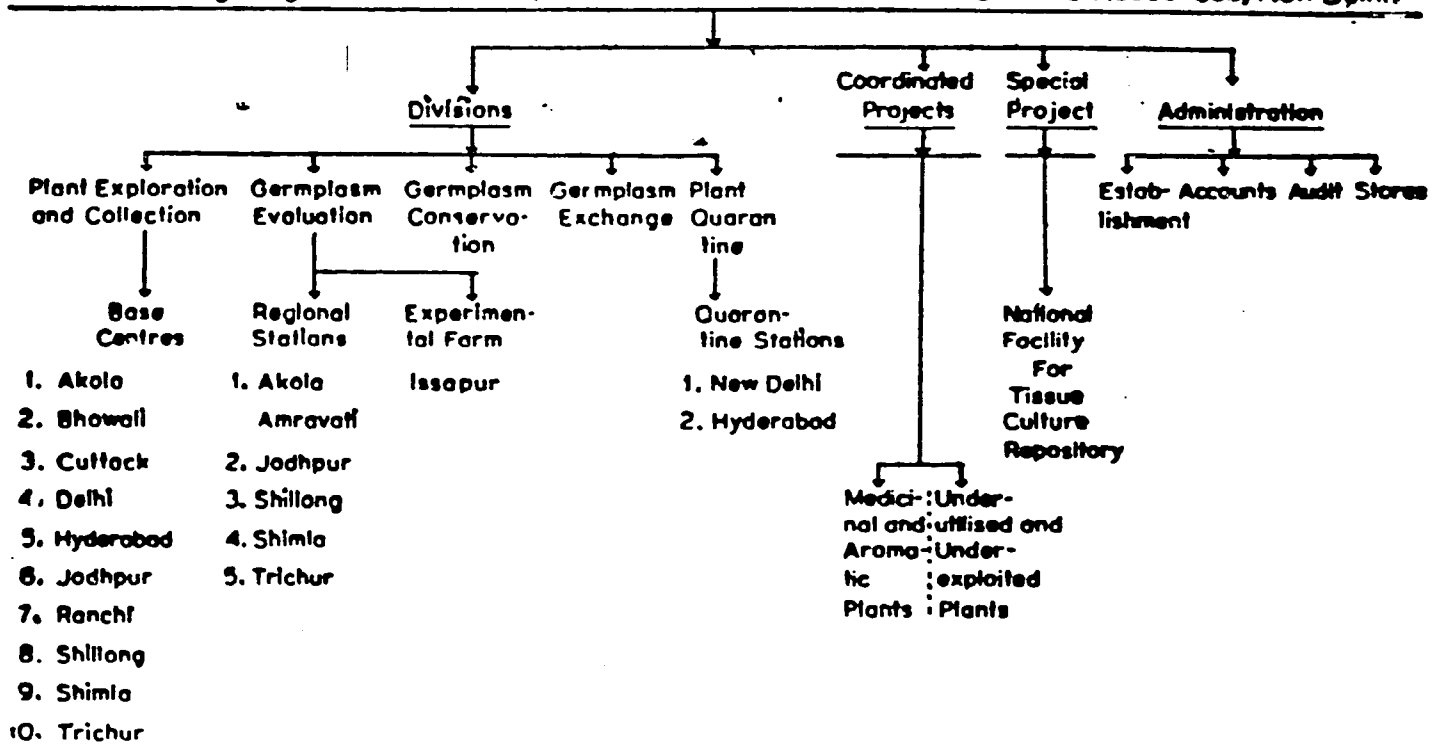
44.	Sh. N. Dikshit	April	Ranchi and Singhbhum	Multi-crop(including oilseeds)
45.	Sh. N. Dikshit	September/ October	Keonjhar and Mayurbhanj	Oilseeds - Niger, Sesame, groundnut, cotton, minor millets & vegetables.
46.	Sh. N. Dikshit (with CRRI, Cuttack)	October	Sundargarh, Sambalpur and adjoining hilly tracts of eastern ghats	Rice mainly

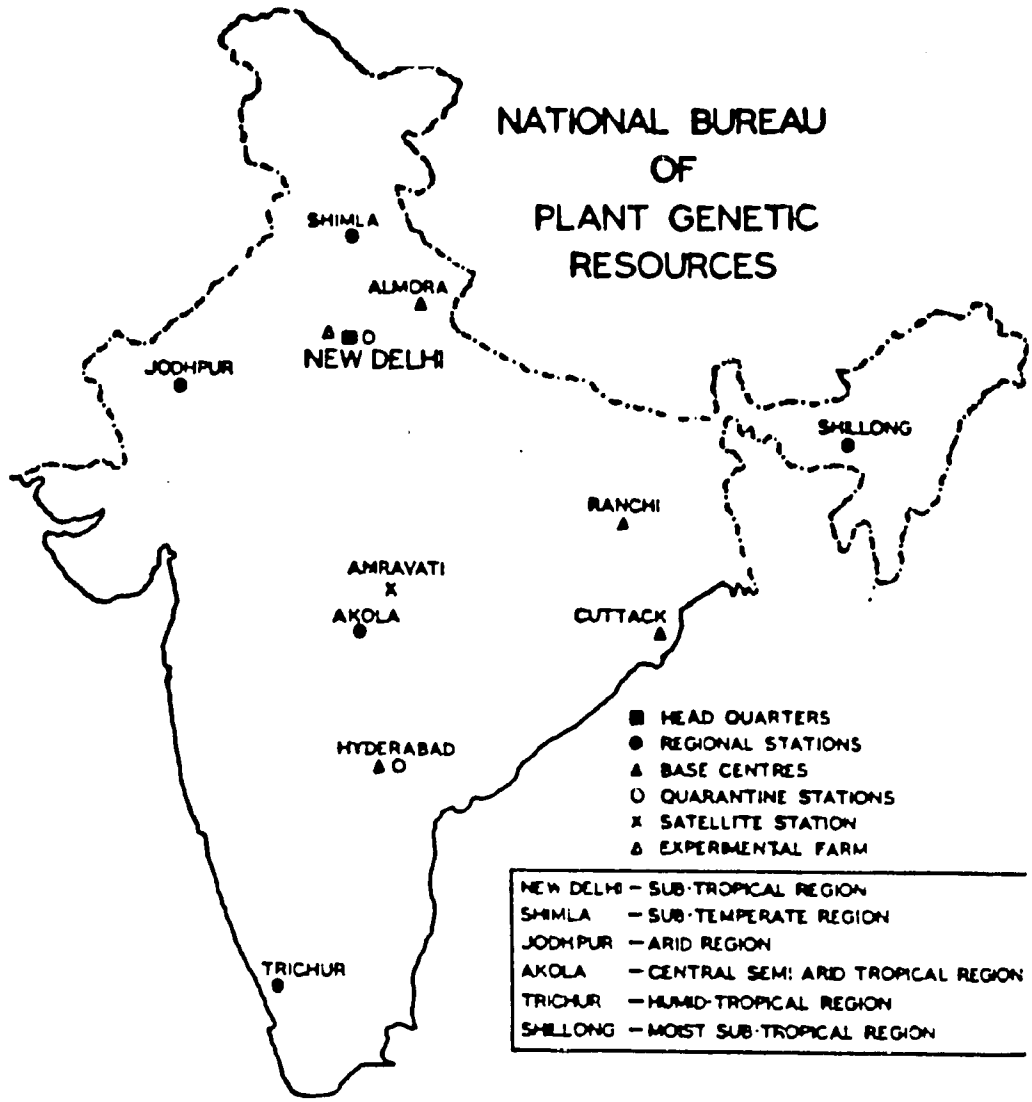
Base Centre, Hyderabad

47.	Sh. P. Someshwar Rao	August/ September	Telangana Region	Minor millets & others
48.	Sh. P. Someshwar Rao	October/	Anantpur, Mehboobnagar and adjoining areas.	Custard apple

Annex 'U'

Chart showing organisational set-up of National Bureau of Plant Genetic Resources, New Delhi.





Headquarters, Regional Stations and Base Centres of NBPGR

Draft No. 2
June 5, 1987

AGRICULTURAL RESEARCH PROJECT
GENERAL PROCEDURES FOR PROCUREMENT
OF IMPORTED/EQUIPMENT/SUPPLIES

1. Identification of subproject equipment needs. Basic needs are specified in the subproject proposal document submitted by GOI to USAID. The items listed therein may be modified, added to or deleted by ICAR.

2. Additional information needed. In general, more information is needed by ICAR and by Winrock than is found in the subproject proposal. Additional information will be provided by ICAR to USAID/Winrock through a Request Form (see attached) which is to be completed for each item of equipment. It is the responsibility of the requesting scientist to complete the Request Form, using whatever resources are necessary and available, including communication with ICAR and Winrock for information. If information needed is not available in the Winrock Delhi office, it will be requested via telex from Winrock/Washington.

3. Initiation of procurement procedures. When ICAR has the additional information on the equipment items, the list will be submitted by the Subject Matter Division through PIU to USAID/Delhi to proceed with procurement procedures. Each item on the list will be accompanied by a completed and signed REQUEST FORM. A copy of this form is attached.

4. Preparation of performance specifications. On receipt of a request from ICAR, along with the list and by-item Request Form, USAID/Delhi will ask Winrock/Delhi to prepare performance (bid) specifications. Normally they will be written by/under the supervision of the Winrock/Washington office. They will be written based on the Request Form and the photocopy attached to it of the selected item from the equipment catalogue.

   It is noted that USAID regulations prevent bidding by BRAND name. Therefore, there is no guarantee of obtaining the specific brand name requested and shown in the photocopy of the catalogues description. However, proper performance specifications insure that is as good or better, possibly because the specifications were written from a catalogue description.

If ICAR insists on a specific BRAND of equipment, justification will have to be provided which will be used in an attempt to obtain a waiver from USAID. Waivers usually take 2-3 months to process.

5. Utilization of performance specifications. The performance specifications will be returned to Winrock/Delhi and ICAR when complete.

ICAR will use performance specifications to apply for NMIC from DGTD, and for any other clearances that may be required, based on the specifications. A copy of the NMIC (and any other special clearances) will be given to Winrock/Delhi for transmittal to Winrock/Washington.

At the same time, ICAR will use the performance specifications to formally request USAID/Delhi to proceed with procurement, subject to the understanding that NMIC and other clearance documents must be obtained before an item can be procured.

Based on an ICAR/DARE formal request, USAID/India will issue a Delivery Order to Winrock with approximate budget details.

Simultaneously, Winrock will use the performance specifications to advertise, when required, for quotations or bids in the U.S., according to USAID procedures. Normally 45 days will be given for responses to bid requests. Winrock will be able to drop any item at any time in the process if clearances are not obtained.

6. After bids are received, they will be reviewed for conformity to specifications, price, etc., and a decision will be made by Winrock as to the supplier.

7. Duty free clearances. When the final supplier is selected, a detailed invoice will be sent to Winrock/ICAR. ICAR will then proceed to obtain duty free clearance for each item by brand name, supplier, shipper etc. The duty free clearance certificate/statement must be promptly given to Winrock/Delhi for transmittal to Winrock/Washington.

8. Placement of order. When copies of all needed clearances are received at Winrock/Washington then the order will be placed with the supplier to deliver ASAP to the shipper.

Only 90 days are available from the day of the bid opening to place the order and guarantee the price. If the 90 days limit is passed and the appropriate clearances (NMIC, Duty Free Clearance, Ministry of Electronics Clearance etc.) are not received, the bidding process may have to be reinstated).

9. Preparation for shipment. All clearances with the final shipping invoices and insurance papers will be returned to Winrock/ICAR when the items are secured at the US shipper and are ready for shipment. Copies will be placed in the appropriate shipping boxes containing each item. Clearances will also be sent with the shipping documents attached to the shipment.

All shipping containers will be marked with the following statement : THIS EQUIPMENT IS IMPORTED UNDER THE GOI/ICAR/USAID CONTRACT NO. _____ . THESE GOODS ARE DUTY FREE. Shipments will be consigned to the user institution with the name/title of the person and address of the institution shown on the Bill of Lading. Unless advised by ICAR to the contrary, Winrock will use its judgement regarding mode of shipment (surface or air). In general, large heavy items not urgently needed would be shipped by surface. Smaller and lighter items urgently needed would be shipped by air.

Insurance coverage: Winrock will arrange for insurance coverage up to the time of arrival at the recipient institution. The recipient institution is responsible for checking the condition of the equipment on arrival of the equipment at the recipient institution, and will promptly inform Winrock/Delhi of particulars.

10. Clearance through customs. ICAR/the recipient institution (consignee) is responsible for clearance of equipment, and for payment of all charges related thereto. However, the shipping agent contracted by Winrock will assist with clearance.

11. Transhipment. The shipping agent contracted by Winrock will be responsible for receipt of the items cleared by customs and onward shipment to the consignee.

REQUEST FORM

ARP SUBPROJECT IMPORTED EQUIPMENT

1. Subproject:

2. Responsible Officer (or title) of institute/university to receive equipment, and shipping address:

3. Name and purpose of item of equipment - specify intended use (For example: GAS CHROMATOGRAPH FOR MEASURING CARBON DIOXIDE, OXYGEN, NITROGEN, METHANE AND CARBON DIOXIDE BY THERMAL CONDUCTIVITY AND ETHYLENE BY FLAME IONIZATION. To be used for measurement of respiratory and ripening gases and storage and package atmosphere compositions associated with postharvest technology of fruits and vegetables. If a specific "BRAND" name is deemed necessary, provide detailed justification):

4. Catalogue information. Attach photocopy of the selected item from the equipment catalogue, or from informatin specification sheets, including all accessories clearly marked. Include expected U.S. price (catalogue price):

5. List of priority requirements that the instrument must have, if other than specified under "3" or "4", above (such as compatibility to existing equipment, power source - AC 220V 50C, or battery operated, etc.):

6. Urgency. How urgent is equipment needed?

7. Indian scientist/consultant to be contacted, if further clarification is needed:

8. Approved by ICAR:

Approval: _____

Date: _____

Annex 'I.'

Memorandum of Understanding between The Indian Council of Agricultural Research for Collaboration in Plant Genetic Resources Activities

This Memorandum of Understanding is made this _____ _day of _____, 1987, between the Indian Council of Agricultural Research (hereinafter ICAR) and the International Board for Plant Genetic Resources (hereinafter IBPGR).

WHEREAS ICAR is an entity established by the Government of India with responsibility in India to undertake, aid, promote and coordinate agricultural and animal husbandry education, research and its application in practice, and to act as a clearing house of information not only in regard to research but also in regard to agricultural and related matters generally and to do all other things as it may consider necessary, incidental and conducive to the attainment of these objectives, including as a matter of high priority the collection, utilization and conservation of India's rich crop genetic diversity; and

WHEREAS IBPGR is an autonomous international scientific organization, created by and operating under the aegis of the Consultative Group on International Agricultural Research (CGIAR), with responsibility (acting in cooperation with the Food and Agriculture Organization of the United Nations (FAO)) to promote and coordinate an international network of genetic resources centres to further the collection, conservation, documentation, evaluation and use of plant germplasm and thereby contribute to raising the standard of living and welfare of people throughout the world; and

WHEREAS both ICAR and IBPGR, recognizing that they have common objectives in connection with many different facets of plant genetic resources activities, have determined that the interests of each of them will be advanced by intensified collaboration between them;

NOW THEREFORE ICAR and IBPGR have decided to enter into this Memorandum of Understanding in order to promote such intensified collaboration in a manner set forth herein.

Article 1

Collaborative Programmes

(a) The parties hereto will develop a series of Collaborative Programmes each of which will be in effect for a period of (two) years unless, in the case of any particular Collaborative Programme, both parties agree upon a Programme of longer or shorter duration.

(b) Each Collaborative Programme (CP) will consist of a set of specific projects or activities on which both parties agree to collaborate during the life of the CP. In the case of each such project or activity, the Programme will specify the operating and financial responsibilities to be undertaken by ICAR or by other Indian entities under the aegis of ICAR and the assistance to be provided by IBPGR, whether in the form of technical assistance, financial assistance or equipment. The IBPGR's responsibility for supporting each such project or activity will be limited to the estimated cost of its contribution thereto as set forth in the CP.

(c) Specific projects or activities to be included within the CP may include research projects; training programmes, within India or abroad, for Indian Scientists or Technicians; collecting expeditions, particularly for crops within the South/Southeast Asia region; the development, improvement or expansion of germplasm conservation facilities within India; characterization, evaluation and/or documentation of germplasm held within India; and any other type of specific project or activity which the parties agree is of high priority to the achievement of their common objectives.

(d) The person or persons responsible for each specific project or activity included within a CP will be identified and, to the extent feasible, so will other persons who are expected to play significant roles in implementing the project or activity.

(e) Provision will be made in connection with each Project or activity included within a CP for periodic progress reports and a completion report to be submitted to both ICAR and IBPGR.

Article 2

Development, Approval, Review and Amendment of Collaborative Programmes

(a) The parties envisage that the following steps will be taken in connection with the development of each CP:

(i) After appropriate consultation with ICAR, IBPGR will determine and advise ICAR of the ceiling amount of finance which it is able and willing to devote to the CP under consideration.

(ii) ICAR will then prepare a set of specific projects or activities which it proposes should be included within the CP and the contribution towards each which it proposes should be made by IBPGR, the aggregate of such contributions to be within the ceiling amount determined by IBPGR pursuant to sub paragraph (i).

(iii) Thereafter, representatives of ICAR and IBPGR will meet, alternatively in New Delhi and Rome, and will seek to develop an agreed CP.

(iv) The CP as so agreed will then be submitted for approval to the IBPGR Board of Trustees or Executive Committee, as the IBPGR may determine and will similarly be submitted for approval to the Council of ICAR or such other governing entity of ICAR as its Council may designate. The CP will become effective when so approved by both parties.

(b) Whenever the Director-General of ICAR, the Director of IBPGR or the IBPGR Field Officer for South and Southeast Asia considers it necessary or advisable, appropriate representatives of the two parties will meet in New Delhi or Rome as the parties may agree, to discuss whatever issues of importance to the success of the CP either party may wish to present for consideration. The parties envisage that at least one such meeting will be held during the life of each CP and another in connection with the development of the next CP.

(c) Either party may at any time propose an amendment either to a current CP or, if necessary, to this Memorandum of Understanding. Any such amendment will become effective if and when approved by both parties pursuant to the same procedures required for the initial approval of the CP or of this Memorandum, as the case may be.

Article 3

General Guidelines for Collaborative Programmes

(a) IBPGR will be expected to finance the foreign exchange costs of specific projects or activities included in agreed CPs, up to the amount of its estimated contribution to the project or activity as set forth in the CP pursuant to Article 1(b) of this Memorandum. ICAR will be expected to finance, or arrange for the financing of, foreign exchange costs in excess of the amount agreed to be contributed by the IBPGR and all local currency costs.

(b) ICAR will be responsible for any necessary clearence and release of equipment and/or materials imported into India in connection with the implementation of any project or activity included within a CP and any import duty or other charges will be borne by ICAR or the Government of India.

(c) All projects and activities included within a CP will be implemented in a manner consistent with the basic principles adopted by IBPGR and by ICAR for the conduct of all their programmes, including in particular the free provision of samples of germplasm held within India by or under the supervision of ICAR or of the National Bureau of Plant Genetic Resources (NBPGR), to any plant breeder, other scientist or genetic resource centre within the global scientific community which requests such samples for a serious scientific purpose.

(d) ICAR will seek to ensure that all germplasm collected and/or conserved by it pursuent to projects or activities included within a CP are effectively characterized, evaluated and documented and that full information concerning such germplasm is made available to scientists and genetic resources centres within the global scientific community seeking such information for a serious scientific purpose.

(e) ICAR will also seek to ensure that conservation facilities supported by the IBPGR pursuant to a CP, or which are responsible for conserving germplasm collected pursuant to a CP, conduct their conservation, regeneration, documentation and other activities in accordance with the general standards approved by the IBPGR for the operation of such facilities.

Article 4

(a) The parties hereto agree to cooperate together on matters in addition to those included within CPs whenever such cooperation is requested by either party and is agreed to by both parties as designed to advance their common objectives. In particular, ICAR will give favourable consideration, to the extent it considers feasible, to any request from IBPGR that an appropriate Indian entity maintain a duplicate collection of genetic resources held in an IBPGR-designated base collection outside of India.

(b) Upon request by ICAR, IBPGR will seek to assist any appropriate Indian genebank or research institution under the aegis of ICAR in obtaining plant genetic materials held outside of India by a genebank within the IBPGR's global network.

(c) IBPGR's Field Officer for South and Southeast Asia will be instructed to make his services available, to the greatest extent feasible, and if possible without cost, both to ICAR and to other relevant Indian institutions, whether or not under the aegis of ICAR, to help promote any plant genetic resource activity conducted by ICAR or by such other Indian institution which he believes to be important to the fulfilment of IBPGR's responsibilities.

Article 5

Effective Date; Termination

This Memorandum of Understanding will take effect from the date of its signature and will remain effective until either ICAR or IBPGR serves notice in writing on the other of the intention to terminate it, in which event this Memorandum of Understanding shall stand terminated at the end of one calendar month from the date of issue of such notice.

The termination of this Memorandum of Understanding will not affect the validity or duration of specific programmes, projects or activities being undertaken hereunder, unless otherwise mutually agreed by the parties hereto.

In witness whereof the undersigned being duly authorized by their respective organizations have signed this Memorandum of Understanding and attached thereto their seals.

Done at _____, on the _____ day of _____, 1987, in two originals, one in Hindi and the other in English, both texts being equally authentic except that, in cases of any difference in interpretation, the English text shall prevail.

(N.S. RANDHAWA)
Director-General, ICAR
For the Indian Council of
Agricultural Research
New Delhi, India

(J.T. WILLIAMS)
Director, IBPGR
For the International Board for
Plant Genetic Resources
c/o FAO
Rome, Italy

International Board for Plant Genetic Resources
Crop Genetic Resources Centre (IBPGR)
Plant Production and Protection Division
Food and Agriculture Organization of the United Nations
Via delle Terme di Caracalla 00100 Rome Italy
Cables: Foodagri Rome Telex: 610181 FAO I Telephone: 57971

PR 3/11 IBPGR - Storage (seed)

18 MAR 1987

Dear Dr. Paroda,

The International Board for Plant Genetic Resources (IBPGR) has developed a global network of crop germplasm collections. Its strategy with respect to conservation is to designate, for each major crop, one or more centres to accept responsibility for holding base collections under suitable storage conditions to ensure their longevity.

The IBPGR recently reviewed its global network of institutes to hold base collections. The IBPGR invites NBPGR, India to accept the responsibility for maintaining Asian or Global collections of the following genera or species:

Genera or species	Geographic responsibility	Institute for duplication
Vigna mungo	Global	-
Vigna umbellata	Global	-
Capsicum	Asian	CATIE, Costa Rica
Raphanus	Global	-
Brassica campestris (oil seed)	Asian	PGR, Ottawa, Canada
Brassica juncea (oil seed)	Asian	PGR, Ottawa, Canada
Benincasa spp.	Global	IPB, Los Banos, Philippines
Luffa spp.	Global	IPB, Los Banos, Philippines
Momordica spp.	Global	IPB, Los Banos Philippines
Trichosanthes spp.	Global	IPB, Los Banos
Lagenaria siceraria	Global	IPB, Los Banos Philippines
Okra	Asian	NSSL, Ft Collins
Cajanus cajan	Global	-

If you accept this invitation the commitments required by the IBPGR are:

a) that the collection will continue to receive adequate operating funds and personnel and that if, at some future time, this is not possible FAO/IBPGR will be notified promptly;

.../..

Dr. K.S. Paroda
Director
NBPGR
IARI Campus
New Delhi 110012
India

Info cc:
Dr. B.P. Chopra, India
Dr. H. Shands, USDA, USA
Dr. B. Fraleigh, Ottawa, Canada
Dr. H. Heinze, CATIE, Costa Rica
Dr. R.V. Valmayor, Philippines

that if the material stored is not available from an active collection, it will be made freely available from the base collection to any professionally qualified institution or individual seriously interested in using it;

c) authorized representatives of the IBPGR will be given full access to the collection and data at all reasonable times;

d) [illegible] will be made to duplicate the material for safety;

e) the base storage seeds will be dried to [illegible] moisture content, packaged and stored at temperatures lower than -5°C (and preferably between -10 and -18°C) with a viability monitoring regime as [illegible] by the Plant Genetic Resources Newsletter 41: 3-[illegible];

f) a suitable method of regeneration will be used to reconstitute the samples when seed viability begins to decline or quantity of seed is reduced to a critical level.

If you are in agreement with this proposal, please sign and return the attached copy of this letter to indicate your acceptance.

Thank you for your cooperation with the IBPGR programme.

Yours sincerely,

J.T. Williams
Director

Agreed: _____

Date: _____

Best Available Document

Annex M

PROJECT AUTHORIZATION

Name of Country: INDIA

Name of Project: Plant Genetic Resources

Number of Project: 386 0513

Pursuant to Section 103 of the Foreign Assistance Act of 1961, as amended, I hereby authorize the Plant Genetic Resource Project for India involving planned obligations of not to exceed $12.5 million in grant funds over a seven year period from the date of obligation, subject to the availability of funds in accordance with the A.I.D. OYB/Allotment process to help in financing foreign exchange and local currency costs for the project.

The Project will provide technical and financial support to the Indian National Bureau of Plant Genetic Resources and cooperating institutions to support the collection, preservation, evaluation and exchange of India's plant genetic resources. The project will also support collaborative germplasm collection and research between Indian and US scientists.

The Project Agreement which may be negotiated and executed by the officers to whom such authority is delegated in accordance with A.I.D.

regulations and delegations of authority shall be subject to the following essential terms and covenants and major conditions, together with such other terms and conditions as A.I.D. may deem appropriate.

A. Source and Origin of Goods and Services

Goods and services financed by A.I.D. under the project, except for ocean shipping, shall have their source and origin in the United States or in India, except as A.I.D. may otherwise agree in writing. Ocean shipping financed by A.I.D. under the project shall be financed only on flag vessels of the United States, except as A.I.D. may otherwise agree in writing.

B. Conditions Precedent to Disbursement

(1) Disbursements: Prior to any disbursement under the Grant for any specific activity specified in the mutually approved implementation plan or to the issuance by A.I.D. of documentation pursuant to which such disbursements will be made, the Grantee will, except as the parties may otherwise agree in writing, furnish to A.I.D., a detailed operational and financial plan for each activity.

(2) Disbursements for Training: Prior to any disbursements under the Grant for long-term or short-term training for any of the approved training activities under this Project or to the issuance by A.I.D. of documentation pursuant to which such disbursements will be made, the Grantee will furnish to A.I.D. a detailed description of the procedural mechanism to be established and utilized by the Grantee for the selection of individuals for and implementation of training abroad.

C. Special Covenants

(1) NBPGR will establish and staff an administrative support office under the Director NBPGR replete with the professional and support staff required.

(2) The GOI will process exemption certificates and duties for equipment procured under the project.

(3) The GOI will provide the site for the NBPGR headquarter facilities.

(4) The GOI will process nomionations of project funded nominations of project funded participants for overseas training and to attend international meetings.

(5) Participants trained under the project will continue to work in the services of the Grantee on appropriate project related activities for a period of time designated by the GOI in its standard requirements for persons receiving training.

_____

Richard N. Blue

Director

USAID/India

Date_____

Clearances: AD/AG: CHAntholt_____

DPP: CDCrowley_____

RLA: SJSpielman_____

CO: GEidet _____