

Chapter **52**

**National Network on
Conservation of Plant
Genetic Resources
Seed in India**



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Summary

The conservation of Plant Genetic Resources in India was initiated in 1905. The National Bureau of Plant Genetic Resources (NBPGR) was established in 1976. For the conservation of various crop species, a complementary *in situ* and *ex situ* strategy has been followed. Most germplasm has been conserved as seed both in base and active collections following genebank standards recommended by the Food and Agriculture Organisation of the United Nations and the International Plant Genetic Resources Institute. A network approach has been followed for division of labour, application of the complementary conservation strategy and facilitated access to genetic resources in crop improvement. The national network consists of a national genebank at the NBPGR, headquarters, 11 NBPGR regional stations and 40 crop-based National Active Germplasm Sites located at various institutes. The network is also linked with other stakeholders. The national genebank is responsible for conservation of germplasm on a long-term basis as the base collection. The National Active Germplasm Sites are responsible for collection, multiplication, evaluation, maintenance and conservation of active collections and distribution of germplasm for use in crop improvement. The seed material received from outside the country is processed as per the national quarantine regulations. The material collected within the country and assembled through introduction is assigned a unique national identity, multiplied, processed and conserved as per the genebank standards. The exchange of germplasm accessions is done under a material transfer agreement. The network facilitates the use of germplasm by disseminating information on available genetic resources and through interaction between the NBPGR and crop scientists.

Introduction

In India, the collection and conservation of plant genetic resources (PGR) of crop species for utilisation in crop improvement programmes was initiated with the establishment of the Imperial Agricultural Research Institute in 1905 at Pusa village, Darbhanga District, Bengal (now in Bihar) state. This institute was shifted to New Delhi in 1936 and later in 1947, was renamed the Indian Agricultural Research Institute (IARI). The early conservation efforts of PGR involved frequent multiplication and storage of seeds of crops by the breeders in the Botany Division of the Institute. To strengthen these efforts, a unit was set up for the assembly of global germplasm in the division in 1941, which was upgraded as the Division of Plant Introduction in 1961. The Plant Introduction Division of IARI provided the necessary impetus and leadership at the national level, particularly for the assembly of PGR through introduction from different parts of the world and their subsequent conservation.

The establishment of crop(s) based research institutes further extended and strengthened these efforts. The Central Rice Research Institute, Cuttack was established in 1946. Isolated efforts were also being made by the researchers

in the State Department of Agriculture, which got a boost with the establishment of the State Agricultural Universities (SAUs). Govind Bullabh Pant University of Agriculture and Technology, the first SAU, came into being in 1960. Crop improvement research, including PGR management was greatly strengthened and focused with the establishment of multidisciplinary, multi-centre all India Co-ordinated Crop Improvement Projects starting with that for maize set up in 1957. The project had co-ordinated research centres mostly in SAUs and Indian Council of Agricultural Research (ICAR) institutes located in important crop growing areas. Presently, there are 40 multiple-crop or crop-based institutes, project directorates and national research centres, 37 co-ordinated projects and 31 SAUs.

These projects, ICAR institutes and SAUs maintained and conserved working collections of germplasm of different crops through frequent seed regeneration and storage under ambient conditions. For example, the Central Rice Research Institute, Cuttack and Indira Gandhi Krishi Vishwa Vidyalaya, Raipur conserved rice genetic resources; the All India Co-ordinated Maize Improvement Project and the All India Co-ordinated Wheat Improvement Project, with the headquarters at IARI, maintained maize and wheat germplasm, respectively. The centres of co-ordinated projects supported these efforts across the country.

At the national level, the ICAR is responsible for research, initial transfer of technology in agriculture and policies related thereto (including PGR management). The ICAR upgraded the Plant Introduction Division, IARI in 1976 to the status of an institute, the National Bureau of Plant Introduction and later, in 1977, renamed it as the National Bureau of Plant Genetic Resources (NBPGR). The NBPGR has the mandate to manage PGR including collection, introduction, exchange, quarantine, evaluation, conservation and use. Thus, NBPGR, under the umbrella of ICAR, functions as the nodal agency for PGR management and closely collaborates with ICAR institutes and SAUs for PGR management, particularly utilisation.

Conservation Strategy

The strategy for conservation of genetic diversity is targeted at the cultivated species and their wild and weedy relatives, following the gene pool concept. This concept generally refers to the component of individuals or groups of species, between and among which actual or potential gene flow is possible. Following this approach, a range of methods of conservation may be required to satisfy the needs of a gene pool containing species and genera, which may come from different habitats and have different modes of reproduction. For

example, the rice gene pool, which includes cultivated rice (*Oryza sativa* L.), has a number of very diverse wild *Oryza* species, that occur in diverse ecological regions. The wild species have breeding systems varying from facultative vegetative propagation to obligate self-pollination. In such a situation, based on the merits of the two strategies, it is quite logical to have a balance between *in situ* and *ex situ* conservation approaches to meet the requirement, and within *ex situ*, a balance between its components. In the case of wild *Oryza* species and traditional varieties, which are being displaced by the high yielding varieties, it has to be assessed whether they would be best conserved either *in situ* wild, *in situ* on-farm, *ex situ* in a field genebank, *ex situ* in a seed genebank, *ex situ in vitro*, *ex situ* in a cryogenebank, or a combination of these. Therefore, a complementary approach, involving different *in situ* and *ex situ* conservation technologies would be appropriate and is preferred to ensure dynamism and safety, and economical and effective conservation. This will provide sustainable support to the use of PGR for food and agriculture, by present and future generations.

Seed Genebank Standards

Research on seed storage has indicated that the potential of seeds to store, i.e., retaining genetic integrity and seed viability, is influenced by storage seed moisture content and temperature. Germplasm is generally conserved as a base collection or an active collection.

Base collections are those that are being conserved on a long-term basis for posterity. These are unique accessions that are closest to the original samples and are not to be disturbed except for regeneration of active collections.

Active or working collections, are those that are immediately available for multiplication and distribution for use in research and crop improvement.

To minimise the alteration in genetic structure and loss of viability in germplasm accessions during storage, the seed genebanks (that are part of the national network) preferably follow the genebank standards as recommended by FAO/IPGRI (Anonymous, 1994) in relation to various factors important to the good maintenance of active and base collections. The base collections are being stored in modules maintained at -20°C. Such a low temperature minimises metabolic activities and is expected to enable the seed to retain viability for 50 to 100 years without any change in genetic structure. Active collections are stored in modules maintained at 4°C and 35–40% relative humidity, under which seeds are expected to remain viable for 15 to 50 years without substantial change in viability and genetic integrity. For both types of

collections, seed is processed after validating physical and genetic purity of seed, assessment of seed viability and seed moisture content. In most crops, seed samples with more than 85% seed viability are conserved. However, recognising inherent problems, such as indeterminate nature, which limits the harvest of physiologically mature seed of the same age in certain crops like cotton, several forages and vegetable crop species, the initial viability standards have been lowered down to between 50 to 75% by NBPGR (Table 52.1). For long-term storage, the seed moisture content is brought down to 3–7%, while for medium-term storage the seed moisture content is brought down to 8–10%. For base collections to be put under long-term conservation, the preferable size of accession is 2,000 seeds in the case of self-pollinated and 4,000 in the case of cross-pollinated crops. However, in many cases, such as groundnut and castor, because of large seed size and low multiplication rates, the sample-size of the accessions has been reduced to between 1,000–1,500 seeds. The base and active collections are regularly monitored for seed viability, seed quantity, seed health, etc., at recommended intervals of 10 and 5 years, respectively. However, the monitoring of accessions at the National Seed Genebank (NSGB) in the Germplasm Conservation Division, NBPGR has generated valuable information on storability in a number of crop species, such as wheat, minor millets, cotton, grain legumes etc. (Anonymous, 2001). These results suggest a revision of the exact period of monitoring intervals. This information will be useful in revising the seed genebank standards in relation to other components and make seed conservation more cost effective.

Seed storage problems are more common in India, because a large part of the country has a predominantly hot and humid, tropical and sub-tropical climate with great variation in temperature, rainfall and relative humidity across the year.

National Network on Conservation of PGR

Efficient conservation of PGR in a country of the size and dimension of India, one of the 12 mega-centres of plant biodiversity (Zeven and Zhukovsky, 1975) and where 384 crop plants are reported to be cultivated (of which 168 species were earlier reported under the Hindustani centre, one of the eight Vavilovian centres of origin and diversity – see Paroda *et al.*, 1999), essentially requires a network approach. Network facilitates short-, medium-, and long-term conservation requirements, the division of responsibilities, application of complementary conservation strategies, and access for the use of these genetic resources in crop improvement programmes.

The national network consists of the NSGB at NBPGR headquarters, New Delhi, 11 NBPGR Regional Stations situated in different agro-climatic zones of the country, and 40 crop-based National Active Germplasm Sites (NAGS), located generally at various ICAR institutes. The network is linked with the All India Co-ordinated Crop Improvement Projects, various research institutes (crop-based institutes, project directorates and national research centres; multicrop based institutes) in the ICAR, SAUs, etc. All network components operate in close collaboration to ensure the efficient conservation and sustainable use of germplasm in crop improvement, in which the National Seed Genebank plays a pivotal role in conservation.

1. The National Seed Genebank

The NSGB is responsible for conservation of seeds of unique accessions on a long-term basis, as base collections for posterity. In addition, it provides technical support to the network in the planning, development and operation of medium-term genebank facilities, in human resource development, and in provision of accessions for the regeneration of active collections. The Indian NSGB has 12 modules with a capacity to hold around 1 million accessions. The present base collection holdings in NSGB are 231,173 (Table 52.2).

2. NBPGR Regional Stations

The NBPGR has 11 regional stations/base centres/satellite stations located in different agroecological and phytogeographical zones of the country. They are responsible for the collection, characterisation, evaluation and/or conservation of germplasm in the region. The regional stations also co-ordinate various PGR activities in the region with other partners. Seven of the regional stations have medium-term seed storage modules for the conservation of active collections to meet the requirement of the region for various crops. The regional stations hold around 98,498 active collections (Table 52.3). In addition, plant quarantine is looked after at the NBPGR headquarters, New Delhi and at the NBPGR regional station, Hyderabad.

3. National Active Germplasm Sites

Forty NAGS hold active/working collections (Table 52.4). The NAGS are based at ICAR institutes, at All India Co-ordinated Crop Improvement Projects and at SAUs. They are entrusted with the responsibility of crop-specific collection, multiplication, evaluation, maintenance and conservation of active collections and their distribution to users at a national level. Large multiplications of active collections are preferred to reduce the number of regeneration cycles that can cause possible genetic changes and to meet the demand of seed distribution. The NAGS have a multidisciplinary team of scientists to study all the aspects of crop improvement, production and management. Therefore, the NAGS, in

Table 52.1 Seed-viability standards used in the Indian National Seed Genebank at the National Bureau of Plant Genetic Resources, New Delhi							
S.No.	Crop	Acceptable (%)	Preferred (%)	S.No.	Crop	Acceptable (%)	Preferred (%)
1.	Amaranth	80	≥85	45.	Little millet	85	≥85
2.	Ashgourd	60	≥75	46.	Longmelon	65	≥75
3.	Asparagus	70	≥85	47.	Lucerne	80	≥85
4.	Barley	85	90–95	48.	Maize	85	90–95
5.	Barnyard millet	85	≥85	49.	Marvel grass	50	≥75
6.	Bengalgram	85	90–95	50.	Mothbean	80	≥85
7.	Egyptian clover	80	≥85	51.	Muskmelon	65	≥75
8.	Birdwood grass	60	≥75	52.	Niger	80	≥85
9.	Bittergourd	65	≥75	53.	Oat	85	90–95
10.	Blackgram	80	≥85	54.	Okra	70	≥75
11.	Bottlegourd	65	≥75	55.	Onion	75	≥85
12.	Brinjal	75	≥85	56.	Paddy	85	≥85
13.	Buffel grass	–	≥75	57.	Parsley	65	≥75
14.	Cabbage	80	≥85	58.	Pea	80	≥85
15.	Capsicum	70	≥75	59.	Pearl millet	85	≥85
16.	Carrot	80	≥85	60.	Pigeonpea	80	≥85
17.	Castor	80	≥85	61.	Proso millet	85	≥85
18.	Cauliflower	75	≥80	62.	Pumpkin	65	≥75
19.	Celery	70	≥85	63.	Radish	80	≥85
20.	Chinese cabbage	80	≥85	64.	Rapeseed mustard	85	90–95
21.	Cotton	75	≥75	65.	Ricebean	70	≥85
22.	Cowpea	80	≥85	66.	Ridgegourd	60	≥75
23.	Cucumber	65	≥75	67.	Rocket salad	80	≥85

Table 52.1 continued

S.No.	Crop	Acceptable (%) ⁺	Preferred (%)	S.No.	Crop	Acceptable (%) ⁺	Preferred (%)
24.	Indianbean	80	≥85	68.	Safflower	80	≥85
25.	Dharaf grass	50	≥75	69.	Sesame	80	≥85
26.	Dianthus grass	50	≥75	70.	Setaria grass	50	≥75
27.	Finger millet	85	≥85	71.	Snake gourd	60	≥75
28.	Frenchbean	75	≥85	72.	Snakemelon	60	≥75
29.	Gardenbeet	65	≥75	73.	Sorghum	85	≥85
30.	Greengram	75	≥85	74.	Soybean	80	≥85
31.	Groundnut	80	≥85	75.	Spinach	70	≥75
32.	Clusterbean	70	≥85	76.	Sponge gourd	65	≥75
33.	Guinea grass	50	≥75	77.	<i>Stylosanthus</i> spp.	50	≥75
34.	Horsegram	80	≥85	78.	Summer squash	60	≥75
35.	Indian clover	65	≥75	79.	Sunflower	80	≥85
36.	Indian squash	60	≥75	80.	Teosinte	80	≥85
37.	Italian millet	85	≥85	81.	Tomato	70	≥85
38.	Jute	80	≥85	82.	<i>Trigonella</i>		
					<i>foenum-graecum</i>	70	≥85
39.	Grass pea	80	≥85	83.	Triticale	85	90–95
40.	KnoI-Khol	80	≥85	84.	True potato seed	80	≥85
41.	Kodo millet	85	≥85	85.	Turnip	80	≥85
42.	Lentil	80	≥85	86.	Watermelon	75	≥75
43.	Lettuce	70	≥85	87.	Wheat	85	90–95
44.	Linseed	80	≥85	88.	Winter squash	60	≥75

Based on the Indian Minimum Seed Certification Standards and initial viability of accessions stored in the National Seed Genebank

Table 52.2 Plant germplasm holdings in the Indian National Seed Genebank at the National Bureau of Plant Genetic Resources, New Delhi (as of July 2002)

Crop Group	Species (no.)¹	Accessions (no.)
Cereals	104	100,400
Millets and forages	18	29,589
Pseudo cereals	14	2,745
Grain legumes	59	35,144
Oilseeds	19	29,096
Fibre crops	19	7,194
Vegetables	44	10,402
Fruits	6	163
Medical and aromatic Plants	136	1,053
Narcotics	3	919
Spices & condiments	7	2,130
Genetic stocks	43 ²	213
Released varieties	89	1,890
Duplicate safety samples	2 ³	10,235
Total	504	231,173

¹ Including wild species

² Thirty-eight species are common with those listed above under various crops; and only five are additional

³ Species are included in the respective crop/crop groups.

addition to their conservation role, are well equipped for the evaluation of germplasm and the generation of information on the potential value of accessions. This information forms the basis for use of accessions in research and crop improvement. Eleven of the NAGS have been provided with medium-term seed storage modules, to facilitate the use of active collections in research and breeding programmes. Table 52.4 lists the number of accessions held by the NAGS. In addition to the NAGS, the network co-operates with other ICAR institutes, co-ordinated projects, SAUs and other stakeholders.

Table 52.3 Active collections being maintained/conserved at the National Bureau of Plant Genetic Resources, New Delhi and its Regional Stations

Location	Crops	Accession (no.)
New Delhi ¹	Forages, grain legumes, rapeseed mustard, sunflower	20,147
Akola ¹	Castor, chickpea, finger millet, groundnut, horsegram, kodomillet, <i>Lathyrus</i> , lentil, linseed, niger, pigeonpea, prosomillet, safflower, sesame, soybean, wingedbean	31,181
Amravati	Castor, chickpea, pigeonpea	4,849
Bhowali ¹	Barley, chillies, frenchbean, lentil, wheat, wild relatives	2,665
Cuttack	Agricultural and horticultural crops, medicinal plants, rice	581
Hyderabad ¹	Blackgram, brinjal, chillies, tomato	2,900
Jodhpur ¹	<i>Acacia</i> sp., <i>Atriplex</i> sp., carissa, castor, <i>Citrullus</i> , clusterbean, <i>Cordia</i> sp., coupe, jujube, jojoba, <i>Jatropha</i> sp., mothball, mungbean, pearl millet, pomegranate, <i>Prosopis</i> , sesame	15,169
Ranchi	Bengal quince, black myrobalan, <i>Bombax malabaricum</i> , butter tree, flame of the forest, gooseberry, jackfruit, java plum, monkey jackfruit, <i>Pongamia glabra</i> , <i>Terminalia arjuna</i>	226
Shillong ¹	Adzukibean, buckwheat, chenopods, chilli, <i>Colocasia</i> sp., <i>Coix</i> , ginger, maize, paddy, Perilla, ricebean, turmeric, under utilised crops	1,761
Shimla ¹	Adzukibean, amaranth, <i>Aisandra butyracea</i> , apple, apricot, buckwheat, chenopods, cherry, frenchbean, hazelnut, kiwi, pineapple guava, peach, pecan nut, plum, ricebean, strawberry, walnut, wild cucumber	7,322
Srinagar	Adzukibean, amaranth, barley, buckwheat, chenopods, chickpea, frenchbean, lentil, mungbean, oats, pea, rapeseed mustard, saffron, wheat	1,305
Thrissur ¹	Horsegram, okra, rice, <i>Sesamum</i> sp., <i>Vigna</i> sp.,	10,402
Total		98,498
¹ Medium-term storage facility is available		

Table 52.4 Crop germplasm holdings of various National Active Germplasm Sites

Crop(s)	Institute	Accessions (no.)
Field crops		
Cotton	Central Institute of Cotton Research, Nagpur ⁴	8,768
Crops of northeast region ³	ICAR, Research Complex, Northeast Hill Region, Shillong ⁴	-
Fodder crops	Indian Grassland and Fodder Research Institute, Jhansi ⁴	6,267
Groundnut	NRC ¹ on Groundnut, Junagarh ⁴	6,432
Jute & allied fibres	Central Research Institute for Jute and Allied Fibres, Barrackpore	3,226
Maize	Project Directorate on Maize, IARI, New Delhi	2,500
Oilseeds	Directorate of Oilseeds Research, Hyderabad ⁴	10,550
Pearlmillet	AICRP ² on Pearlmillet, Jodhpur	2,794
Pulses	Indian Institute of Pulses Research, Kanpur ⁴	5,021
Rapeseed & mustard	NRC on Rapeseed and Mustard, Bharatpur	8,082
Rice	Central Rice Research Institute, Cuttak ⁴	24,000
Rice & <i>Lathyrus</i>	Indira Gandhi Krishi Vishwa Vidhyalaya, Raipur ⁴	15,000
Small millets	AICRP on Small millets, Banglore ⁴	8,572
Sorghum	NRC on Sorghum, Hyderabad	7,366
Soybean	NRC on Soybean, Indore	2,500
Sugarcane	Sugarcane Breeding Institute, Coimbatore	5,861
Tobacco	Central Tobacco Research Institute, Rajahmundry	1,500
Under utilised crops	NBPGR Headquarter, New Delhi ⁴	199
Wheat & barley	Directorate of Wheat Research, Karnal ⁴	7,000
Horticultural/Agroforestry crops		
Agroforestry spp.	NRC on Agroforestry, Jhansi	40
Arid fruits	NRC on Arid Horticulture, Bikaner	1,923
Banana	NRC on Banana, Tiruchrapalli	907

Table 52.4 continued

Crop(s)	Institute	Accessions (no.)
Cashew	NRC on Cashew, Puttur	433
<i>Citrus</i> species	NRC on Citrus	51
Grapes	NRC on Grapes, Pune	600
Leechi, bael, aonla, jackfruit	Central Horticultural Experiment Station, Ranchi	2,426
& other horticulture crops ³	Indian Institute of Horticultural Research, Bangalore	-
Medicinal & aromatic plants	NRC on Medicinal and Aromatic Plants, Anand	190
Mango ³	Central Institute for Sub-Tropical Horticulture, Lucknow	-
Mulberry ³	Central Silk and Mulberry Genetic Resources Centre, Hosur	-
Oil palm	NRC on Oil Palm, Eluru	119
Onion & garlic	NRC for Onion and Garlic, Nasik	1,066
Orchids	NRC for Orchids, Gangtok	225
Ornamentals &	National Botanical Research Institute, Lucknow	-
non-traditional crop ³		
Plantation crops	Central Plantation Crops Research Institute, Kasargod	522
Potato	Central Potato Research Institute, Shimla	2,500
Spices	Indian Institute of Spices Research, Calicut	6,055
Temperate horticultural crops ³	Central Institute of Temperate Horticulture, Srinagar	-
	NBPGR Regional Station, Shimla ⁴	-
Tropical fruits	Indian Institute of Horticulture Research, Bangalore	11,467
Tuber crops	Central Tuber Crops Research Institute, Thiruvananthapuram	3,871
Vegetables	Indian Institute of Vegetables Research, Varanasi ⁴	16,139

¹ AICRP: All India Coordinated Research Project; ²NRC: National Research Centre; ³ Figures not available; ⁴ with medium-term storage facility

Handling of Seed Material

The seed material received at the NSGB at the NBPGR or at the relevant NAGS is handled mostly in the way shown in the flow diagram illustrated in Figure 52.1. The material introduced from outside the country is processed through the quarantine as per the national legislation for import of seed material for research. For collections made within the country, a multi-disciplinary team of scientists assesses the quality, quantity and health of the seed samples. The list of collected or introduced accessions is supplied to the Agricultural Research Information Services of the NBPGR for assignment of a national identity. The national identity is unique for an accession and is never changed or re-allocated. Generally, the collecting institute/station, including the NBPGR and its regional stations, is responsible for characterisation and multiplication of collected germplasm in the zones of its origin. In the case that sufficient quantity of seed is received, the accession is directly transferred to the NSGB after processing of seeds as per the genebank standards. In the case of accessions with fewer seeds, the relevant collecting institute/centre is requested to multiply the germplasm and supply the required quantity of seed. In addition, the relevant NAGS and All India Co-ordinated Crop Improvement Projects also supply the seeds for use as active collections. In the case of recalcitrant or intermediate seeds, the germplasm is put in the field genebank at the relevant NAGS; and at the same time, efforts are made to investigate the protocol for conservation, either through cryopreservation as a base collection or for short- or medium-term storage with supportive seed treatments.

Single Window System of Germplasm Exchange

The international exchange of seed of germplasm accessions available in the national network is done through a single window system, in which the NBPGR (Germplasm Exchange and Plant Quarantine Divisions) plays the central role. For export of seed material for research, the indents are processed in consultation with the relevant Project Co-ordinator of the All India Co-ordinated Crop Improvement Project to obtain permission from the Department of Agriculture Research and Education, Government of India and the material is processed for a Phytosanitary Certificate. For import of germplasm, an import permit and phytosanitary certificate is essential. NBPGR, under the Plant Fruits and Seed (PFS) Order (1989) has been authorised to issue import permits and handle the quarantine processing of

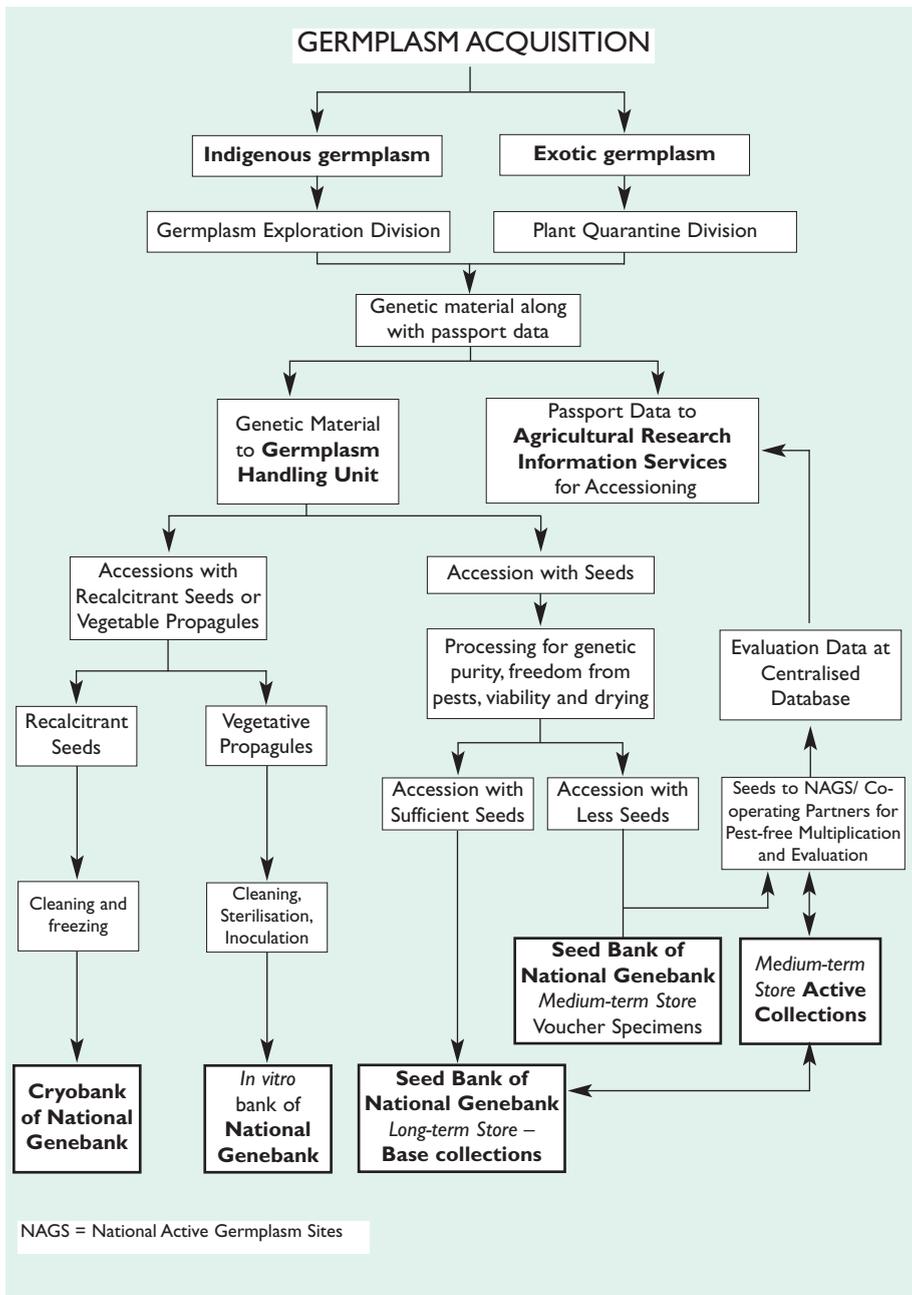


Figure 52.1 Flow of genetic material at National Bureau of Plant Genetic Resources.

germplasm material such that a phytosanitary certificate can be issued for export. The internal distribution of seed material at the national level may take place through the NBPGR or NAGS or directly from the concerned source.

The Convention on Biological Diversity (CBD) Article 3, provides sovereign right to the nations over their bio-resources in pursuance to the national policy; whereas, Article 15 notes that the authority to determine access to genetic resources rests with the national governments and is subject to national legislation. The germplasm is shared under mutually agreed terms (Article 15, item 4) ensuring fair and equitable sharing of benefits. NBPGR uses a Material Transfer Agreement to this effect for access to genetic resources.

Information Documentation and Facilitated Use

The NBPGR facilitates the use of germplasm by disseminating information on available germplasm accessions. It has published 79 catalogues on various crops and brings out a periodic publication entitled 'Plant Introduction Reporter', recently renamed as 'Plant Germplasm Reporter'. In addition, the NBPGR scientists regularly attend the annual workshop of the All India Crop Improvement Projects for various crops. During the workshops, NBPGR scientists interact with crop scientists, report the progress on the assembly of indigenous and exotic collections, provide information on the availability of potentially valuable germplasm and participate in developing a technical programme for the next year, particularly for germplasm collection, characterisation and evaluation.

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