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Plant Germplasm Registration System in ICAR – Achievements

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The Plant Germplasm Registration Committee (PGRC) was constituted by the Indian Council of Agricultural Research in 1996 to provide recognition to researchers involved in identifying, describing and documenting potentially valuable genetic materials and to incorporate these into the public domain for their efficient use by the breeders and researchers. In the last 25 years a total of 48 meetings of PGRC have been held and 1,948 crop genetic materials have been registered belonging to 249 crop species. Among these, highest number of germplasm are registered for resistance against biotic stress (601) followed by quality and nutritional traits (583). In major food crops like cereals, oilseeds and grain legumes, maximum registration is for biotic stresses while in ornamentals, fruit crop, medicinal and aromatic crops, tea and coffee, maximum germplasm is registered for quality traits.

Introduction

Plant genetic diversity is of fundamental importance in the continuity of a species as it provides the necessary adaptation to the prevailing biotic and abiotic environmental conditions, and enables change in the genetic composition to cope with changes in the environment. Climate change leads to the concurrence of a number of *abiotic and biotic stresses*, thus affecting agricultural productivity. Extensive crop improvement programmes are needed to address these challenges. Materials with high potential in breeding for a changing climate need to be assembled in genebank collections. Not only crop wild relatives (CWR), but also useful materials resulting from various research projects, where genes from wild or exotic sources are integrated into adapted material, which have resistance to biotic and abiotic stresses need to be identified and assembled for use in breeding programmes. Accessibility of these unique genetic resources for use by the breeders depends upon the availability of information and material in public domain and equally important is the recognition of the breeder who has developed/identified the unique germplasm. Unlike the breeders/developers of released cultivars, scientists associated with the development of unique trait specific or potentially valuable germplasm and genetic stocks had no mechanism for recognition of their work before 1996. With an important rationale to recognize the efforts of researchers for developing the potentially valuable germplasm and to publically describe and document new and useful genetic materials and to incorporate these into the public domain for their efficient use by the breeders and researchers, the Indian Council of Agricultural Research (ICAR) constituted a Plant Germplasm Registration Committee (PGRC) under chairmanship of Deputy Director General (Crop Science), to register such unique germplasm. The responsibility of registration and conservation of trait-specific plant germplasm was entrusted to NBPGR by ICAR. The PGRC meets quarterly (normally last month of the quarter) with the concurrence of the Chairman, for consideration of applications and related matters.

In 1996, detailed guidelines and proforma for registration was formalized to facilitate the process of germplasm registration. Taking into consideration the upcoming developments in management of plant genetic resources (PGR) and related policies at global and national level, the guidelines and proforma continue to evolve and accommodate changes suggested by the experts. The guidelines were first published in 2005 and distributed at various fora to give wider publicity of the activity. The major revisions were incorporated in 2014 with respect to submission of application for registration, data requirement and deposition of seed/genetic material in compliance to provisions required as per the changing scenario. Again in 2021, the guidelines were revised to incorporate changes in the data requirement with respect to registration of vegetatively propagated horticultural crops.

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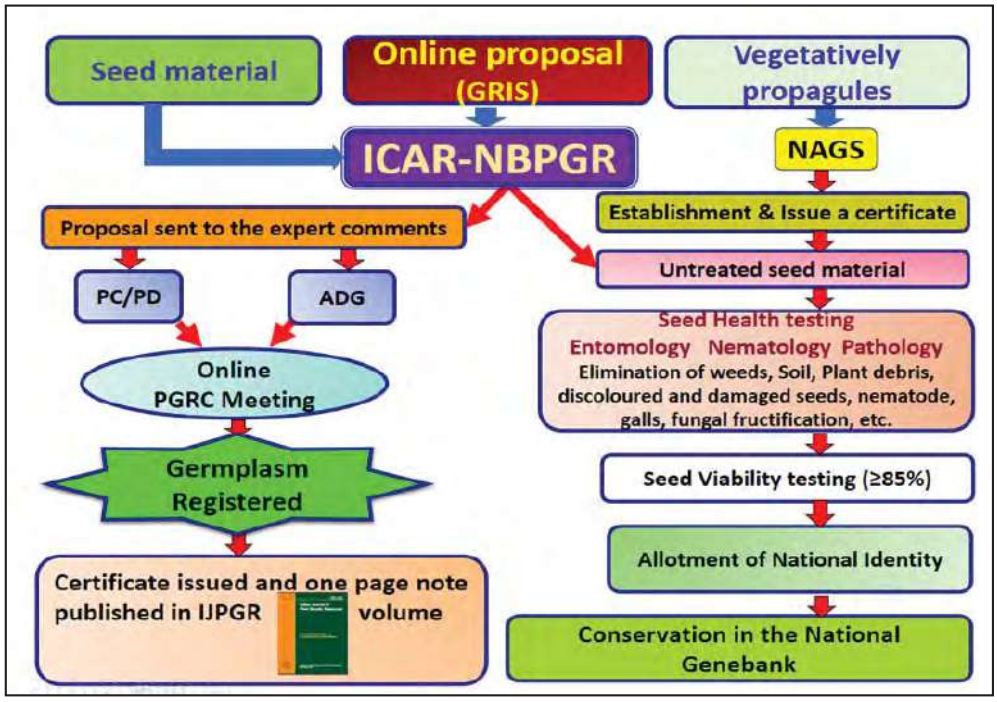
Germplasm/genetic stock/elite material of field, horticultural and other economic crops, including argo-forestry species, spices, medicinal and aromatic plants, ornamental plants, which is unique, uniform, stable and has potential attributes of academic, scientific or commercial value are eligible for registered. Exotic germplasm (imported) can be registered for a trait other than those published or registered. Similarly, selections made from exotic germplasm can also be registered. Selection for unique traits from landraces (other than the landrace is known for) may be considered for registration. The registration is subject to fulfilling of the data requirements as per the guidelines. The guidelines for registration of germplasm are available at NBPGR website (http://www.nbpgr.ernet.in:8080/registration/Guidelines.aspx). The registration remains valid for 18 years for trees and vines and 15 years for other plant species, after which the registered germplasm would be national sovereign property. A registration can be repealed by the PGRC in case of false claim(s).

Germplasm Registration Information System (GRIS)

Earlier applications were submitted as hard copies. With the advent of an online system in 2018 the entire process of filling application has become simple and fast through the Germplasm Registration Information System (GRIS) (http://www.nbpgr.ernet.in:8080/registration/). The progress of each application can be tracked through a personal dashboard. Trait-specific germplasm is also searchable *via* the GRIS. Genetic stocks have been provided with a QR Code to access detailed information related to these lines. The online system, thus, provides genebank managers, breeders and plant researchers with hands-on tool for management of germplasm registration process, and to policy makers with a reliable source of information.

Registered germplasm is conserved either in National Genebank (in form of seeds) or at designated crop-based National Active Germplasm Site (NAGS) (especially vegetatively propagated crop germplasm) depending upon the type of the propagule. National Genebank at NBPGR is responsible for long-term conservation of orthodox seed material accompanied by passport and genebank-related information. Untreated seed material received as prescribed seed quantity (minimum 2,000 seeds for self-pollinated and 4,000 seeds for cross-pollinated crops) for registration are subjected to seed health testing for ensuring the germplasm free from quarantine pests (NBPGR, 2005, Guidelines for Registration of Plant Germplasm; http://www.nbpgr.



Flow Chart of Plant Germplasm Registration Activity: Conservation, Multiplication and Distribution of Registered Germplasm

ernet.in/ download/registration.pdf.). Unique National Identity or IC Number (Indigenous Collection) are assigned, subject to qualifying the international genebank standards (FAO, 2011). After testing of germination following International Seed Testing Association standards (ISTA, 1993), moisture content of the seeds is equilibrated to 5–7% in the walk-in-drying room (15 ^{o}C and 15% RH), seeds are packed in tri-layered aluminum foil packets using vacuum sealer, labelled and stored at –18 ^{o}C in National Genebank. However, the standards are relaxed for seeds of difficult species, e g wild, rare and endangered species on case-to-case basis. Recalcitrant seed and vegetatively propagated crop germplasm are deposited in the field genebank of the concerned crop-based NAGS (http://www.nbpgr.ernet.in/download/registration.pdf.) for conservation and a certificate to this effect has to be obtained by the developer before the material is proposed for registration. It is obligatory on the part of developer and developing organization to maintain the stock of registered germplasm to share the germplasm in National Agricultural Research System (NARS). Active or working collection(s) may also be maintained by the NAGS with a responsibility for its multiplication and distribution to *bona fide* users in the NARS.

Publication of Registered Germplasm

All germplasm approved for registration is officially communicated to the applicants along with Registration Number. A certificate to this effect is also issued to the applicant, which can be downloaded from GRIS. A brief description of not more than one page (according to instructions given in GRIS) is published in the ensuing issue of Indian Journal of Plant Genetic Resources – official publication of the Indian Society of Plant Genetic Resources, NBPGR, New Delhi-110012. The compiled information is also published in the form of information bulletins (NBPGR 2006, Kak *et al*., 2009, Kak and Tyagi 2010, 2015, Kak and Gupta 2017, 2020), to disseminate information among scientists/users. An interactive database of registered germplasm is also available at NBPGR website (http://www.nbpgr.ernet.in:8080/registration/InventoryofGermplasm.aspx).

Achievements

Starting in 1996 and continuing for 25 years, total 48 meetings of Plant Germplasm Registration Committee have been held and 1948 crop genetic materials have been registered as of 31st March 2022 belonging to 249 crop species. Considering total number of proposals submitted (4,300) and number of germplasm registered (1,948), 61% proposals are developed/ identified by ICAR crop-based institutes, followed by 23% by SAUs and 6% proposals belonged to ICAR-NBPGR alone. It is to be noted that a very few germplasm accessions were registered by private sector (1%) (Fig 1). The vigorous efforts made to publicize the information on registration during important scientific meetings and increased frequency of PGRC meetings, the rate of qualifying germplasm for registration also increased. Maximum number of the germplasm has been registered for resistance against biotic stress (601) followed by quality and nutritional traits (583). In major food crops like cereals, oilseeds and grain legumes maximum germplasm was registered for biotic stresses. In ornamentals, fruit crop, medicinal and aromatic crops and crops like tea and coffee, maximum number of germplasm was registered, generally, for quality traits.

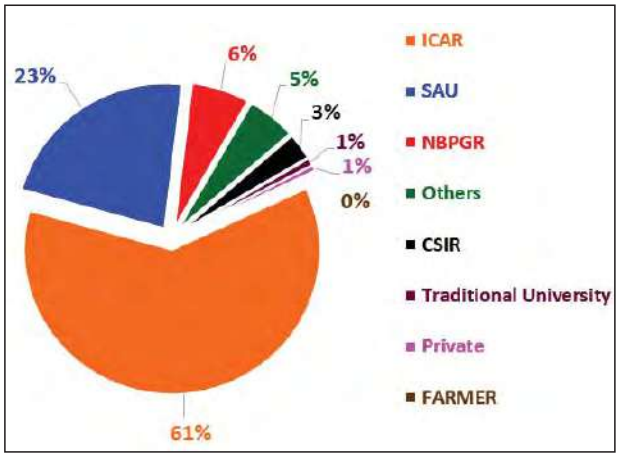


Fig. 1. Institute-wise germplasm registered

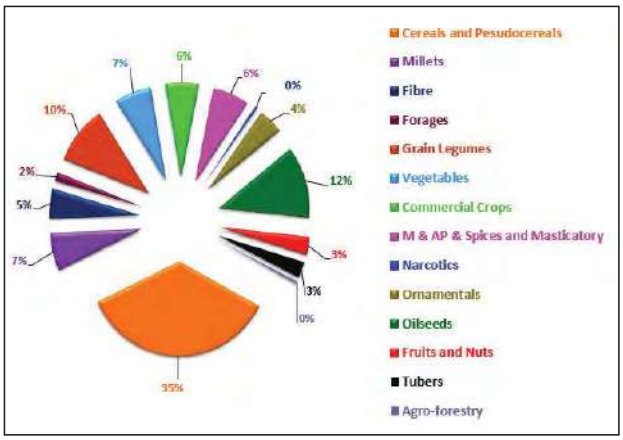


Fig. 2. Crop group-wise representation (%) trait-specific germplasm registered (1996-2022)

NBPGR regularly organize the Germplasm Field Days for displaying the germplasm variability of various crops in the field to select genotypes of interest by the breeders. The registered germplasm accessions of different crops are displayed at suitable locations including in the field genebanks of regional stations of NBPGR located strategically in various agro-climatic regions. Concerned crop breeders select the material and the same is distributed to the breeders to meet their requirement under material transfer agreement (http://www.nbpgr.ernet.in/ download/SMTA.pdf). The users can indent the germplasm including registered ones of their interest available in NBPGR (http://www.nbpgr.ernet.in/download.htm).

In conclusion plant germplasm registration serves the basic intent of registering, conserving, distributing the potentially valuable germplasm and documenting the information to be made available in public domain for further utilization by breeders to develop climate-resilient varieties in crops as genetic variability has been playing and will continue to play significant role in mitigating the challenges due to climate change in future.

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