

Plant Germplasm Registration

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Abstract

There is a growing realization over the world that the introduction of modern agriculture has to be supplemented with measures to conserve biodiversity *in situ* if yield gains are to be stabilized. Hence, there is a growing interest from agricultural development specialists and conservation biologists for understanding the socioeconomic factors determining the conservation of biodiversity *in situ*. *In situ* conservation and crop improvement can complement one another in marginal areas mainly for landraces / folk varieties / primitive form of crop plants. The emphasis on *in situ* and *ex situ* approaches will, however, depend on the conservation context - the object, aims and location of conservation. *In situ* conservation involves the knowledge of traditional agriculture and growing zones / areas where genetic diversity of the species could be concentrated.

The ex-plant which is designated for specific traits with ecological conditions, agricultural systems and cultural patterns must be registered / documented and credibility should go to the actual owner / user community. The hybrids evolved by the scientists would also be recognized with its parents for a particular specific character for which it is known and must have National Identity (IC number).

Introduction

NBPGR is a nodal agency having responsibility to assign the registration number through Plant Germplasm Registration committee (PGRC). Germplasm or genetic stock of agri-horticultural and other economic crops, including agro-forestry species, spices, M. & AP., ornamental plants contains unique, uniform, stable and potential attributes of academic, scientific or commercial value registered.

Types of germplasm:

(a) Introduced germplasm: Tomato, peas, French bean, scarlet bean, Lima bean, winged bean, Faba bean, Brassicae (cauliflower, cabbage, knol-khol, turnip, leafy mustard etc.), radish, carrot, *Beta*, capsicum, Chayote, potato, *Cyclanthera pedata*, *Allium* spp. (onion, leek, shallot, garlic), asparagus, artichoke and parsley.

(b) Indigenous germplasm: Eggplant, sponge gourd, ridge gourd, snake gourd, round gourd, *Cucumis melo*, phunt, kakri, cucumber, leafy vegetables viz., Basella, Chenopodium, Amaranthus, Brassica, spinach, Rumex/Sorrel; taro, yam, elephant foot yam, ginger, *Allium* spp. and Bitter gourd.etc.

(c) Germplasm of exotic origin for which India is a centre of diversity: Okra, pumpkin, chilli, cowpea, *Brassicaceae*, Chyote and coriander.

(d) Under utilized / under exploited vegetables: In tribal areas of India many minor vegetables are grown in their field as well as in kitchen garden. Such crops are consumed locally. The genetic resources of such minor vegetable crops include over 50 species (Arora, 1995). Some important ones are: *Allium rubellum*, *Amaranthus* spp., *Apium graveolens*, *Asparagus officinalis*, *Basella alba/ rubra*, *Bamboo* spp., *Fagopyrum cymosum*, *Hibiscus sabdariffa*, *Ipomoea aquatica*, *Lactuca sativa*, *L. indica*, *Malva* spp., *Moringa oleifera*, *Ocimum* spp., *Parkia roxburghii*, *Polygonum* spp., *Pilea* spp., *Portulaca oleracea*, *Sesbania grandiflora*, *Solanum torvum*, *Trichosanthes* spp., *Trigonella* spp., *Vigna* spp., *Zizania latifolia*, several aroids and yams.

(e) Wild relatives and related species of vegetable crops: The wild relatives and related species of vegetable crops belongs to the categories, legumes – 31 spp., vegetables – 54 spp., spices and condiments – 27 spp. (Arora and Nayar, 1984) and these are distributed in the western and eastern Himalayas, Northeastern region, Gangetic plains, Indus plains and in the western and eastern peninsular regions. Botanically these can be classified as follows (Arora, 1995).

Identification of genetic stock/ germplasm for registration: The distribution of a germplasm for a particular geographical area with ecological conditions, agricultural systems and cultural patterns that make possible the survivability and use of the biodiversity in that area in relation to specific genetic stock. Though the concentration of variability could have ethnical and cultural origin besides biological evolution. It is an assert that the farmers family / concerned personnels / scientist is able to identify genetic variations (specific genetic stock/varieties) based on phenotypic elements, growing period, soil adaptation, colour and shaped, flavour and quality and time is a variable factor to define.

Gene pool classification: It is a proposition of some guidelines for classification or grouping of genetic diversity based on cross-compatibility relationships that can simplify use of genetic diversity. Harlen (1992) developed 'gene pool' concept by assigning the constituent taxa to primary, secondary and tertiary gene pools. At the intra-specific level, cultivars are grouped into races and sub-races.

Primary gene pool: Here those species / germplasm fall which are easily crossable; hybrids are fertile with good chromosome pairing; normal gene segregation and gene transfer is generally easy. Includes spontaneous races (wild and/or weedy) as well as cultivated races. It can be divided into two subspecies: subspecies A to include the cultivated races and subspecies B to include the spontaneous races

Secondary gene pool: Includes species which are crossable within the crop species. Gene transfer is possible, but with barriers (poorly or not at all). This gene pool is available for use; however, the plant breeder or geneticist will have to put an extra effort to overcome the cross-ability barriers with application of various possible cyto-genetic manipulations to establish a fertile hybrid.

Tertiary gene pool: Refers to wild species that produce hybrids with crop species which are lethal or completely sterile. Gene transfer is either not possible with known techniques, requires embryo culture or grafting to obtain hybrids, doubling chromosome number or using bridging species or biotechnological techniques. It is the outer limit of potential genetic reach. It is rather ill defined.

Survey and characterization: We have to make the survey and could be identified previously, therefore, we have to array the data and then analyze it under historical, geographical, agro-ecological, cultural, social and economic points of view . Variables habitat, number and cultivated area in each zone, zone importance, crop and wild species concentration, uses, customs, accessibility and relation between hot spot are the prime factors (Verma et.al. 2008a, 2008b). In case of a perennial fruit plants

the growers constitute the primary source of information data. It is important to strengthen the relation with the growers to get first hand information. The base of this relation is mutual respect and the responsibility to assume commitments is based on friendship.

Plant Genetic Resources (PGR): It refers to genetic material of plant origin of actual or potential value in the form of seed, vegetative propaguel, tissue, cell, pollen, DNA molecule etc. containing the functional unit of heredity that can be utilized in crop improvement. This is generally referred to as a germplasm and includes varieties, landraces and wilds / weedy relatives of economically important plant species available in India. This large group of texa needs to be collected, studied, documented and conserved for posterity.

Indian Gene Centre: The Indian gene center is one of the 12 mega-biodiversity centre of crop plant diversity with two major hot spots(Western Ghats & North-Eastern Hill Region) which holds rich floristic wealth of over 17,500 species of higher plants and about one-third of endemic flora. High priority accorded to nearly 500 species of cultivated plants where 166 crop plants have originated in Indian Sub-Continent and over 320 species of wild relatives of crop plants are reported.

Crop Diversity in Indian Gene Centre:

- Cereals - rice (*Oryza sativa* and wild species), wheat and barley
- Minor millets - (*Panicum*, *Paspalum* and *Brachiaria*) and forage grasses (*Iseilema*, *Cenchrus*, *Cynodon*, *Heteropogon*, etc.)
- Legumes - *Vigna* spp., chickpea, pigeon pea, lablab bean, horse gram, sword bean, velvet bean and cluster bean
- Oilseeds – rapeseed-mustered and sesame
- Vegetables okra , egg plant, cucumber, melons, ridge gourd, bottle gourd and sponge gourds
- Fruits- Citrus spp., banana and plantain, jackfruit, mango, Indian gooseberry, karonda & jamun
- Fiber – Jute, Asiatic cotton, mesta and sunhemp.
- Spices - pepper, ginger and turmeric

Stepwise Plant Registration process:

1. Plant Germplasm Registration Committee (PGRC)

- (i) Chairman – DDG (CS) for maximum of 03 years.
- (ii) Permanent member – Director, NBPGR; Member Secretary Senior Level Scientist, NBPGR identified by the Chairman, PGRC; Other Members – Co-opted as per the advice of the Chairman.
- (iii) Need based crop specialist with reference to the material.

2. Nodal Agency

- (i) NBPGR, New Delhi. Application is to be addressed to the Director along with seed samples or a certificate of submission of propagules with respective crop / plant based NAGS for establishment/conservation.
- (ii) Member Secretary, PGRC duly acknowledge with date, the receipt of the application and of the seed material, communicating application No. and the National identity.
- (iii) NBPGR maintains permanent register and data base listing the germplasm materials approved by PGRC with details on unique and other related information.

3. Application Form

- (i) Application on the prescribed proforma (Form A, Annexure II). The PGRC meet at least twice a year with the concurrence of the Chairman for consideration of application and related matters.

4. Eligibility Criteria for Registration

Germplasm or genetic stock of agri-horticultural and other economic crops, including agro-forestry species, spices, M. & AP., ornamental plants contains unique, uniform, stable and potential attributes of academic, scientific or commercial value registered. All claims concerning the material submitted for registration should accompany scientific evidence for uniqueness, reproducibility and value in the form of :

- (i) Publication in standard peer reviewed journal (reprint copy). AND OR
- (ii) Evaluation data for at least three years under AICRP trial / nursery test or verification by concerned PD/PC or 03 location / year data under any other relevant system. AND OR
- (iii) Publication of information on potential value of proposed germplasm (Annual report or any other such reports). AND OR
- (iv) Certificate of the validation test of the claimed attribute by any institution as per the advice of Member Secretary. AND OR
- (v) Recommendation of institute's germplasm identification committee regarding the novelty and uniqueness of germplasm for trait(s) claimed.

5. Germplasm Ineligible for Registration

- (i) Without accompanying documentary evidence.
- (ii) Does not contain complete passport data (Annexure VI), correct / authentic identification, parentage, institutional or National identity, geographical location of origin and uniqueness.
- (iii) Exotic material Per se, with no evidence of human intervention in its improvement.
- (iv) Varieties of common knowledge or selection from traditional or farmer's varieties without prior approval from the concerned personnel.
- (v) Variety Prior art, with no evidence of human intervention.
- (vi) Varieties and hybrids (including parents) released in the country, zone or state. However, parental lines of non released hybrids may be submitted for consideration.
- (vii) Germplasm of any genera or species, which involves any technology, which is injurious to the life or health of human being, animals or plants.
- (viii) Material for which any form of protection has been sought elsewhere.

6. Screening of Application (s) and their Consideration by the PGRC

- (i) The Member Secretary, PGRC screen the proposal(s) on prescribed proforma, as per the guidelines of the checklist (Annexure II).
- (ii) Proposal forwarded to the relevant Director, PD or PC for validation of information, particularly on uniqueness and novelty of the proposed germplasm.

- (iii) After initial screening, the incomplete applications may be advised for appropriate revision.
- (iv) Validation of the data is necessary, the applicant should be asked to produce a validation report from an appropriate institute, advised by the Member Secretary. Revised application must accompany such report duly endorsed by the CA of the Institute, advised for the validation.
- (v) Proposals complete in all respect along with the comments of relevant Director, PD or PC will be put up to the PGRC for consideration.
- (vi) The PGRC consider the proposal as early as possible and not later than one year.
- (vii) The decision of the PGRC final.

7. Validity of Registration

Period for validity of registration is 18 years for trees and vines; 15 years for other plant species, after which the registered germplasm will be national sovereign property.

8. Publication of Registered Germplasm

Germplasm material approved for registration will be officially communicated to the applicants along with registration number (IN GER). Certificate will be issued to the applicant. Brief description not more than one page (Annexure III) is to be published in the appropriate periodicals, i.e.,

- (i) Indian J. Pl. Genet. Res. Published by the ISPGR, NBPGR, New Delhi-12.
- (ii) Indian J. Genet. & Pl. Breed. – published by the ISG&PB, New Delhi.
- (iii) NBPGR, New Letter, NBPGR, New Delhi-12.
- (iv) ICAR, News-published by the PID, KAB, ICAR, New Delhi.
- (v) NBPGR, Internet website <http://nbpgr.delhi.in>.
- (vi) In addition (a) Concerned crop news letter
(b) ICAR Annual Report(s)

9. Conservation, Maintenance and Sustainable Utilization of Registered Germplasm

- (i) Registered germplasm conserved either in NGB or at designated crop / plant based NAGS.
- (ii) All material registered with PGRC should be sent to the relevant Director, PD / PC or NAGS with request for sowing / planting in demonstration plots for field days , multiplication and distribution to the bonafide users.
- (iii) Institution associated with the development of the germplasm is to be mandated with the maintenance of working stock of germplasm for supply to bonafide users.

10. De-registration

- (i) Registration repealed by the PGRC in case of false claim(s). Appeal for counter claim, if any, should reach the PGRC within a period of three months of the publication of brief note in the Indian J. Pl. Genet. Res.

PROCEDURE FOR SUBMISSION OF PROPOSAL / GERMPLASM MATERIAL :

1. Submission of Application and Material

- (i) Plant germplasm proposed to be registered should be submitted to following address:
The Director , National Bureau of Plant Genetic Resources , Pusa Campus, New Delhi-110 012 - Phone: 011-2584 3697; EPABX: 2584 9208, 2584 9211 Extn. 209 210
FAX: 011-2584 2495 Email: director@nbpgr.ernet.in
- (ii) Material is to be accompanied with properly filled Form –A (Annexure I) duly signed by the applicant and Head of the institution with official rubber seal (15 copies, each attached documentary evidences submitted).
- (iii) Form A accompanied complete description of the germplasm material using standard descriptors (as per concerned crop AICRP or NBPGR descriptors). Include photograph(s) of plant/plant parts/crop and /or fingerprints (DNA or biochemical profile), if available.
- (iv) Declaration to the effect that working –stock for supply to users maintained by the institution associated with the development of material.
- (v) Another declaration is that such germplasm does contain any gene or gene sequence involving terminator technology mandatory.

2. Guidelines for Submitting the Orthodox Seed Material

Seed material dried to low moisture level without loss of seed viability.

- (i) Minimum number of 5000 seeds in case of cross-pollinated crop species, 3000 in self – pollinated and 500-1000 in difficult species, such as some vegetables, M. & AP., wild relatives etc. submitted.
- (ii) Seed supplied from a fresh harvest and not more than 90 days old.
- (iii) Seeds supplied sound, healthy, physiologically mature and collected from healthy plants.
- (iv) Providing good quality healthy seeds. it is advised to dry the seed material in shade immediately after the harvest.
- (v) Potential viability of seeds more than 85% in most crop species except in special cases, such as cotton, some vegetable crops etc.
- (vi) Seeds not treated with chemicals.
- (vii) Seeds packed in good quality paper, muslin cloth or plastic packet(s) with proper identity. If required, the packets should be packed in card-board boxes to minimize damage and moisture absorption.

3. Guidelines for Submission of Recalcitrant / Intermediate Seed Material

Generally characterized by large sized and high moisture contents (20-80%) at the time of shedding. These can be supplied to NBPGR, only in case, where established protocols are available for conservation using cryogenic technology. The guidelines to be follows are given below:

- (i) Preferably, more than 1000 seeds supplied. However, recognizing the importance of material, even small quantity may be acceptable. Supply of additional seeds may help develop DNA profiles.
- (ii) Sent complete fruit. To avoid any injury to the fruit surface, it should be sent in aerated polythene bags/cardboard boxes.
- (iii) If fruits are bulky and difficult to transport, the seeds should be extracted without causing any injury and should be transported within 48 hrs, packed in saw dust/charcoal /peat moss etc.
- (iv) Avoid transporting at high temperature (above 30⁰ C). Store and transport should be preferably in moist conditions between 15-20⁰C temperature conditions.
- (v) Extracted seeds should be treated with suitable fungicide (0.1 % Captan or Thiram powder).
- (vi) Avoid air drying and washing of seeds.

In remaining cases the genetic material should be supplied to relevant NAGS in the form of propagules establishment in the field gene bank following the guidelines given below. Acknowledgement deposition and establishment of genetic material has to be obtained from the concerned NAGS and submitted along with application.

4. Guidelines for Submission of Propagules

For vegetatively propagated crop species, the germplasm material / propagules (tuber, bulbs, rhizomes, cuttings etc) supplied to concerned crop based designated NAGS after initial establishment and conservation. Acknowledgement obtained from concerned NAGS has to accompany the proposal. Additionally, following guidelines need to be followed for safe supply and conservation of germplasm

- (i) 10-25 propagules (depending on crop) supplied to the concerned NAGS for their maintenance in field repository or in-vitro repository (if available) with a request for an acknowledgement.
- (ii) Concerned NAGS should be informed in advance about the supply of material to facilitate processing and establishment of germplasm.
- (iii) Genetic material, stocks, propagules of non-orthodox seed producing crops are generally being maintained in the form of grafts, slips, propagules, seedlings and plants. While supplying genetic material following steps and precautions are to be followed depending on the crop:

- (a) Slips, grafts, propagules or plants supplied to the NAGS should be free from insects, weeds and diseases as far as possible. Material should be well labeled and packed properly in aerated polythene bags. During the dry summer grafts or crafts are to be wrapped in moist moss grass to retain the moisture.
- (b) In case of crops like coconut, the material should be sent either embryos or seedlings. If the embryos need to be transferred from the field, the embryos need to be embedded in the endosperm and packed in the sterile plastic bag with sterile moist cotton. These are to be kept in the refrigerator over night and transferred in the same box with proper labels on it.
- (c) In case of seedlings, the embryos are to be grown using the river sand in plastic bags/boxes. Established seedlings are to be transferred to bigger pots. The healthy, vigorous seedlings can be supplied.
- (iv) Material should be packed in small wooden/card-board boxes with proper aeration. Also these boxes should be well marked with labels at 3 or 4 places “To be handled carefully: seedlings” in order to avoid any damage during transit.
- (v) Material should be sent to the NAGS immediately after harvest. To avoid any delay in transaction, use speed post or courier services or airfreight.

CHECK LIST FOR SCREENING OF APPLICATIONS:

- (i) Whether this is a new application or a registered one ? (Yes/No)
- (ii) Whether same or similar material has been registered earlier? (Yes/No)
- (iii) Whether unique or distinguishing evidence or data is provided in support of the claim on potential value of germplasm? (Yes/No)
- (iv) Whether documentary evidence or data is provided in support of the claim on potential value of germplasm? (Yes/No)
- (v) State any other economic potential value of germplasm, if possible.
- (vi) NBPGR viewpoint about the candidate germplasm.
- (vii) Whether applicant, institution, university, or centre has given a commitment for maintenance and supply of germplasm for use? (Yes/No)
- (viii) Whether appropriate size of germplasm sample for long – term storage at National Gene Bank or for conservation and maintenance of active collections at the concerned NAGS has been sent? (Yes/No)
- (ix) Whether the applicant has sent maintainer line of the National Gene Bank, (Yes/No)
- (x) Whether acknowledgement receipt of germplasm from concerned NAGS for deposition and establishment is attached, whether required? (Yes/No)
- (xi) Whether detailed address of the corresponding person is given? (Yes/No)
- (xii) Whether appropriate institutional authority has duly endorsed the application? (Yes/No)

Literature cited

References

- Arora, R.K. 1995. Genetic resources of vegetable crops in India : Their diversity and conservation, In Genetic Resources of Vegetable Crops (Eds., R.S. Paroda, P.N. Gupta, Mathura Rai and S. Kochhar), NBPGR, New Delhi. pp. 29-39.
- Arora, R.K. and E.R. Nayar 1984. Wild relatives of crop plants in India, NBPGR Sci. Monograph No. 7. National Bureau of Plant Genetic Resources (NBPGR), New Delhi.
- Harlan J. 1992. Crops and Man. 2nd ed. American Society of Agronomy, Madison,WI, pp. 284.
- Verma, S.K., Negi, K.S., Muneem, K.C. and Arya, R.R. (2008a). “ In - Situ Conservation Approach for Germplasm of Vegetable Crops”** In winter school on conservation and utilization of indigenous germplasm in improvement of veg. Crops. Compiled by D.K. Singh, Department of Vegetable Science, College of Agri. GBPUA&T-263132, Pantnagar, Uttarakhand. pp. 183-191.
- Verma, S.K., Negi, K.S., Muneem, K.C. and Arya, R.R. (2008b). “ Genetic Diversity of Indigenous Underutilized cucurbits”** In winter school on conservation and utilization of indigenous germplasm in improvement of veg. Crops. Compiled by D.K. Singh, Department of Vegetable Science, College of Agri. GBPUA&T-263132, Pantnagar, Uttarakhand. pp 200-213.