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PULSE CROP GERMPLASM RESOURCES AT NBPGR - ACCOMPLISHMENTS AND PROSPECTS

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Pulse crops are important group of crops next only to cereals. These constitute an essentially recommended component of diet particularly for vegetarians because of their much higher protein content and the complementary amino acid composition as compared with cereal grains. In India, some pulse crops viz., *Pisum arvense*, Lentil and *Lathyrus sativus* were domesticated as early as in the neolithic and chalolithic periods. This region exhibits primary diversity for many pulse crops viz., mung bean, urid bean, chickpea, pigeonpea, cowpea and horsegram. However, pulses remained primarily the crops opted for marginal and poor lands. The native genetic resources of these crops abound in variable forms, landraces, primitive types etc. The National Bureau of Plant Genetic Resources has the mandate to plan, conduct, promote and co-ordinate activities on plant exploration and collection, germplasm import and exchange, plant quarantine, characterization and evaluation, multiplication, regeneration and distribution, documentation and conservation of indigenous and exotic genetic diversity in crop plants and their wild relatives. NBPGR has acquired and evaluted over 37,000 germplasm samples of 20 grain legumes of major and minor importance at its Headquarters and regional stations. The National gene bank's long term repository at NBPGR holds over 22,000 accessions of various pulse crops which are stored at $-20^{o}C$. There is a systematic and interlinked flow of germplasm of pulse crops in the National PGR programme. The research achievements for various pulse improvement programmes has been fairly significant in the country. The NBPGR's genetic resources activities through the Indian National Plant Genetic Resources System (IN-PGRS) and Crop Advisory Committee (Pulses) have added impetus to the germplasm handling and utilization of these crops. An attempt has been made to summarize these efforts related to PGR activities on various pulse crops in the Indian context. An effective approach to disseminate information base on accessions to the users is their suitable documentation. Inventories have been published by NBPGR on various pulse crops which provide basic information on the introduced germplasm. In addition, NBPGR has also brought out a number of Catalogues on the passport, characterization and evaluation data in relation to germplasm sets of different pulse crops which may be of help to users in selecting out the right type of germplasm for making a seed request. Various suggestions for future PGR activities and their prospects are also discussed.

Key words : Grain legumes, genetic resources, management

Pulses constitute an important group of crops, second only to cereals. These possess high protein content and complement with cereals for their amino acid compositions. The Indian sub-continent is a centre of diversity for many pulse crops such as mung bean, urid bean, chickpea, pigeonpea, cowpea

and horsegram. A few pulse crops viz., *Pisum arvense*, lentil and *Lathyrus sativus* were domesticated as early as in neolithic and chalcolithic periods (Vishnu Mittre, 1974). The native genetic resources of these crops abound in variable forms, landraces, primitive types etc. The conservation and utilization of these resources would therefore, be essentially required.

GERMPLASM EXPLORATION AND COLLECTION

Several explorations have been carried out in various parts of the country and a total of 11,945 collections were made in various crop-based or multi-crop explorations in 8 pulse crops during 1976 to 1992. The collections included mungbean (1992), uridbean (1680), chickpea (1541), lentil (561), cowpea (3539), pigeonpea (1434), pea (590) and mothbean (608). Further, based upon past experiences and gaps, systematic attempts were made recently to explore and collect in prioritized areas. In order to set up such priorities, the mechanism of Indian National Plant Genetic Resources System (IN-PGRS) was exploited which includes recommendations of Germplasm Advisory Committee (GAC) on Pulses interaction with All India Coordinated Pulses Improvement Project (AICPIP), previous collectors' reports and specific collection requests by the collaborating Institutes. Thus, during the period 1988-89 to 1992 a total of 2400 accessions of various pulse crops were collected from different states (Table 1).

Table 1. Diversity of grain legumes collected during 1988-92

Crops	No. of entries	States
Pigeonpea	366	M.P., U.P., Haryana, Bihar, West Bengal, Orissa, Maharashtra, Kerala and Karnataka
Chickpea	493	U.P., Maharashtra, Orissa, Punjab, Rajasthan Haryana, A.P., Gujarat and M.P.
Lentil	180	U.P., M.P., Bihar, H.P., Tripura, J&K, Maharashtra and Rajasthan.
Cowpea	261	M.P., U.P., Haryana, Bihar, West Bengal, Orissa, Maharashtra, Tripura, Meghalaya, J&K, A.P., T.N., H.P., Karnataka and Gujarat
Blackgram(urid beam)	364	M.P., U.P., Haryana, Bihar, West Bengal, Orissa Maharashtra, Tripura, H.P., J&K, T.N., Gujarat, Rajasthan and Karnataka
Greengram (mung bean)	295	M.P., U.P., Bihar, Orissa West Bengal, J&K, Maharashtra, Tripura, Meghalaya, Bihar, Gujarat, Rajasthan and Karnataka
Pea	223	U.P., M.P., Bihar and H.P.
Frenchbean	218	Orissa, Bihar, W.Bengal, Maharashtra, Arunachal Pradesh, Manipur, H.P., J&K and Meghalaya
Total	2400	

Substantial variability was observed and collected in mung bean from Telangana region of Andhra Pradesh for plant habit, leaf size, tolerance to biotic and abiotic stresses, multi-nodal and multi-cluster bearing etc. whereas in urid bean diversity was collected from Chhattisgarh region of Madhya Pradesh and Uttar Pradesh for growth habit, maturity, seed and pod characteristics. Chickpea germplasm collections from north eastern U.P. and north western Bihar showed variability in plant and seed characters. *Cicer microphylluim*, a wild relative of chickpea abounded in patches in Spiti valley, Himachal Pradesh and its various diverse forms were collected. Variability in lentil, particularly for seed types was collected from north eastern Uttar Pradesh and Haryana and western U.P. along the Yamuna river. Maharashtra and H.P. collections are also expected to represent unique variable forms of lentil germplasm (Vishnu Mittre, 1974). Pigeonpea variability was collected from all across the country yet collections from U.P. and north western M.P. represented diverse forms in terms of plant type, seed and pod characteristics. The diversity collected in cowpea particularly from north eastern U.P., Chhattisgarh region of M.P. and the Deccan plateau, exhibited variation for plant height, pod size seed colour and tolerance to biotic stresses. This valuable addition of genetic resources of pulse crops will be useful in terms of conserving variability, their usage in plant improvement programmes and basic studies.

GERMPLASM INTRODUCTION AND EXCHANGE

In addition to the augmentation of pulses germplasm through indigenous collections, further germplasm import/exchange has been carried out from/with other countries across the globe. During 1989-92, 4299 accessions of major pulse crops and their related species were introduced mung bean and pigeonpea were introduced from Far Eastern zone (Taiwan, Thailand, Philippines, Indonesia etc.) whereas chickpea, lentil and peas from Syria (Table 2). The other

Table 2. Legumes introduced during 1989-92

Crop	No. of accessions	Source
Chickpea	1081	Syria, Myanmar, Spain, Nepal, Pakistan
Lentil	912	Syria, Bangladesh
Peas	448	Netherland, Syria, Australia
Frenchbean	431	Columbia
Mothbean	28	USA
Pigeonpea	183	Philippines Myanmar, Indonesia
Mung bean	176	Taiwan, Thailand
Cowpea	97	USA, Brazil, Bangladesh
Vigna spp. and other pulses crop	943	USA
Total	4299	

countries represented were Afghanistan, Australia, Bangladesh, Bulgaria, Canada, France, Germany, Italy, Nigeria and USA. Post entry quarantine clearance was done for the introduced germplasm. In the PEQN, a few promising lines were earmarked which included. EC-284065 in pigeonpea (from Australia), for early duration and high yield; EC-286030-33 in chickpea (from Syria) for resistance to *Ascochyta* blight; EC-292160 in pea (from USSR) for multiple resistance to *Ascochyta* blight and fungal root rot; EC-328164 in cowpea for earliness and high yield and a few other promising introductions in pea - (EC- 324118, -8751, -54, and 89 for multiple traits including earliness) and soybean (EC- 329157, -58, -59, -331131, -32, - 333858, -59 and 60 for early maturity and high yield).

ACTIVE GERMPLASM HOLDINGS

Over 21,000 accessions of various grain legumes viz. mung bean (2733), chickpea (2259), lentil (2156), peas (1793), Lathyrus (448), pigeonpea (2251), cowpea (3434) etc. are maintained at NBPGR Headquarters and its regional stations (Table 3). These accessions are channelized through the characterization and evaluation based on a set of carefully chosen descriptors and their descriptor states mostly for the qualitative and quantitative traits observable

Table 3. Active germplasm collection of grain legumes at NBPGR

Crop	Holdings	Sites
Chickpea	2259	Delhi (79), Akola (1469)
Lentil	2156	Delhi (710), Shimla (530), Bhowali (355), Akola (561)
Peas	1793	Delhi (1417), Shimla (281), Bhowali (95)
Lathyrus	448	Delhi (300), Shimla (13), Akola (135)
Pigeonpea	2251	Jodhpur (26), Akola (2192), Trichur (33)
Mungbean	2733	Shimla (125), Jodhpur (1213), Amravati (1368), Trichur (27).
Uridbean	1744	Delhi (2461), Bhowali (38), Jodhpur (345), Trichur (590)
French bean	4256	Shimla (2800), Bhowali (1345), Akola (111)
Total	21,074	

in field. The evaluated accessions are deposited with longterm repository of the National gene Bank keeping in mind the effective sample size (>=2000 seeds per accessions), germination percent (>90 per cent) and proper seed maturity. A set maintained in the active holdings is used for supply to indentors (Fig. 1).

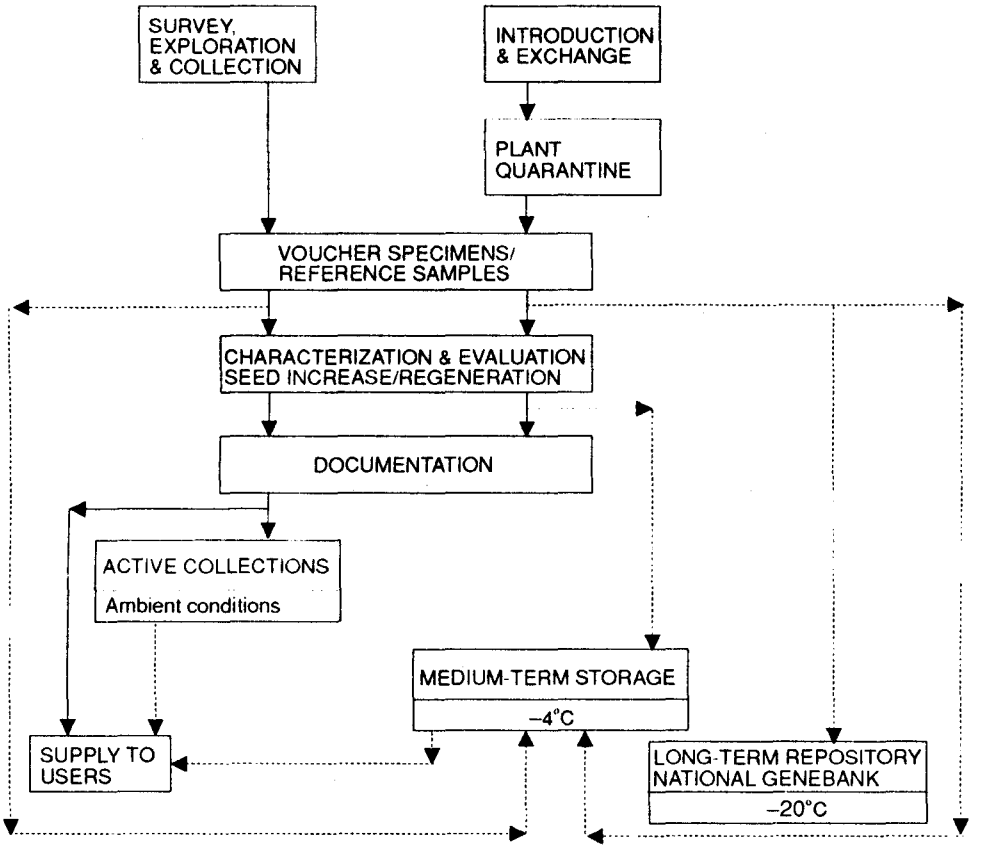

Fig. 1. Flow of germplasm

An attempt was made to identify the duplicates in germplasm holdings of major pulse crops with the help of National Coordinated Programme on Pulses, because the management of huge number of accessions is strenous and the availability of duplicates is a serious bottleneck to this problem. A frequent exchange of germplasm between various crop based Institutes and State Agricultural Universities besides a supply on demand from NBPGR could be enlisted as the main reasons for the occurrence of duplicates. There is a difficulty in identification of duplicates particularly so in cases where the recepient centres reallocate number to the germplasm received. However, a total of 411 duplicates of germplasm accessions have been sorted out from NBPGR and IIPR collections of pigeonpea (71), mung bean (128), urid bean (38), lentil (136) and fieldpea (38) (Singh and Rana, 1993).

CONCLUSION AND FUTURE PROSPECTS

Collection and conservation of plant germplasm are expensive propositions unless linked to effective utilization (NBPGR, 1991). NBPGR has acquired and evaluated over 37,000 germplasm samples of 20 grain legumes of major and minor importance at its headquarters and regional stations. The National Genebank's long term repository at NBPGR holds over 22,000 accessions of various pulse crops which are stored at -20°C. In the recent past, systematic efforts have been taken to define and implement the Indian National Plant Genetic Resources System (In-PGRS). NBPGR is the nodal agency to co-ordinate and promote germplasm conservation and utilization under this system and all the germplasm collections in the country are ultimately linked to single base collection in the Long Term Repository of National Genebank. Further, the situation specific responsibilities for germplasm utilization, varietal improvement and testing are assigned through the Indian Institute of Pulses Research (IIPR) earlier designated as Directorate of Pulses Research (DPR). In order to effectively coordinate, plan and advise these activities on Pulses PGR's a Germplasm Advisory Committee (Pulses) was constituted by NBPGR in 1991. The GAC (Pulses) met twice, in 1992 and 1993, during which the extensive efforts taken up by NBPGR for germplasm collection, evaluation and conservation on one side and its utilization by various centres of coordinated pulses improvement programme on the other were simultaneously discussed (Singh and Rana, 1992, 1993; Singh and Lal, 1993). A list of catalogue published on pulse crops by NBPGR is given in Table 4.

Table 4. List of catalogues published by NBPGR

Crop name	Year of publication	No. of Accessions	No. of descriptors
Cowpea (*Vigna unguiculata*)	1981	707	34
Cowpea (*Vigna unguiculata*)	1982	683	24
French bean (*Phaseolus vulgaris*)	1981	1773	16
Lentil (*Lens culinaris*)	1982-83	240	14
Moth bean (*Vigna acontifolia*)	1980	285	17
Moth bean (*Vigna aconitifolia*)	1981	848	17
Moth bean (*Vigna aconitifolia*)	1983	829	20
Mung bean (*Vigna radiata*)	1983	302	19
Soyabean (*Glycine max*)	1983	2009	18
Wingedbean (*Psophocarpus tetragonolobus*)	1983	1439	31
Winged bean (*Psophocarpus tetragonolobus*)	1984	88	31
Cowpea (*Vigna unguiculata*)	-	259	23
Red gram (*Cajanus cajan*)	-	399	14
Horsegram (*Macrotyloma uniflorum*)	-	403	12
Soybean (*Glycine max*)	1983	1353	25

The status of germplasm collection of various grain legumes in different states of India is presented in Table 5 which can serve as a useful reference for planning future explorations for collection of individual pulse crops.

The foremost priority for the effective use of pulses, germplasm collections in their effective transformation from curator's active collections to the breeders working collections, 20 centres were identified for preliminary evaluation of germplasm at multi-locations in the country. Such evaluation work would be carried out under regular monitoring of national germplasm screening nurseries (NGSNs) by the teams nominated by coordinated programme from time to time. Further, in order to streamline the gene bank, active collections management and interactions and to promote efficient utilization Rana (1992) proposed formation of situation-specific core subsets of available base collections of various crops, in developing countries, including India. It is suggested to initiate concerted efforts in this direction beginning with the crops like urid bean, pigeonpea and chickpea which have got both indigenous diversity and coverage.

Table 5. Status of germplasm collection of various grain legumes in different states of India

Priority area/Crop	Urid bean	Chick-pea	Lentil	Pigeon-pea	Pea	Mung bean	Cowpea
Andhra Pradesh	1	1	4	3	3	4	3
Bihar & West Bengal	2	3	3	2	2	3	2
Gujarat	2	1	3	3	4	3	3
Haryana	2	1	3	3	2	3	3
Himachal Pradesh	1	3	1	3	2	3	2
Jammu & Kashmir	1	3	3	2	2	2	2
Karnataka	1	3	4	3	3	3	3
Kerala	1	3	4	3	4	4	3
Madhya Pradesh	2	1	2	2	1	2	3
Maharashtra	1	2	2	2	3	1	2
Orissa	2	2	4	1	3	3	2
Punjab	3	1	4	4	4	4	4
Rajasthan	2	1	2	3	3	3	2
Tamil Nadu	2	3	4	2	4	4	2
Uttar Pradesh	1	2	1	1	1	2	1
North East Hills	2	3	3	4	4	3	2

Where: 1 = Well collected; 2 = Partly collected
3 = Poorly collected; 4 = Not collected

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