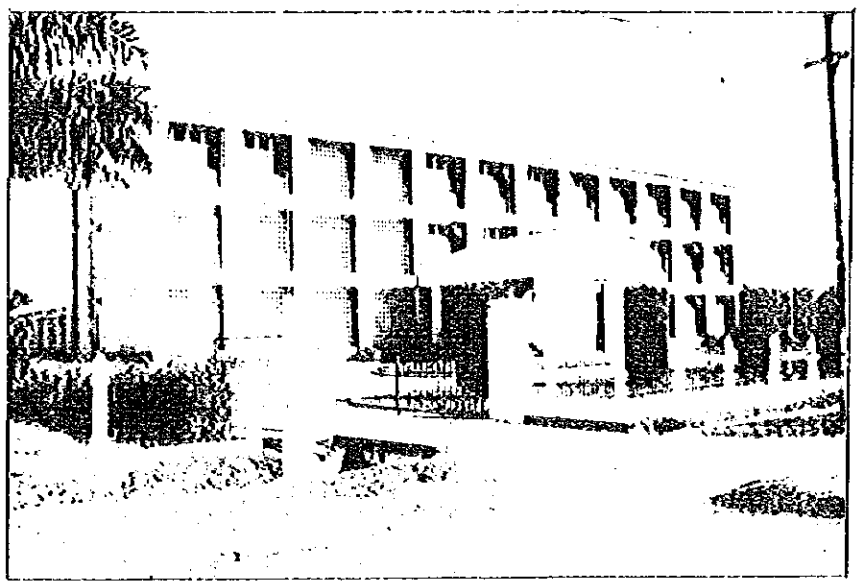
THE GOVERNMENT OF THE UNION OF MYANMAR
MINISTRY OF AGRICCLTURE
MYANMA AGRICULTURE SERVICE
CENTRAL AGRICULTURAL RESEARCH INSTITUTE

THE SEED BANK



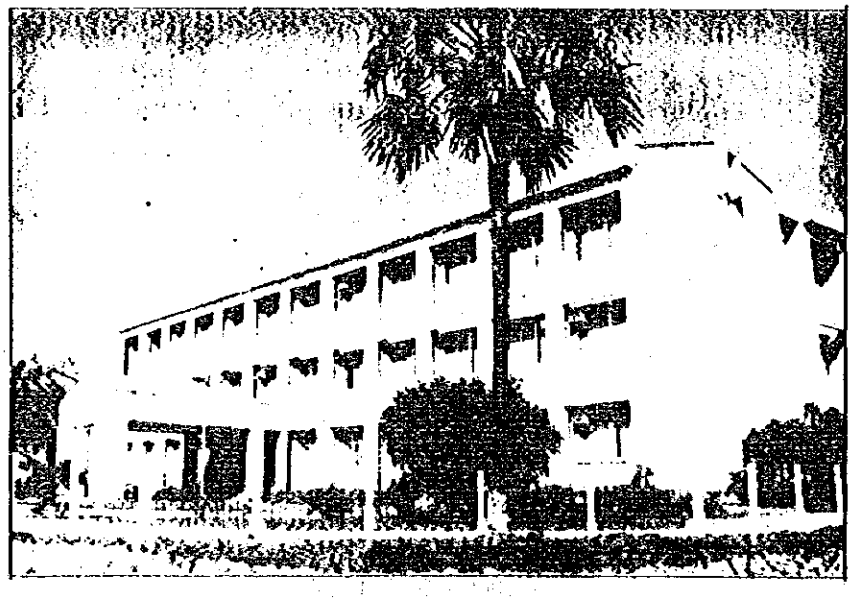
YEZIN, PYINMANA
JANUARY 1996.

Seed Bank in the Union of Myanmar

Introduction

Agriculture sector plays a major role in the economy of the Union of Myanmar. Strenuous efforts have been made to enhance agricultural production for decades. The major components of this program include improved varieties, proven cultivation methods, proper fertilizer application and protection of pests and diseases. High yielding programmes have been implemented for major crops in which high yielding varieties of rice, oilseed crops, cereal crops, pulses etc. are replacing the traditional varieties resulting in extinction of some genetic resources. Genetic diversity is the foundation of all plant breeding programs. New genetic resources are constantly needed to meet the ever increasing demand for food to improve crop quality and to stabilize crop production.

It is well known that various crop species such as rice, sesame and pulses have wide genetic diversites in Myanmar. This indicates that the country abounds invaluable genetic resources with a wide range of diversities.



The Myanmar Seedbank

Preservation of genetic resources is important because they provide gene base indispensable for the evolution of improved varieties. Normally genetic crop species were maintained and preserved through reproduction in the fields. In the recent years, however, the situation has become more urgent because there is a rapid increase in the number of genetic crop species to be preserved. It is therefore necessary to establish a system to ensure stable and labour - saving preservation of genetic resources. In other words, the preservation method needs to be changed from labourious and often erroneous "line reproduction" to "facility preservation" or Seed Bank storage.

The main objectives of Seed Bank at CARI are as follows:

1. To act as a center for international exchange of genetic resources in order to manipulate crop varieties adaptable to the agro-economic nature in Myanmar

2. To categorize and evaluate collected indigenous and exotic genetic materials.

3. To explore, collect and evaluate primitive and wild forms of various crop germplasms.

4. To find out suitable conservation methods for different germplasm materials without damaging their viability and original genetic constituent.

5. To preserve crop genetic resources safely for short and medium-terms.

6. To provide genetic materials for crop breeders in the crop improvement programmes.

7. To promote effective utilization of genetic resources through systematic data processing and recording.

A brief information on Seed Bank Construction

a.	Construction works initiated on	2-2-88	
b.	Construction works completed on	18-2-90	
c.	Handed over to MAS on	22-2-90	
d.	Financial grant from JICA (1613 Million Yen)	= 70.97	Million Ks
e.	Contribution from GOM	42.45	Million Ks
	Total investment cost	113.42	Million Ks

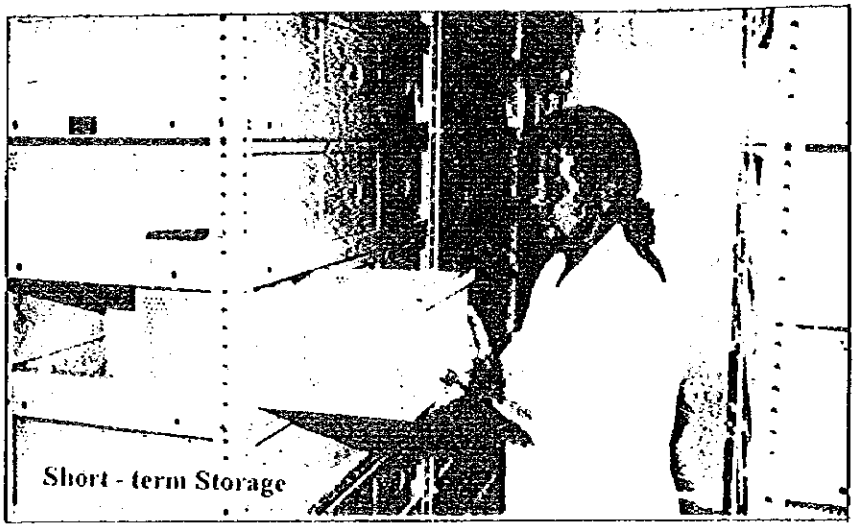
Buildings constructed composed of:

1. Administrative and Training
2. Research Laboratories
   a. Introduction laboratory
   b. Evaluation laboratory
   c. Preservation laboratory
3. Information Section Building
4. Seed Bank Cold Storage
5. Divisions' Annex
6. Isolation Laboratory and Glass houses
7. Garage and workshop
8. Stand-by Generator and Sub-Station house
9. Residential Quarters for Visiting technicians and experts.

Germplasm preservation facilities at the Seed Bank

1. **Short-Term Storage**

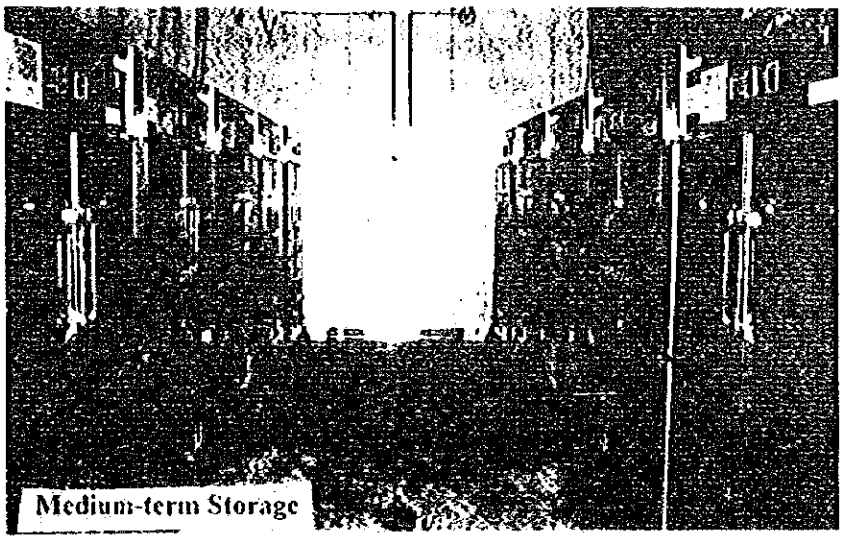
Temperature	**15° C**	
Relative Humidity	**35-38**	**%**
Conservation life	**3-5**	**Years**
Storage capacity	**43200**	**accessions**



Short - term Storage

2. **Medium - Term Storage**

Temperature	**-5° C**	
Conservation life	**20-30**	**Years**
Storage Capacity	**20000**	**Accessions**



Medium-term Storage

3. General standards for germplasm storage

seed moisture content	3-7	%
minimum germination	90	%

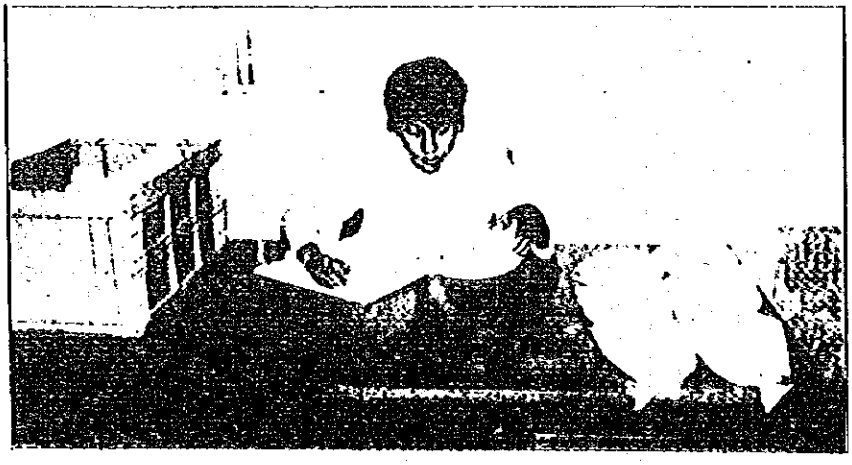
4. Required quantity of seed for safe storage

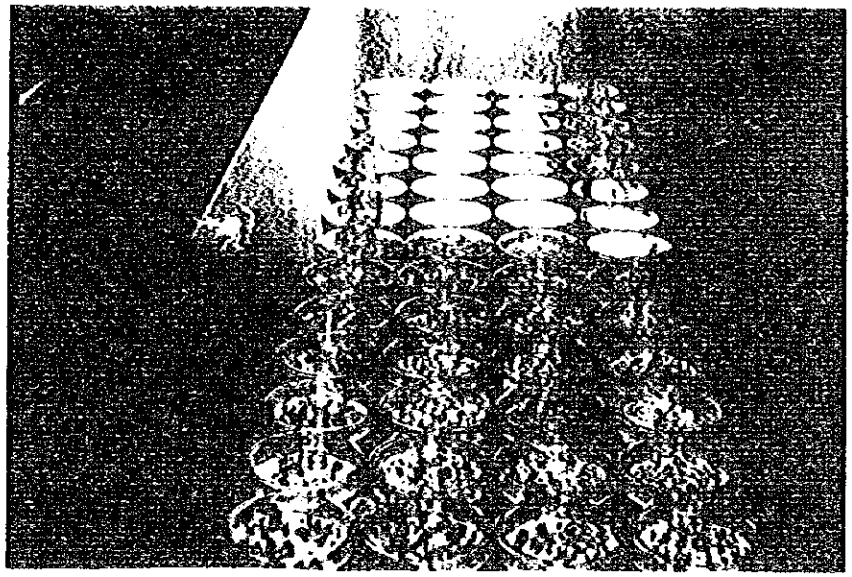
Rice - short - term	300	g
medium - term	40	g
Other crop's short - term	300-350	g
medium - term	60	g

Current Functions of the Seed Bank

1. The Introduction Laboratory

All seed samples received or collected are primarily compiled at the Introduction Laboratory where a temporary accession number is given and finally registered after a check for duplication is made. If the seeds are apparently insuffecient for storage, they are dispatched to the Preservation Laboratory for regeneration. Similarly, samples with incomplete data are sent to the Evaluation Laboratory for rejuvenation and characterization. Diseased and insect - infested seed samples are sent to the Isolation Laboratory for an urgent treatment in order to prevent from the spread. Samples that are finally accepted by the Introduction Laboratory are then processed for the assessment of initial moisture content and germination. Having achieved all the initial assessments, seed samples are sent to the Seed Bank Center for further processing. Seeds with less than 85% germination are, however, sent to the Preservation Laboratory for regeneration.

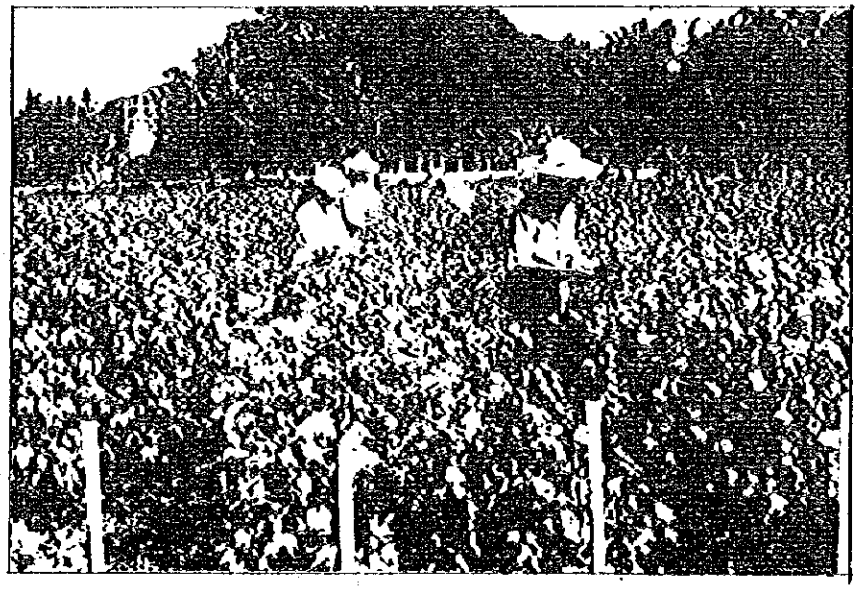




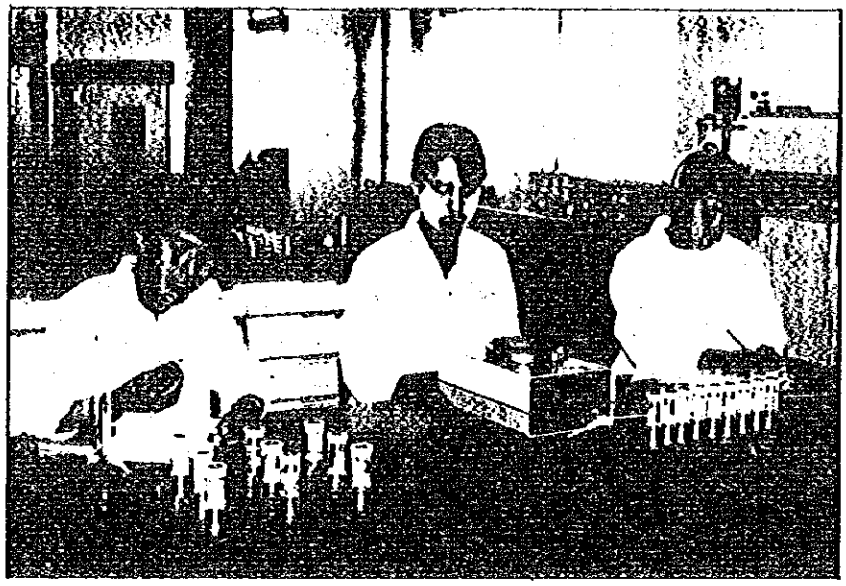
Initial Germination Testing

2. The Evaluation Laboratory

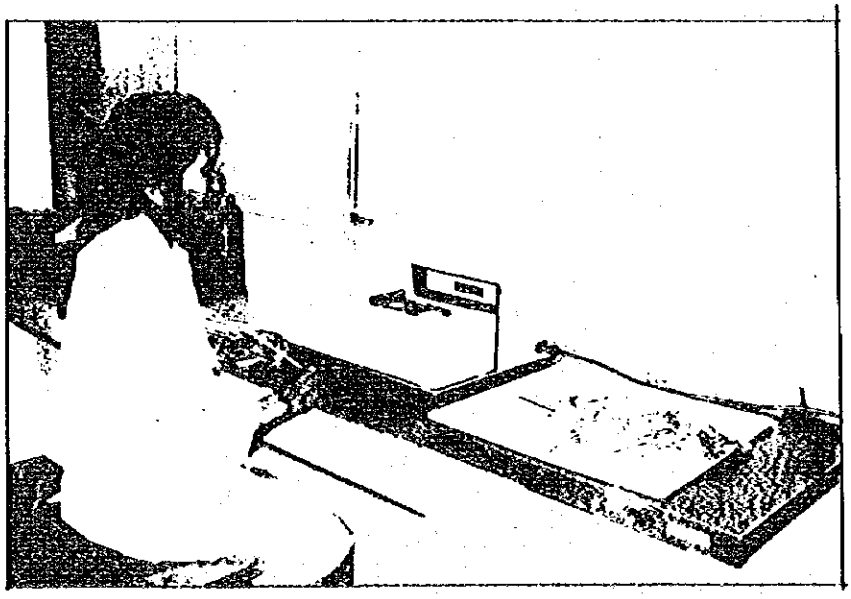
Staff members of the Evaluation Laboratory are responsible for rejuvenation, characterization and evaluation of the germplasms. In carrying out this task, priority is given to the following:



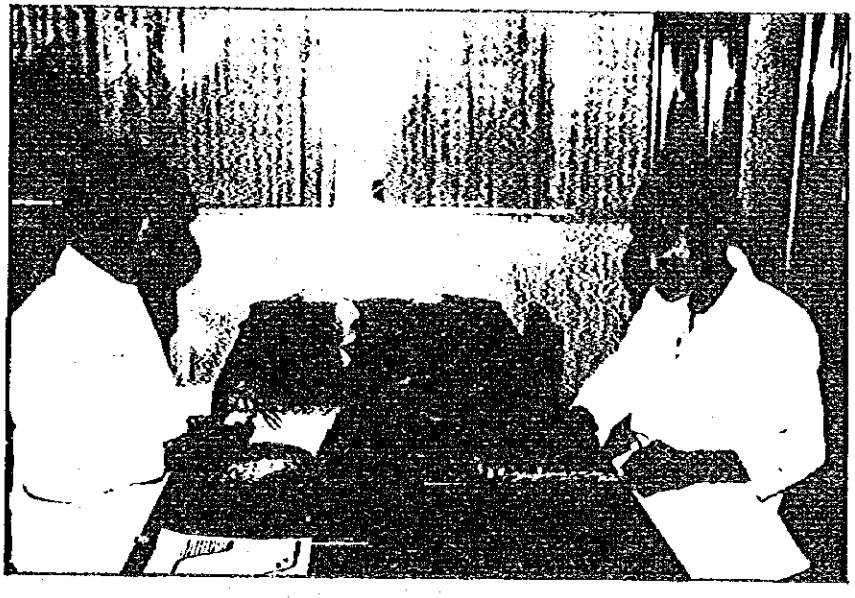
Characterization of Seed Accession



Evaluation of Seed Accession



Evaluation of Seed Accession



Characterization of Seed Accession

(a) Acquisition of complete and reliable data on the morphological and genetic characteristics of germplasms of different crop species collected.

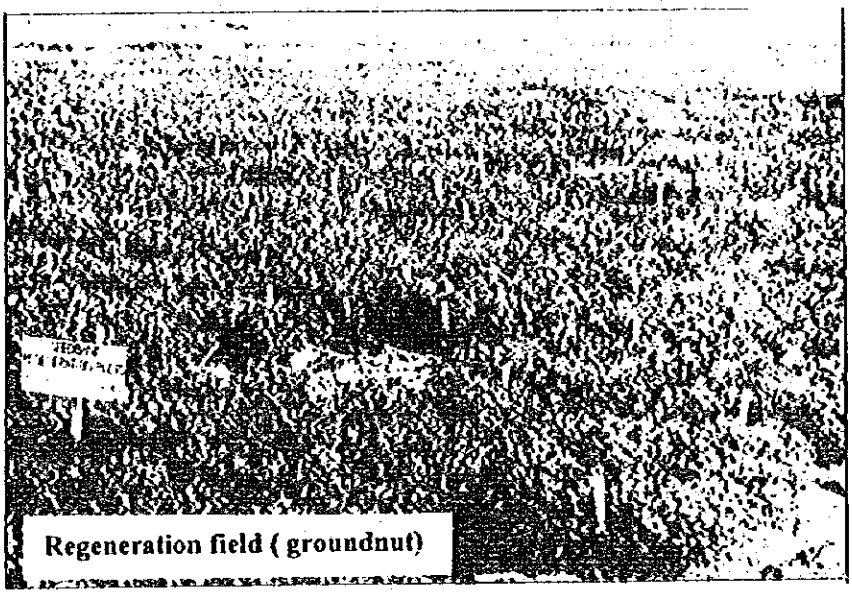
(b) Identification of resistance among the crop germplasms collections to insects and diseases in cooperation with the Pathology and Entomology Divisions of CARI.

(c) Dissemination of summarized information on crop germplasm collections to crop breeders in the crop improvement program through the Information Center.

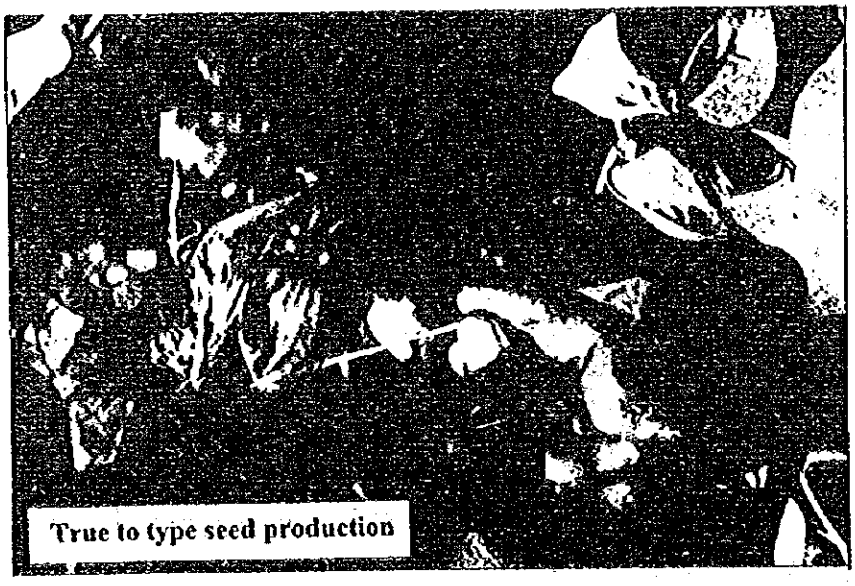
The samples accepted at the Evaluation Laboratory are planted at different suitable environments and details of evaluated data are recorded by referring to crop descriptors prescribed by the International Board for Plant Genetic Resources (IBPGR). Harvested seeds of crop germplasms have to pass through a sequential process such as moisture reduction, cleaning, detection of diseases and insects and other laboratory assessments. The recorded data are eventually calculated and documented and the seeds are dispatched to the Seed Bank Center for cold storage.

3. The Preservation Laboratory

The Preservation Laboratory activities involve regeneration of accessions with insufficient quantity of seed and those with low viability to obtain fresh samples. At present, the staff members from the Evaluation Laboratory are concurrently taking care of the Preservation Laboratory at the CARI Seed Bank.

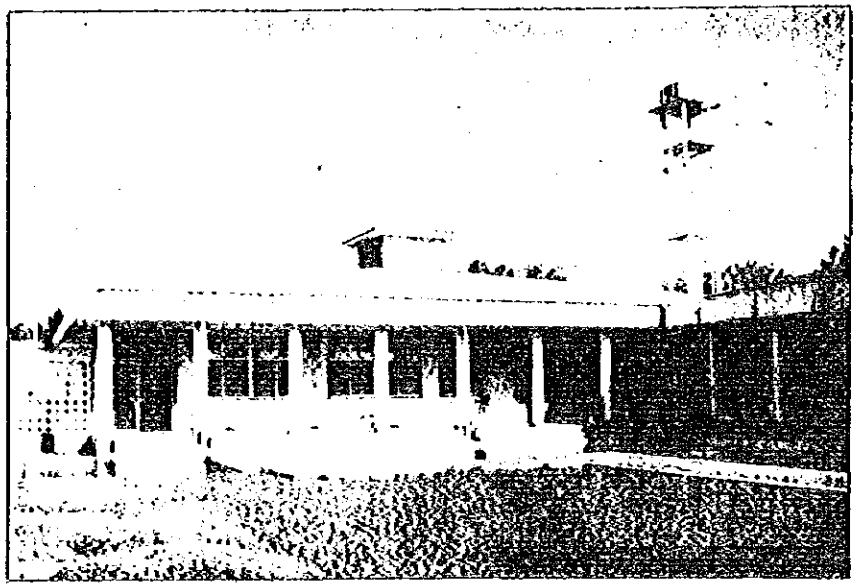


Regeneration field (groundnut)



True to type seed production

4. The Seed Bank Center



Seed bank Cold Storage Building

The Seed Bank Center is the building where cold storage facilities are installed. The staffs of this laboratory are mainly concerned with the final processing of the seed samples prior to entering the cold storage. The following requirements have to be met before entering germplasm accessions for storage.

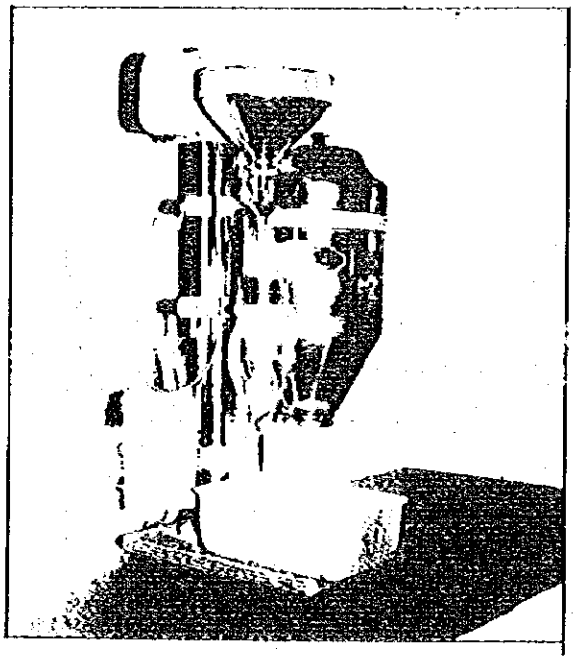
a. The accessions ready for storage must have complete characterization and evaluation data.

b. There must be sufficient quantity of seeds for every accession ready for storage. Homogeneous crop species require 3000-4000 seeds whereas heterogeneous crop species require 8000-12000 seeds.

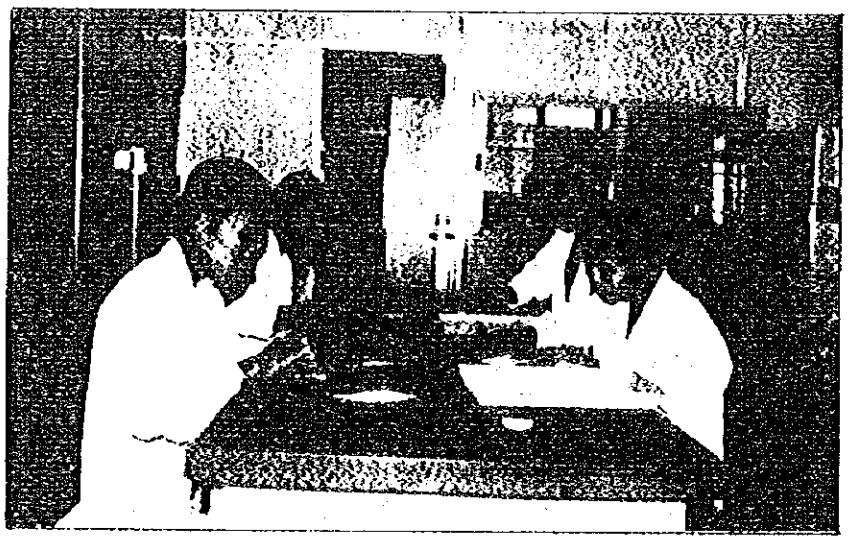
c. Seeds of the accessions must be of true-to-type and must be healthy.

d. Seed moisture content must not exceed 3-7% depending on the type of crop species conserved.

e. The minimum germination of the seeds is 90%.



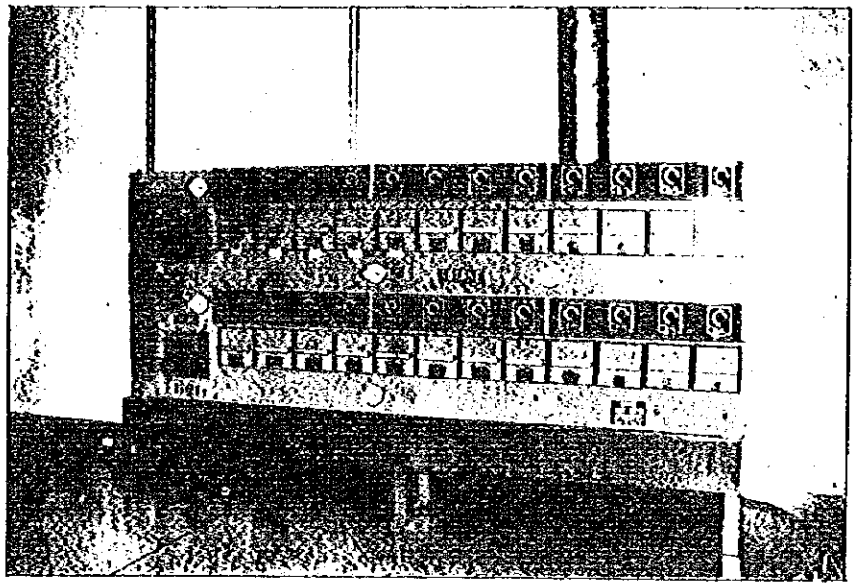
Seed Cleaning and Sorting



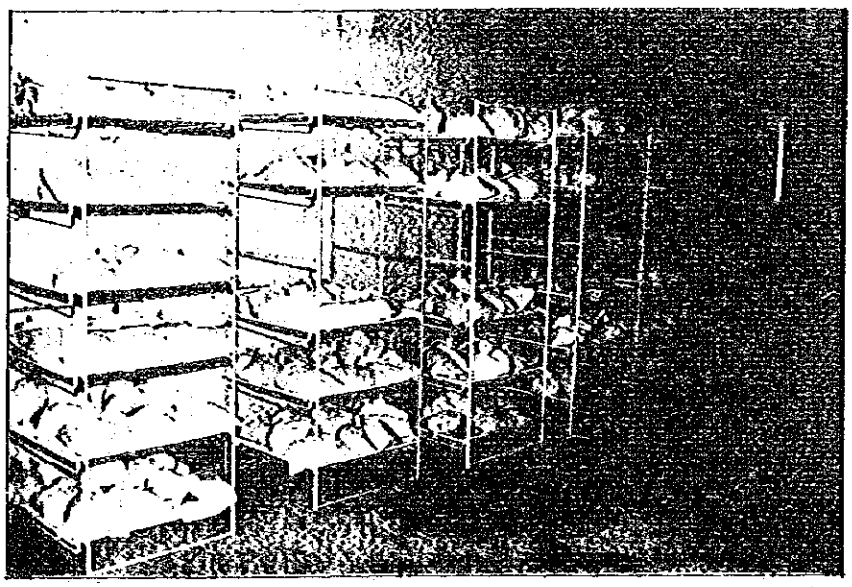
Seed Cleaning

Seed cleaning is done by hand or by using seed sorter in order to achieve required physical purity of the seeds. Seed samples with high initial moisture content are primarily dried in dryers at 30° C for 3-4 days. Seed samples with medium initial moisture content are reduced to 3-7% by using low temperature incubators, desiccators and dehumidifiers. The required moisture level for storage is confirmed by the use of moisture meter.

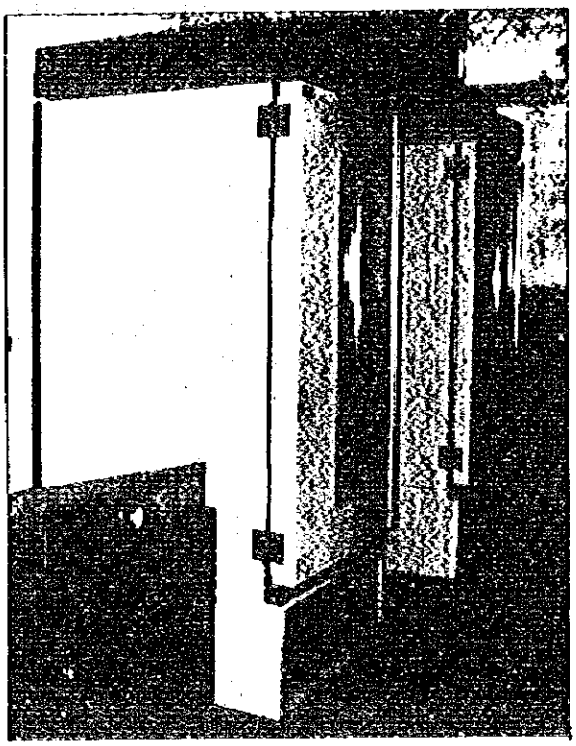
Another task following the moisture reduction is to check whether or not the seeds have lost their viability.



Seed drying

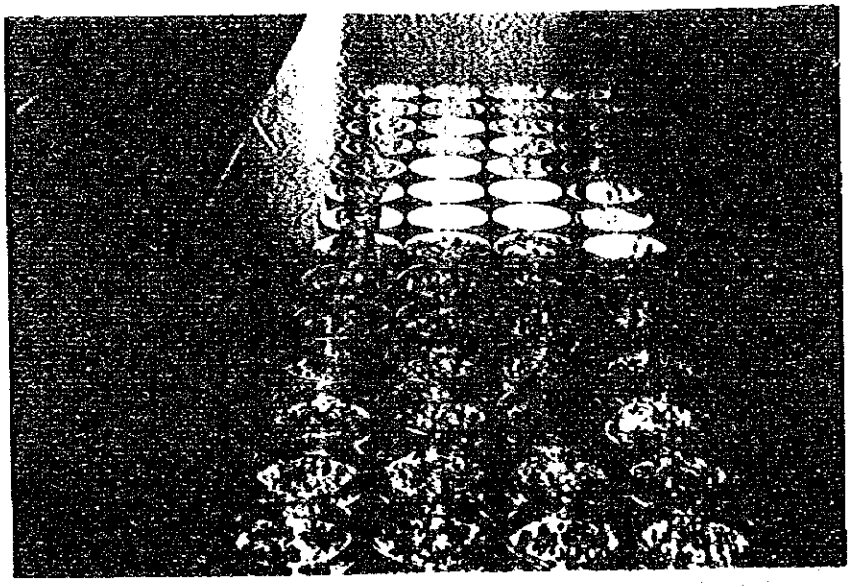


Seed drying

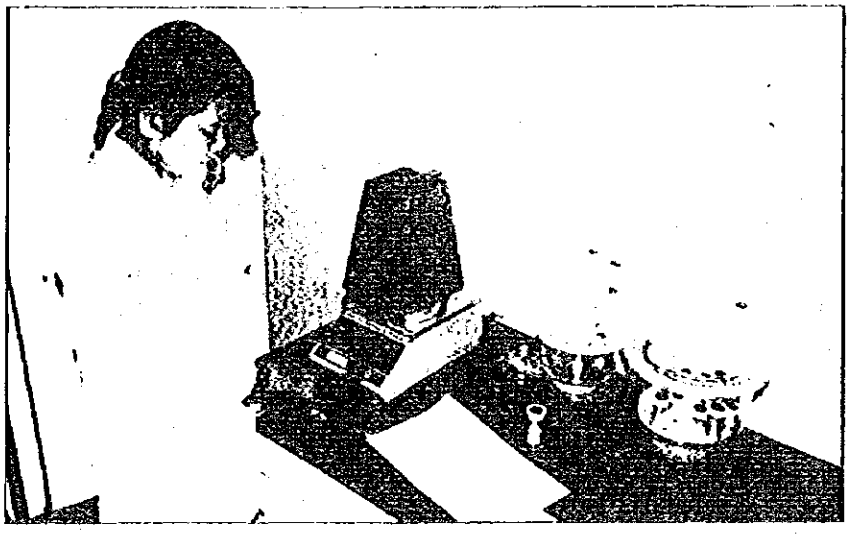


Seed drying

Only seed samples with over 90 percent germination are processed for packaging and storage in cold rooms, whereas those having less than 90% germination are returned to the Preservation Laboratory for regeneration.



Final Testing of Seed Viability



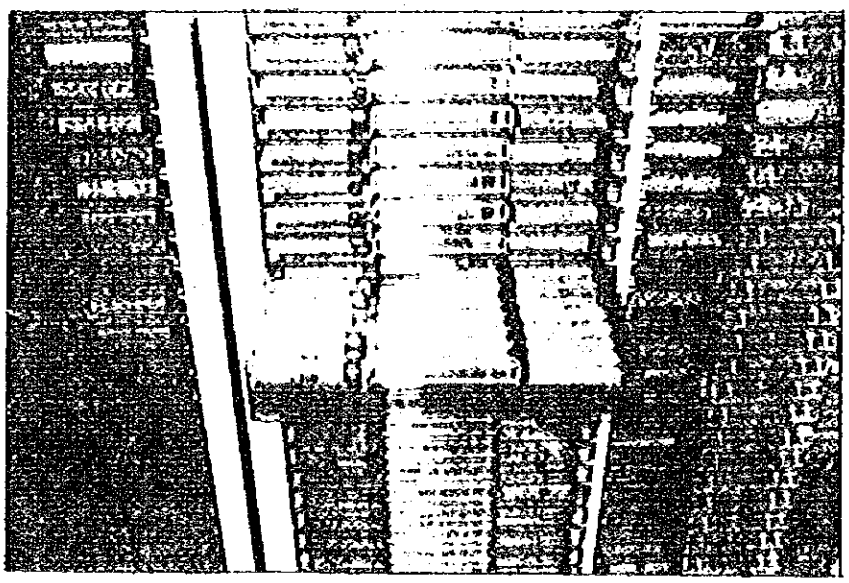
Seed moisture Testing

The packaging methods of seed samples differ depending on storage condition. In the short-term storage, seed samples are placed in capped polyethylene bottles on racks at 15° C and 35-38 % humidity. In the medium - term storage, seed samples are stored in vacuum - packed aluminium foils in cold cabinets kept at -5° C.

Seed Packaging for Cold Storage

5. Seed Specimen Room

As the information related to each and every accession stored in the cold room is relayed to the Information Center, the staff in the Seed Bank Center Laboratory has to keep every duplicate accession in the specimen tubes in specimen room similar to those kept in the cold storage. These specimens are particularly kept for comparison of the difference between regenerated accessions and the original ones in case a certain change might occur.



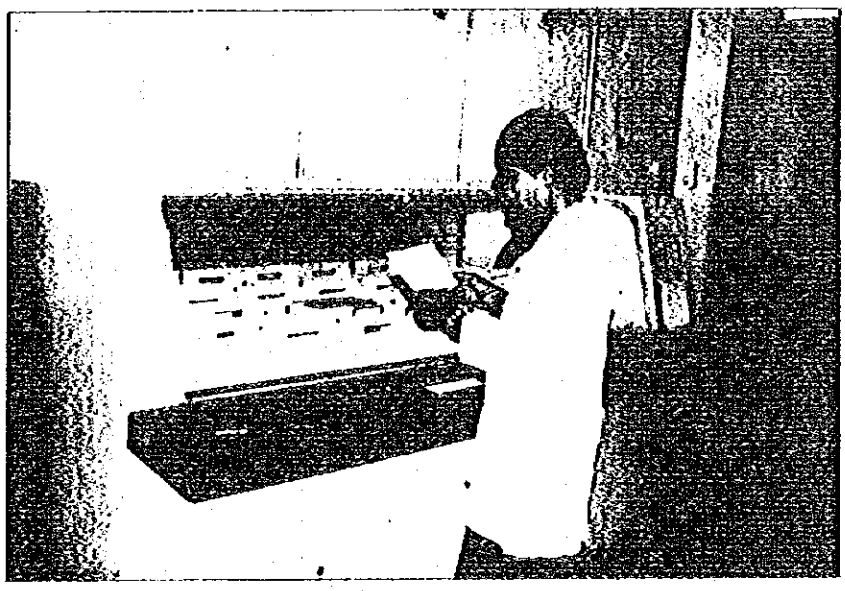
Seed Specimen Tubes

Since viability of the seeds decreases depending on storage life, accessions stored in the short - term storage are to be tested for germination once in every 5 years and for medium - term storage once in every 10 years. Accessions with lower than 90% germination are rejuvenated at the Preservation Laboratory. Drop in the seed quantity of those accessions due to utilization and exchange by the breeders are also rejuvenated.

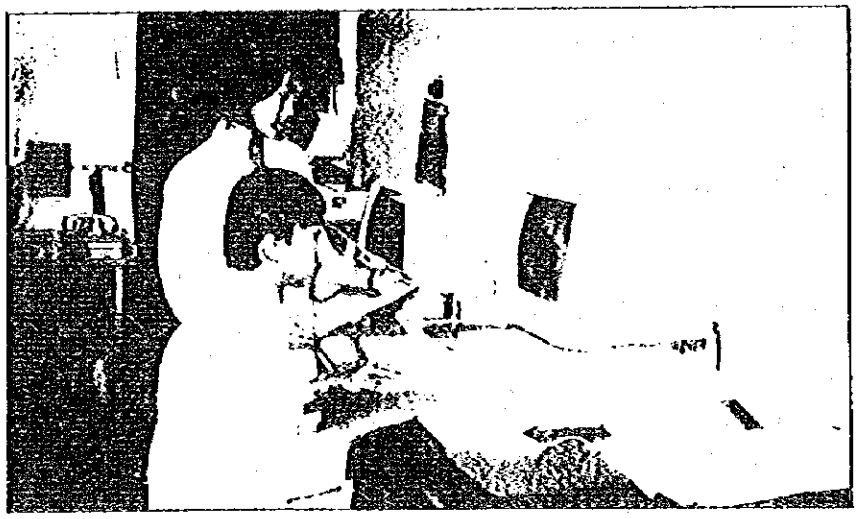
6. The Information Center

All types of information relating to the stored accessions are documented. Data regarding monitoring activities in laboratories and fields are adopted at this center. Data keeping systems are in the form of note books, filing cards and computer files. Basically, three types of data file exist at the Information Center, viz; the passport data file, the management data file and a combined data file of characterization and evaluation.

The passport data file enables the user to detect the entry of germplasms in the gene bank. A general history of an accession is mentioned in the passport data file on cards. They are systematically arranged in a movable cabinet. The management data file indicates the regular monitoring intervals of accessions stored in the cold rooms and also pinpoints the balance of seeds. The characterization and evaluation data file is dedicated to support the plant breeders working in the crop improvement programme. It also acts as a liaison for the international exchange of genetic resources and related information on behalf of the entire Gene Bank.



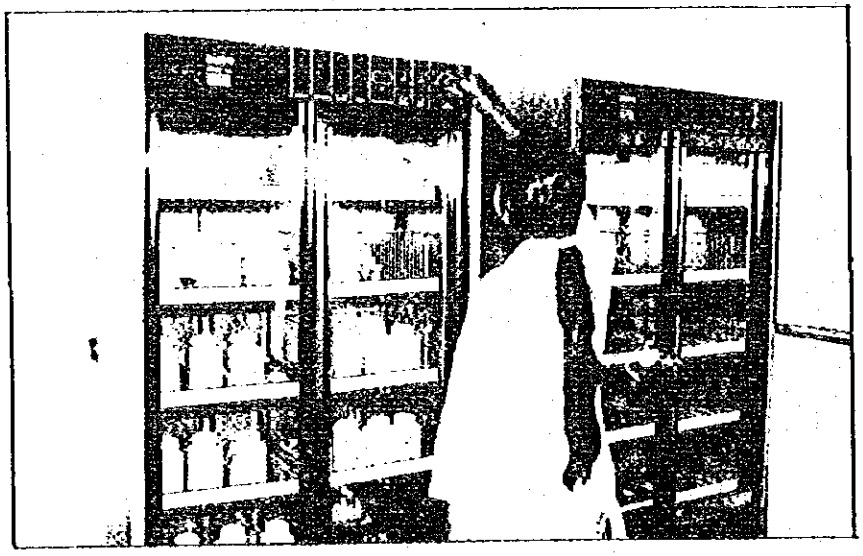
Passport Data File (Card system)



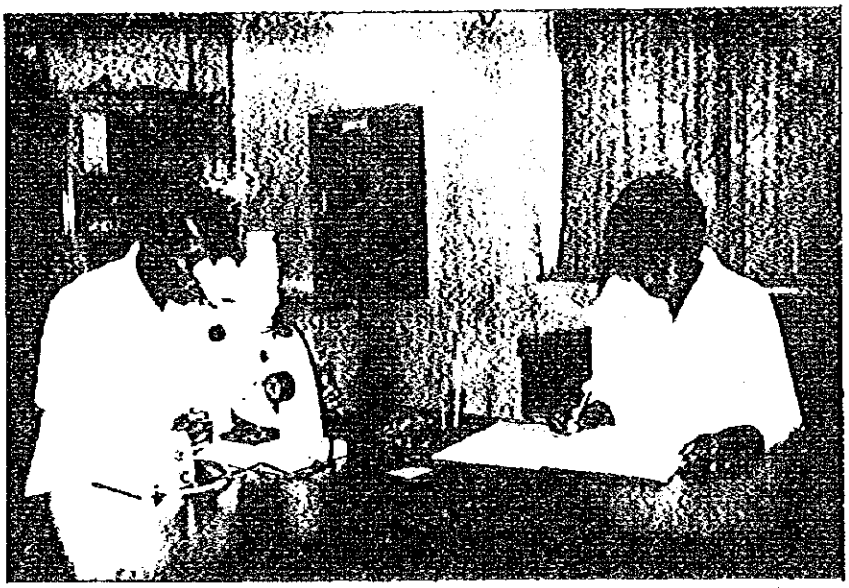
Computerized Data Recording System

7. The Isolation Laboratory

Diseased and insect-infested seed samples and those suspected of infestation are handled by the Isolation Laboratory. To enable diagnosis and to give specific treatments of diseases and insects, the staff at the Isolation Laboratory has to collaborate with the CARI plant protection divisions. Such seed samples are treated and planted in isolation plots to regenerate healthy seeds. The suspected seed samples after proper treatment with chemicals to control pathogens and/or insect pests are passed back to the Laboratory concerned.



Temporary Storage For Isolated Cultivation



Seed Inspection

Fumigation

Isolated Cultivation

Major Advantages of the Seed Bank

(1) Since various crop genetic resources are conserved in the cold rooms under controlled condition without losing their genetic make-up and viability for years, it saves cultivation and Labour costs.

(2) It prevents from mixing and loss of accessions through natural disasters, biotic and abiotic stresses that commonly occur under field condition.

(3) Availability of crop varieties adaptable to Myanmar agro-ecological conditions due to international exchange of genetic resources.

(4) Provide various sources of genetic materials to plant breeders in crop improvement programs.

(5) Promote opportunities of utilizing collected wild species in the development of disease and insect resistant cultivars.

International collaborations

CARI Seed Bank has developed linkages with International Agriculture Research Centers around the world and with International Board for Plant Genetic Resources (IBPGR).since its establishment into fully operational stage in 1990.

(a) Colaboration with CGIAR Crop-Base Institutes.

CARI Seed Bank has collaborated with ICRISAT in 1992 on joint characterization, multiplication and evaluation of 500 groundnut (Arachis) accessions originating in Myanmar and from other similar environments. This has led to identification of a large number of high yielding lines well adapted to local conditions and documentation of the data for further use. This would serve Myanmar groundnut scientists to strengthen their research.

Realising that partial replacement of landraces with improved sorghum and minor millet cultivars would lead to genetic erosion of those crops, ICRISAT in association with CARI Seed Bank has helped launch a collection mission. A total of twenty - two genetic stocks were sent to ICRISAT for further evaluation, characterization and documentation.

Since genetic erosion in wild species is faster than that of cultivated species, collection and conservation of wild rice (Oryza) species was initiated with the assistance from IRRI in 1992. Altogether 116 wild rice species were collected so far and their duplicates were sent to IRRI for effective screening for resistance to pests and diseases.

Myanmar has been actively participating in the International Network for Genetic Evaluation of Rice (INGER) coordinated by IRRI since 1976. "The 17th Advisory Committee Meeting of the International Network of Genetic Evaluation of Rice" was held in Yangon, Myanmar, from Nov. 28 - Dec. 3, 1994, under the joint sponsorship between IRRI and the Government of Myanmar.

(b) Collaboration with IBPGR

IBPGR's office for South Asia in New Delhi, India has helped conduct a one-week in-country training course designed primiarily for the Asian region for Myanmar Seed Bank workers in conservation and management of plant genetic resources in 1992.

Constraints and Future Needs

(1) Trained man-power

Lack of trained man-power has been a major constraint in limiting successful management of the Seed Bank. There is an urgent need in providing specialized in-service orientation programme for numerous seed bank activities such as germplasm collection, conservation, characterization and documentation, quarantine and inspection, and data base management. Regular programmes for short-term training as well as post graduate programme in plant genetic resources are required for generating manpower in this area of specialization.

(2) Machineries and laboratory equipment

The machineries and laboratory equipment which are in need of replacement or repair demand large amount of foreign exchange. This could be achieved with the assistance from international organizations.

(3) Publications

Regular supply of international publications dealing with different facets of genetic resources will play an important role in the dissemination of information to seed bank workers and the effective implementation of the programme.

(4) Technical Cooperation and coordination

The technical cooperation between the MAS staff under the Ministry of Agriculture and the related international or national institutions is essential. National and international meetings, seminar and workshops on plant genetic resources management will help promote collaboration among the scientists concerned.

Conclusion

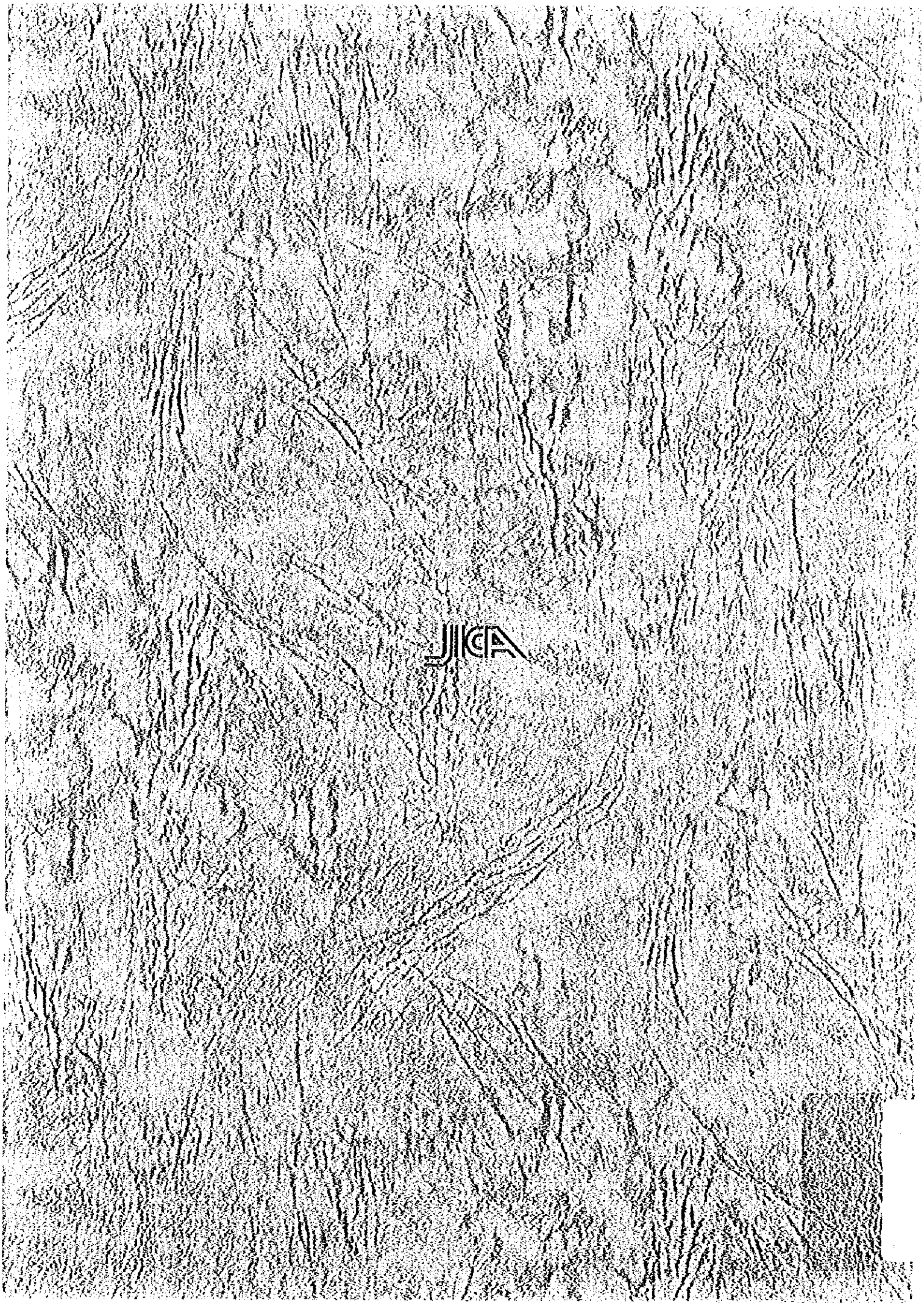
Since its establishment in 1990, the Seed Bank has been in operation under the guide lines given by the Minister of Agriculture and with close supervision and direction of the Managing Director and the General Manager (Research) of MAS. The technical aspects of germplasm resource management are in accordance with the stands formulated by the IBPGR. The development of skilled manpower in specialized areas and cooperation and assistance from other national and international plant genetic resources centers will further enhance the capability of those engaged in the Seed Bank activities.

Staff list of the Seed Bank (by Designation)

Sr. No.	Designation	Employed at present	Additional requirement
1	Project Manager	1	-
2	Assistant Manager	2	2
3	Deputy Supervisor	7	8
4	Assistant Supervisor	1	9
5	Deputy Asst. Supervisor	-	16
6	Typist and Computer Processor	-	1
7	Plumber	1	-
8	Permanent labourer	1	-
	Total	13	36

Collection of genetic resources under short-and medium - term storage at CARI, Yezin, Pyinmana.
(Feb. 1990 to Jan. 1996)

Sr. No.	Crop	Total number of collections	No. of accessional stored	
			short-term	medium-term
1	Rice	4798	2269	1438
2	Wild rice	118	-	92
3	Wheat	1573	1250	1250
4	Corn	340	31	31
5	Sorghum	249	140	25
6	Millet	80	14	-
7	Groundnut	650	5	-
8	Sesame	105	5	-
9	Sunflower	1	1	-
10	Safflower	1	1	-
11	Soybean	2	2	2
12	Pigeon pea	125	4	4
13	Cowpea	92	72	72
14	Mungbean	133	68	64
15	Black gram	91	55	55
16	Chickpea	331	160	160
17	Butter bean	12	2	-
18	Jute	155	-	-
19	Long staple cotton	210	-	-
20	Short staple cotton	108	-	-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