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EX-SITU CONSERVATION OF DESICCATION-TOLERANT SEEDS IN GENEBANK

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The National Bureau of Plant Genetic Resources (NBPGR), New Delhi holds the responsibility to conserve germplasm of agri-horticultural crop plants. The long-term Base collection is maintained in built-in cold store vaults of pre-fabricated polyurethene insulated panels running at –20°C. Over 1,44,100 germplasm accessions are stored as Base Collections in National Genebank. These consist of cereals and pseudo cereals (62,423), millets and minor millets (15,783), oilseeds (20,520), pulses (25,527), fibre crops (3,607), vegetables (7,615), medicinal and aromatic plants (179) and improved/released varieties (888) of various crops.

Key words : Germplasm, conservation, genebank, desiccation tolerent seeds

Vigorous efforts have been made in recent years for *ex-situ* conservation of plant genetic resources through the Indian National Plant Genetic Resources System (IN-PGRS) comprising a network for base collections of germplasm of different crops kept under long term storage and linked with numerous crop specific active collections that are maintained at specified locations. National Bureau of Plant Genetic Resources (NBPGR) is the nodal organization for developing, operating and co-ordinating this system. The National Gene bank (NGB), with facilities for long term storage is an integral part of this system. It has the responsibility to maintain germplasm as a base collection for the nation. It also has an active collaboration with crop based institutes of Consultative Group of International Agricultural Research (CGIAR) and is entrusted with regional and global responsibility for conservation of more than a dozen crops by International Plant Genetic Resources Institute (IPGRI).

The establishment of the National Gene Bank started with the commissioning of the first cold storage module of 100m^3 capacity in 1983, comprising two compartments, one operating at 4°C and other at –10°C. Since then four more modules (two with 100m^3 capacity and two with 176m^3 capacity) maintaining –20°C have been added. The total long term storage capacity for over 2,00,000 seed samples has, thus, been created. Consequent upon the

commissioning of 12 new long term storage modules by 1996, the National Gene Bank will have a capacity for long term storage of over one million accessions of crop germplasm.

ACQUISITON OF GERMPLASM

The Indian National Genebank is a Federal facility and the germplasm stored as the base collection comes under the jurisdiction of Government of India. The responsibility for providing the technical guidance and administrative control are vested with the Director NBPGR. Keeping in view the policy, NGB accepts valuable seed stocks from various national and international sources.

The NGB is linked effectively with 30 ICAR Institutes, National Research Centers, All India Co-ordinated Projects and State Agricultural Universities. These centers are designated as National Active germplasm Sites (NAGS) and are responsible for evaluating and maintaining the active collections of specific crops. NAGS form the major source for supplying germplasm of different crops to NGB for storage as base collections.

NGB also gets germplasm accessions of more than a dozen crops from various countries by virtue of the responsibility entrusted by IPGRI for maintenance of global and regional base collections of these crops. The active collaboration between International Agricultural Research Centers (IARCs) located in India and abroad also, results in considerable exchange of germplasm between NBPGR and ICRISAT (India), IRRI (Philippines), CIMMYT (Mexico) and ICARDA (Syria). The NGB regularly gets accessions of pigeon pea from ICRISAT and lentil from ICARDA for maintaining the duplicate, safety base collections.

The Germplasm Advisory Committees, set up for specific crops or group of crops, advice the NGB regarding improving the capability, efficiency and effectiveness of its services. They suggest countries/regions in the world that need to be explored or approached for introduction of new crops/genetic variability to sustain the national crop improvement programmes. Based on the recommendations, bilateral agreements have resulted in germplasm exchange with over 80 countries (Rana, 1995). These accessions eventually find a place in the NGB through the IN-PGR system.

GUIDELINES FOR SENDING SEEDS TO THE GENEBANK

The NGB accepts germplasm accessions from various sources following the guidelines as mentioned below:

(i) Seeds should be well developed, physiologically matured and free from insects and pests. Undersized, shrivelled and immature seeds should be discarded.

(ii) The harvesting under high moisture conditions should be avoided to ensure disease and pests free seeds. Visual inspection and discarding off-types and discoloured seeds is advisable. Fumigated/treated seeds are not accepted.

(iii) Seeds should be dried soon on harvest, preferably in a room at 22°C temperature and 35% RH.

(iv) Accessions of self-pollinated crops should have at least 3,000 seeds and the cross-polinated twice of that number. Concessions can be made in exceptional cases where seeds are available in limited quantity and for wild relatives.

(v) The germplasm accessions should be packed in good quality paper pouches/muslin cloth bags and wrapped in polythene. Label indicating the unique identification number of the accession should be placed inside and also outside the pouch. The entire seed lot should be packed in either metallic (tin) or cardboard boxes.

(vi) The seed lots should be accompanied by a list of all accessions and must also contain a minimum passport data indicating Name of crop (common, English name); Species/sub species name; Vernacular/Landrace name (if available); Collector No.; Place of collection; National collection number; Population size (No. of seed/weight); Date/year of collection/rejuvenation; Date of flowering; Plant type/habit; Flowering (days/months); Inflorescence type; Fruit characters; Seed characters; Maturity; Morphological marker; data on reaction to diseases/pest/adaptation to stress etc.; and specific local use. In addition, if any detailed evaluation data (based on IPGRI descriptor lists) is available, may also be sent.

(vii) Prior to despatch of the seed material, information including a list of the germplasm, must be sent to the NGB.

Viability testing

The accessions received are subjected to the seed germination test. The ISTA (1976) rules and the recommendations of IPGRI (formerly IBPGR) Advisory Committee are followed to determine the different requirements for light, substrate, temperature, water or any other specific requirement for the different species. The germination test is performed using a minimum of two replicates using 200 seeds (100 seeds per replicate). Generally either rolled towel or filter paper substrates are used. If the accession shows more than 85 per cent viability, it is accepted for further processing. A list of accessions showing less viability is prepared and sent back to the source of supply for sending these accessions again from fresh harvest.

Seed drying and packaging

The accessions qualified for long-term storage are transferred into muslin cloth bags and kept in a seed drying cabinet, maintaining 15°C temperature and 15% RH. The seeds are allowed to equilibrate and within a period of fortnight (depending upon species and initial moisture content) attain a moisture content in the range of 3-7%. However, moisture content is determined following IPGRI guidelines either by the 'low constant temperature oven method' or by 'high constant temperature oven method' to ensure quality control. After equilibration, each accession is packed in a tri-layered aluminium foil pouch and hermetically sealed. Each pouch is labelled indicating the crop, genus, species, accession number, identification number, germination percentage, moisture per cent, storage date and source. They are then arranged serially in plastic baskets and placed in the cold storage modules, maintained at -20° C. The location indicating the module, rack, shelf and basket numbers are provided to the gene bank data base.

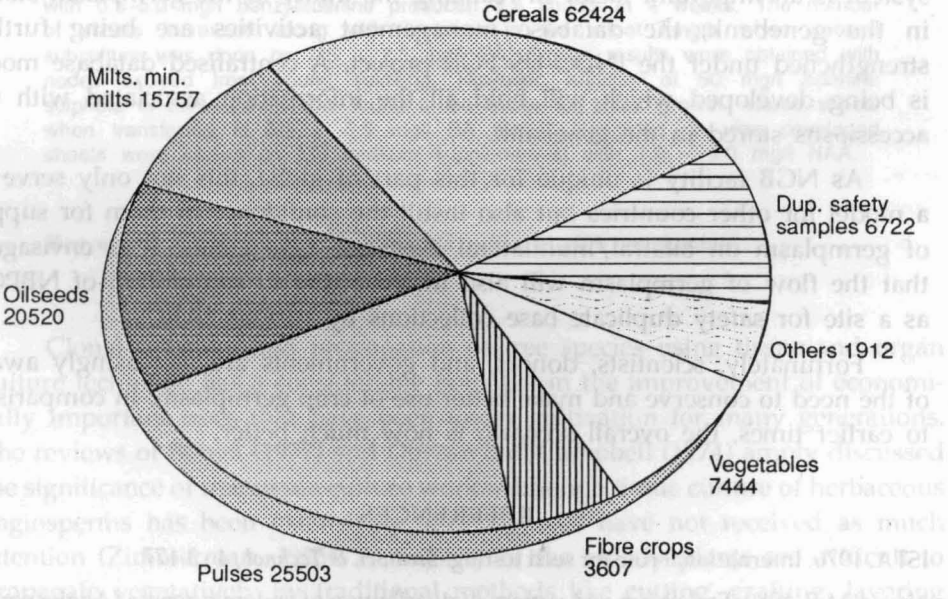
GERMPLASM HOLDINGS IN THE GENEBANK

Figure 1 shows the total proportional picture of base collections maintained in NGB. Presently (as on March 31, 1995), the NGB has a total of 1,43,889 accessions as base collections. It includes the major groups of crops *viz.*, -cereals

Table 1. Base collections in National Genebank kept in long term storage in seed repository maintained at -20°C (As on 31st March, 1995)

Crop Groups	No. of Accessions
Cereals	61,863
Pseudo-cereals	560
Millets & minor millets	15,783
Oilseeds	20,520
Pulses	25,527
Fibre crops	3,607
Vegetables	7,615
Med. & A.P.	179
Spices	67
Others	778
Released varieties	888
Duplicate safety samples	6,722
Total	1,44,109

(61,863), pseudo-cereals (560), millets and minor millets (15,757), oilseeds (20,520), pulses (25,503), fibre crops (3,607), vegetables (7,444), spices and condiments (67) medicinal & aromatic plants (179) and other miscellaneous crops (778). Apart from the released improved varieties (888), safety duplicate samples of pigeon pea (1702) from ICRISAT and lentil (5020) from (ICARDA) (Fig.1) are also conserved in the genebank. The released improved varieties of various crop groups which have been stored in NGB are - cereals (275), millets and minor millets (9131), fibre crops (63), pulses (133) oilseeds (163), narcotics (66), vegetables (55) and one variety each of forage crops (barseem) and medicinal crop (opium). Further details of total accessions of various crops and their sources are given in Table 1. On an average 15,000 - 20,000 accessions of various crops are added every year to the existing collections of NGB. However, it is obvious from Fig. 1 that the germplasm of fibre, vegetable, spices & condiments and medicinal & aromatic crop plants need more attention for their conservation in the genebank.



MONITORING OF SEED VIABILITY IN THE GENEBANK

The aim of NGB is to store good quality seed and maintain viability of the accessions above 85%. The preferred standard for monitoring accessions kept in the base collection is after 10 years of storage. However, in view of the fact that this facility has developed recently, random accessions are monitored periodically after 3-5 years of storage. If the viability is falls below 85%, a request is sent to the NAGS to regenerate seed accessions for replacement in the base collection.

UTILIZATION

The germplasm stored in the NGB is available for crop improvement programmes to research scientists world wide. The request for any accession is first forwarded to the concerned NAGS for providing the material from the active collections. If seeds of any accession is not available in the active collections, the Incharge of the NAGS may obtain seeds from the base collection for multiplication and/or distribution to the research scientists. The NAGS is also responsible for regenerating the seed material for adding it to their active collection and sending a part for the base collection.

DATA MANAGEMENT

At present the information like crop name, botanical name, germination percentage, moisture percentage, date of storage source of material, location in the gene bank and all the accompanying passport data is stored in the form of dBASE files. Since the development of an effective data management system is an important factor in realizing the utility of the germplasm stored in the genebank, the database management activities are being further strengthened under the INDO-US PGR project. A centralised database model is being developed which will hold all the information associated with the accessiosns stored in the genebank.

As NGB facility is unique for this part of globe, this not only serve as a model for other countries but also instill the confidence in them for supply of germplasm on bilatral/multilateral exchange agreements. It is envisaged, that the flow of germplasm will also increase due to recognition of NBPGR as a site for safety duplicate base collections by various IARCs.

Fortunately, scientists, donors, and governments are increasingly aware of the need to conserve and make better use of crop germplasm. In comparison to earlier times, the overall scenario is now much better.

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