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RESEARCH ARTICLE

Germplasm Access from ICAR-NBPGR and Use within India

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Plant genetic resources for food and agriculture support the livelihoods of every person and encompass the diversity of genetic material. Rapid progress in the field of agriculture was witnessed in the last three decades of this century with respect to collection, conservation, exchange and sustainable utilization of PGR (http://www.fao.org/agriculture/crops/thematic-sitemap/theme/seeds-pgr/conservation/en/). At the national level, the ICAR-NBPGR is the nodal institution for the management of PGR under the umbrella of the Indian Council of Agricultural Research (ICAR), New Delhi. The ICAR-NBPGR has developed a very strong Indian Plant Germplasm Management System which operates in a collaborative and partnership mode with other organizations. The system has contributed immensely towards safeguarding and exchanging the PGR from other countries for enhancing the agricultural production and productivity in the country. ICAR-NBPGR is also serving the needs of researchers for various crop improvement program through supply of the desired germplasm from National Genebank and from active collections maintained at regional stations in different agro-climatic zones of the country. National Active Germplasm Sites (NAGS) are effective partners in collaborating with ICAR- NBPGR for meeting the requirements of researchers in the country. The present study was undertaken to learn more about the use and distribution of germplasm accessions, which may help to assess the areas of constraint and hence, to encourage policies to enhance germplasm use/utilization.

Key Words: Distribution, Exchange, India, NBPGR, PGR, Use

Introduction

Plant genetic resources (PGR) are the biological basis of world food security and, directly or indirectly, support the livelihoods of every person on Earth. PGRFA encompass the diversity of genetic material in traditional varieties and modern cultivars, as well as crop wild relatives and other wild plant species used as food. Plant domestication produced numerous landrace populations that served as the founder material for further genetic improvement through more recent selective breeding. (Bradshaw, 2017). In fact, most of the contemporary crop varieties descend from a relatively small number of founder landraces. Exchange of PGR and their utilization is a continuous process. This exchange of germplasm has benefited agriculture across the globe. The exotic and indigenous germplasm offer enormous opportunity for addressing the needs of the breeders/ researchers for developing varieties resistant to various pests and diseases and to improve quality, quantity and other value addition traits. There is continuous search for newer resources to meet the future demands that arise with the emergence of climate change, new diseases, and enhanced demands food and nutritional security (De Jonge, 2009). ICAR-NBPGR is the nodal institution under Indian Council of Agricultural Research (ICAR), New Delhi for the management of PGR. NBPGR works with the mandate for promotion of sustainable use, of PGR and policy issues. NBPGR operates in collaboration mode and in strong partnership mode with other organizations. Since its establishment, NBPGR has continually contributed significantly towards import and exchange of germplasm from over 150 countries for further utilization in crop improvement programmes. To understand the extent of use/ utilization of exotic as well as indeigenously collected germplasm, the study was undertaken. The study also reflects on the constraints in accessing the germplasm from National Gene Bank or National Active Germplasm Sites so that the mechanisms may be developed to encourage the access regulations and their further us and distribution.

Any researcher/user in India if needs to access seed or planting material from other countries, the germplasm must be introduced/ imported following the Plant Quarantine (Regulation of Import) Into India, Order 2003. The Director of the National Bureau of Plant Genetic Resources (NBPGR) is authorized to issue an

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import permit for the purpose. However, to access the germplasm from NBPGR very simple procedure is laid out.

Materials & Methods

Access at national level is based on the provisions of Biological Diversity Act, (BDA), 2002 and Rules (2004). The request for supply of germplasm in small quantities and only for research purposes are being considered by Director, ICAR-NBPGR. The indentor is desired to submit its request in requisition proforma for supply of seed/ planting material in small quantities (GEX 01). The applicant is also required to fill in and submit the duly signed Material Transfer Agreement for research use within India for public and private entities (MTA). The two documents are available at NBPGR website. NBPGR arranges for the supply of germplasm germplasm maintained in network mode from its regional stations and other National Active Germplasm Sites (NAGS), where the active collections are held. If the desired material are available at ICAR-NBPGR, they are collected and forwarded to the indentor, or else the requests are forwarded to various sources in India including NAGS and the material thus procured is forwarded to the indentor. The material is always transferred under a Material Transfer Agreement, though the practice of sending materials using the Standard Material Transfer Agreement (SMTA) under the International Treaty is still rare. Since 1976 a total of 5,04,679 samples are supplied from NBPGR within country for use by researchers. For this study the documented information was analyzed from year 2014 to 2019. The data was assembled for this study through the records/ online database of Germplasm Exchange Unit and compiled by the author. All information kept as records in NBPGR. NBPGR receives large number of requests and they are serially registered in ledger books).

Results & Discussion

In the period of five years from 2014 -19, a total of seventy five thousand six hundred and twenty two (75, 622) accessions were distributed to researchers in 190 crops within the country. For the supply of seed/planting material nearly 90% of the requests were met by NBPGR, New Delhi and its regional stations at Akola, Cuttack, Bhowali, Ranchi, Jodhpur, Hyderabad, Shimla, Srinagar, Shillong and Thrissur and for the rest 10% NAGs played active role in meeting the demands of the researchers. These samples were supplied against 2055 requests registered during the period. Large number of requests are receied by NBPGR. There is a prescribed proforma (GEX01) for requisition of seed/ planting material. The indentor is required to fill in all details relating to the name of crop, number of accessions/ samples requested and type of study to be carried out. These proformas were studied and Based on the frequency of requests received for a particular crop and the based on the number of samples supplied a rank list was prepared which indicated information on the number of times the crop was requested by different institutes thus giving information on the top scorer crop the research is being carried on. According top 25 requests for different crops were ranked for the frequency of request and another 25 based on number of samples supplied (Table 1 & 2).

Earlier the seed material was supplied by ICAR-NBPGR to private sector based on their specific requests, however after the enactment of Biological Diversity Act, 2002, the requested were regulated as per the provisions of BDA, 2002. In 2017, a revision in the MTA (reference) was brought into effect and procedures laid out and 544

Table 1. Top 25 crops based on the number of requests received (2014-2019)

Crop	No of requests registered	Rank
Tomato (*Solanum* sp.)	137	1
Rice (*Oryza* sp.)	126	2
Okra (*Abelmoschus* sp.)	125	2
Brinjal (*Solanum melongena*)	77	4
Chilli (*Capsicum annuum*)	99	5
Wheat (*Triticum* sp.)	95	6
Bitter gourd (*Momordica charantia*)	68	7
Maize (*Zea mays*)	66	8
Mungbean (*Vigna radiata*)	59	9
Cowpea (*Vigna unguiculata*)	58	10
Cucumis (*Cucumis melo*)	56	11
French bean (*Phaseolus vulgaris)*	52	12
Chickpea (*Cicer arietinum*)	51	13
Mustard (*Brassica juncea*)	49	14
Urd bean (*Vigna mungo*)	48	15
Amaranth (*Amaranthus tricolor*)	42	16
Pigeonpea (*Cajanus cajan*)	36	17
Pea (*Pisum sativum*)	33	18
Chenopodium (*Chenopodium quinoa*)	32	19
Barley (*Hordeum vulgare*)	29	20
Lentil (*Lens culinaris*)	27	21
Cluster bean (*Cyamopsis tetragonoloba*)	23	22
Bottle gourd (*Lagenaria ciceraria)*	23	23
Buckwheat (*Fagopyrum esculentum*) & rice bean (*Vigna umbellata)*	22	24
Onion (*Allium cepa*)	21	25

Table 2. Top 25 crops based on number of samples supplied (2014-2019)

Crop	Number of samples supplied	Rank
Wheat	12216	1
Chickpea	8683	2
Okra	3445	3
Rice	3213	4
Rice bean	2424	5
Pigeonpea	2305	6
Chilli	2287	7
Tomato	2237	8
Maize	2183	9
Brinjal	2133	10
Sesame	2078	11
Finger millet	1900	12
Mustard	1636	13
Horsegram	1394	14
Urdbean	1351	15
Cowpea	1333	16
Frenchbean	1314	17
Amaranth	1302	18
Mungbean	1285	19
Soybean	1170	20
Pea	1145	21
Barley	1144	22
Lentil	1111	23
Foxtail millet	1102	24
Barnyard millet	1024	25

samples were supplied to Indian private seed companies in 2017-18 (Table 3). The types of users (users submit their requests in a prescribed proforma which have all the details of the user of the seed/ planting material) who submit requests for germplasm are mainly plant breeders, researchers, students engaged in research activities.

Although, NBPGR conserves a vast repository of novel genes that may be utilized in breeding new crop varieties, mostly the requests are not very specific in nature. On the basis of the requests submitted, the access is mainly for carrying out biochemical analysis, molecular characterization, phyto-chemical evaluation, screening, evaluation, breeding and for grafting studies. Total number of samples supplied for research purposes from NBPGR and other National Active Germplasm Sites and the number of samples supplied in different crop are shown in Figure 1 and Figure 2. Analysis of recipient groups exhibit that 45% of the total samples were received by students of State Agriculture Universities (SAU's) followed by scientists of ICAR institutes (41%), traditional/ central universities (11%), private and other government institutions (1%). The distribution

Table 3. List of Private Seed Companies which received seed material in different crops (2017-2019)

Indentor	Crop
Ambrocia Seed Producer Company Ltd.	Wheat
Ananya Seeds Private Limited,	Brinjal, Tomato, Chilli
Arizona Seeds Private Limited,	Tomato
Arjuna Natural Extracts Ltd	Amaranth
Basant Agro Tech (I) Ltd.,	Soybean
Daftari Agro Bio-tech Pvt.,	Ethiopian mustard
Eagle Seeds & Biotech Ltd	Wheat
M/s ACSEN Hy. Veg. Private Ltd.,	Onion, Carrot, Cauliflower
Noble Seeds Private Limited	Okra
Nuziveedu Seeds Limited,	Mustard, Wheat
Pahuja Seeds Private Limited	Cucumber
Rasi Seeds (P) Ltd.s	Cotton, Wheat, Rice
Seed works Seed Works International Private Limited	Mustard
Shreeoswal Seed and Chemical Ltd.,	Wheat, Mustard, Triticale
Somani Kanak Seedz Pvt. Ltd.	Bottle gourd, Sponge gourd, Brinjal
Tierra Seeds Science Pvt. Ltd.,	Mustard
VNR Seeds Pvt Ltd	Bitter gourd, Tomato, Okra

is depicted in Figure 3. More or less similar type of study was also carried out by Bonham *et al.* (2010) on Plant Genetic Resources and Germplasm use in India depicting breeder's approaches to germplasm acquisition, accessing information about germplasm and benefits associated with germplasm use.

Feedback on the Use of Germplasm

It is always pertinent to know about the performance and utilization of the material sent to indenters. While sending the material, a feedback form is also being attached which includes reference number, crop name, accession number, purpose of request, information about establishment of material, seed supplied back to Genebank, details of utilization in experiment/ crop improvement and publication, if any. Most of the indenters send duly filled feedback form but did not mention performance/ utilization of the germplasm received. However, some of the indenters send full details of the material and readily use them in their breeding programme while some also send enough quantity of multiplied seeds for deposition in Genebank.

Some examples of feedback received for the germplasm supplied during 2016 and 2017 are described here. Wheat lines imported from UK were established well and are being utilized for tilling. Four genetic

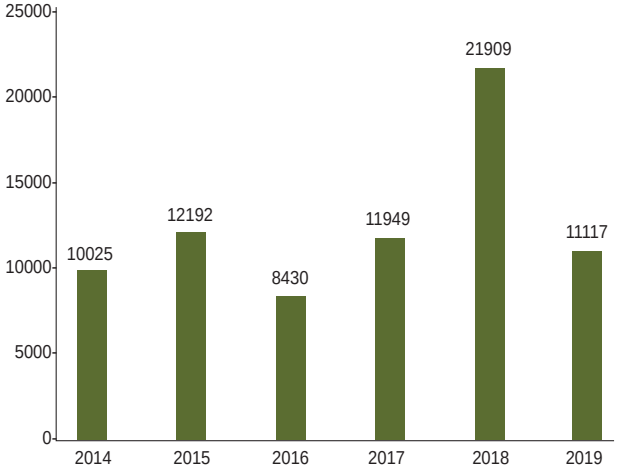

Fig. 1. Total number of samples supplied to researchers within country from ICAR-NBPGR from its Headquarter at Delhi and Regional Stations (2014-2019)

stocks of wheat. On the basis of APR and SRT data, promising stem rust resistant genotypes were selected for use in crossing programme to target novel rust resistance genomic regions. Crosses were attempted using prominent Indian wheat genotypes like DPW621-50, HD2967, DBW14, HUW510, HI977 and PBW343 to introgress Sr39 gene from exotic source HR22 (Hartog) (feedback from ICAR-IIWBR, Karnal and ITC, Bangalore).

Five wild species of okra high degree of resistance to *Yellow vein mosaic virus* (YVMV) and *Okra enation leaf curl virus* (OELCV). The lines will be further utilized for interspecific gene transfer for resistance to YVMV and OELCV. All the wild derived materials having *A. mizoramensis* sp Nova as male parent showed high degree of resistance to both these diseases (feedback from ICAR-IIVR, Varanasi). Bottlegourd and sponge gourd indigenous collections showed good variability in fruit shape and are being utilized in breeding programme (feedback from. Accession IC49581 of *Catharanthus roseus* was found promising under salt stress condition (feedback from Delhi University).

Imported *Vasconcellea qercifolia* is resistant to papaya ringspot virus (PRSV); *V. pubenscens* is reported to immune to PRSV, but it is cross incompatible with Papaya. *V. parviflora* is susceptible to PRSV but it is compatible with *V. pubenscens.* Therefore, it can be a good bridge species to transfer PRSV resistance gene from *V. pubescens* to papaya (feedback from ICAR-IARI, New Delhi). Though some of the indenters are sincerely doing their job in keeping the track of material

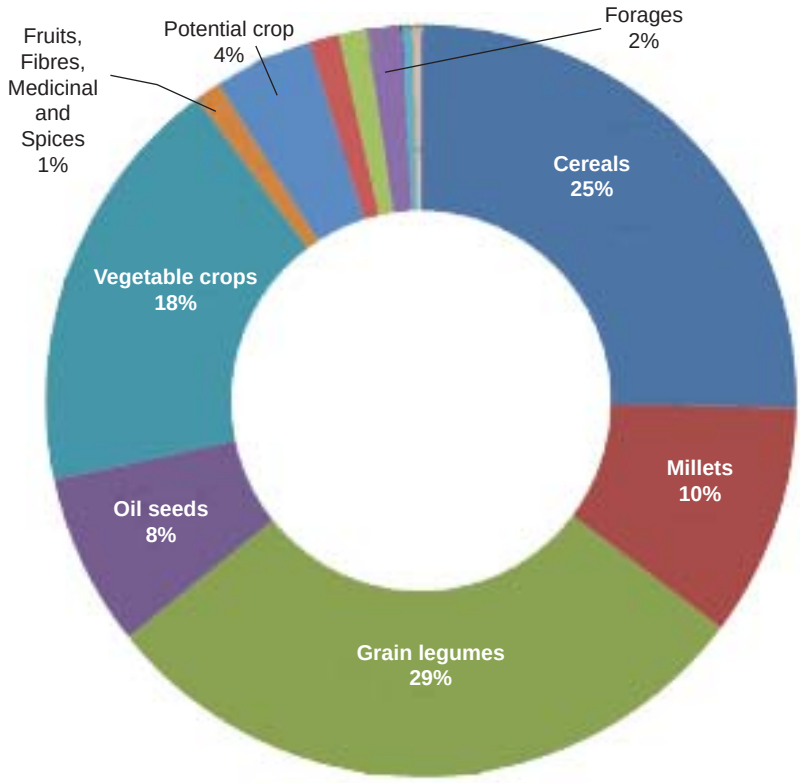

Fig. 2. Number of samples supplied in different crop groups (2014-2019)

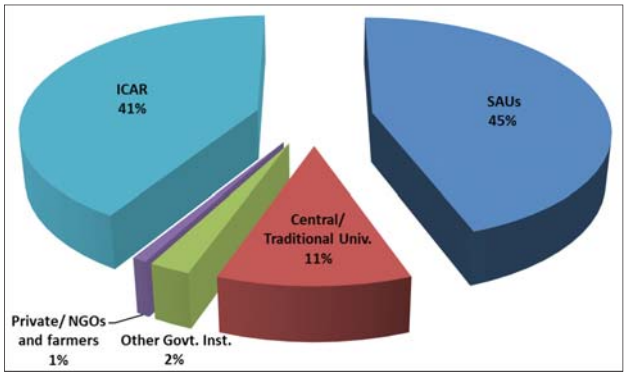

Fig. 3. Germplasm distribution from NBPGR to different Recipient Groups (2014-19)

supplied, all the indenters should follow the same making it a success story. Feedback information received on establishment of hing accessions is a success story (Fig. 4).

Superior quality & best tasting berries of seabuckthorn and Monk Fruit (EC938819) a new introduction from China is established at Institute of Himalayan Bioresource Technology (IHBT), Palampur (Fig. 5)

ICAR-NBPGR has been playing the pivotal role in germplasm exchange among countries as well as catering to the needs of researchers/users within country, meeting their demands of desired genetic resources. A large number of wild species/crop wild relatives are also

Fig. 5. Monk fruit established at IHBT, Palampur

Fig. 4. Heeng accessions introduced first time from Iran established at Institute of Himalayan Bioresource Technology, (IHBT), Palampur

being conserved which at National Genebank which are finding their routes to the crop improvement programmes in different crops.

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