

Importance of Plant Genetic Recourses in Plant Breeding

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SUMMARY

The sum total of hereditary material i.e. all the alleles of various genes, present in a crop species and its wild relatives is referred to as germplasm. The sum total of hereditary material i.e. all the alleles of various genes, present in a crop species and its wild relatives is referred to as germplasm. It very much useful in wild hybridization or distant hybridization programmes.

INTRODUCTION

Plant genetic resources is also known as genetic resources or gene pool or genetic stock. Important features of plant genetic resources are as- Genetic pool represents the entire genetic variability or diversity available in a crop species. Germplasm consists of land races, modern cultivars, obsolete cultivars, breeding stocks, wild forms and wild species of cultivated crops. Germplasm includes both cultivated and wild species and relatives of crop plants. Germplasm is collected from centres of diversity, gene banks, gene sanctuaries, farmer's fields, markers and seed companies. Germplasm is the basic material for launching a crop improvement programme and Germplasm may be indigenous (collected within country) or exotic (collected from foreign countries)

Germplasm Conservation

Conservation refers to protection of genetic diversity of crop plants from genetic erosion. There are two important methods of germplasm conservation or preservation.

- i) In-situ conservation and ex situ conservation
- ii) Ex - situ conservation

In - situ conservation:

Conservation of germplasm under natural conditions is referred to as in situ conservation. This is achieved by protecting the area from – human interference, such an area is often called natural park, biosphere reserve or gene sanctuary. For examples: NBPGR, New Delhi, established gene sanctuaries in Meghalaya for citrus, north Eastern regions for musa, citrus, oryza and *saccharum*. Gene sanctuaries offer the following advantage.

Merits: The wild species and the compete natural or semi natural ecosystems are preserved together. This is also known as genetic resources or gene pool or genetic stock. Important features of plant genetic resources are given below.

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- Germplasm includes both cultivated and wild species and relatives of crop plants.
- Germplasm is collected from centres of diversity, gene banks, gene sanctuaries, farmer's fields, markers and seed companies.
- Germplasm is the basic material for launching a crop improvement programme.
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Demerits:

- Each protected area will cover only very small portion of total diversity of a crop species, hence several areas will have to be conserved for a single species.
- The management of such areas also poses several problems.
- This is a costly method of germplasm conservation.

Ex - situ conservation:

It refers to preservation of germplasm in gene banks. This is the most practical method of germplasm conservation. This method has following advantages.

- It is possible to preserve entire genetic diversity of a crop species at one place.
- Handling of germplasm is also easy.

This is a cheap method of germplasm conservation.

This type of conservation can be achieved in the following 5 ways.

Seed banks:

Germplasm is stored as seeds of various genotypes. Seed conservation is quite easy, relatively safe and needs minimum space. Seeds are classified, on the basis of their storability into two major groups.

- a) Orthodox seeds and b) Recalcitrant seeds

Orthodox seeds:

Seeds which can be dried to low moisture content and stored at low temperature without losing their viability for long periods of time is known as orthodox seeds. (eg.) Seeds of corn, wheat, rice, carrot, papaya, pepper, chickpea, cotton, sunflower.

Recalcitrant:

Seeds which show very drastic loss in viability with a decrease in moisture content below 12 to 13% are known as recalcitrant seeds. (e.g) citrus, cocoa, coffee, rubber, oilpalm, mango, jack fruit etc.

Seed storage: Based on duration of storage, seed bank collections are classified into three groups. (a) Base collections (b) Active collections and (c) Working collection.

Base collections: Seeds can be conserved under long term (50 to 100 years), at about – 20°C with 5% moisture content. They are disturbed only for regeneration.

Active collection: Seeds are stored at 0°C temperature and the seed moisture is between 5 and 8%. The storage is for medium duration, i.e., 10-15 years. These collections are used for evaluation, multiplication, and distribution of the accessions.

Working collections: Seeds are stored for 3-5 years at 5-10°C and the usually contain about 10% moisture. Such materials are regularly used in crop improvement programmes.

Plant Bank:

(Field or plant bank) is an orchard or a field in which accessions of fruit trees or vegetatively propagated crops are grown and maintained. But there are some limitations

Limitations:

1. Require large areas
2. Expensive to establish and maintain
3. Prone to damage from disease and insect attacks
4. Man – made
5. Natural disasters
6. Human errors in handling

Shoot tip banks:

Germplasm is conserved as slow growth cultures of shoot-tips and node segments. Conservation of genetic stocks by meristem cultures. There are several advantages as given below.

- Each genotype can be conserved indefinitely free from virus or other pathogens.
- It is advantageous for vegetatively propagated crops like potato, sweet potato, cassava etc., because seed production in these crops is poor
- Vegetatively propagated material can be saved from natural disasters or pathogen attack.
- Long regeneration cycle can be envisaged from meristem cultures.
- Regeneration of meristems is extremely easy.
- Plant species having recalcitrant seeds can be easily conserved by meristem cultures.

Cell and organ banks:

A germplasm collection based on cryopreserved (at – 196°C in liquid nitrogen) embryogenic cell cultures, somatic/zygotic embryos they be called cell and organ bank.

DNA banks:

In these banks, DNA segments from the genomes of germplasm accessions are maintained and conserved.

Germplasm evaluation

Evaluation refers to screening of germplasms in respect of morphological, genetical, economic, biochemical, physiological, pathological and entomological attributes. Evaluation of germplasm is essential from following angles.

- To identify gene sources for resistance to biotic and abiotic stresses, earliness, dwarfness, productivity and quality characters.
- To classify the germplasm into various groups
- To get a clear picture about the significance of individual germplasm line.

Germplasm cataloguing, Data storage and Retrieval.

Each germplasm accession is given an accession number. This number is pre fixed in India, with either IC (Indigenous collection), EC (exotic collection) or IW (Indigenous wild). Information on the species and variety names, place of origin, adaptation and on its various feature or descriptors is also recorded in the germplasm maintenance records. Catalogues of the germplasm collection for various crops are published by the gene banks. The amount of data recorded during evaluation is huge. Its compilation, storage and retrieval is now done using special computer programmes.

National Bureau of Plant Genetic Resources (NBPGR)

NBPGR establishment in 1976 is the nodal organization in India for planning, conducting, promoting, coordinating and lending all activities concerning plant.

- Collection
- Introduction
- Exchange
- Evaluation
- Documentation
- Safe conservation
- Sustainable management of germplasm

The Indian sub-continent, thus holds prominence as one of the twelve regions of variability in crop plants in global perspective.

Gene banks for various crops in India

Institutes	Crops
Central Institute for Cotton Research, Nagpur	Cotton
Central Plantation crops Research Institute, Kasargod	Plantation crop
Central Potato Research Institute, Simla	Potato
Central tobacco research Institute, Rajahmundry	Tobacco
Central tuber crops research Institute, Thiruvananthapuram	Tuber crops other than potato
Central Rice Research Institute, Cuttack	Rice
Directorate of Oilseeds research, Hyderabad	Oilseeds
Directorate of Wheat Research, Karnal	Wheat
Indian Agricultural Research Institute, New Delhi	Maize
Indian Grassland and Fodder Research Institute, Jhansi	Forge and fodder crops
National research centre for sorghum, Hyderabad	Sorghum
International Crops Research Institute for Semi-Arid Tropics	Groundnut, Pearl millet, Sorghum, Pigeon pea and Bengal gram

List of important International Institutes working for conservation of germplasm

Name	Institute	Activity
IRRI	International Rice Research Institute, Los Banos, Philippines	Tropical rice Rice collection: 42,000
CIMMYT	Centre International de-Mejoramientos de maize Trigo, El Baton, Mexico	Maize and wheat (Triticale, barely, sorghum) Maize collection – 8000
CIAT	Center International de-agricultural Tropical Palmira, Columbia	Cassava and beans, (also maize and rice) in collaboration with CIMMYT and IRRI
IITA	International Institute of Tropical Agriculture, Ibadan, Nigeria.	Grain legumes, roots, and tubers, farming systems.

CIP	Centre International de-papa-Lima. Peru	Potatoes
ICRISAT	International Crops Research Institute, for Semi-Arid Tropics, Hyderabad, India	Sorghum, Groundnut, Cumbu, Bengalgram, Redgram.
WARDA	West African Rice Development Association, Monrovia, Liberia	Regional Cooperative Rice Research in Collaboration with IITA and IRRI
IPGRI	International Plant Genetic Research Institute, Rome Italy	Genetic conservation.
AVRDC	The Asian Vegetable Research and Development Centre, Taiwan	Tomato, Onion, Peppers Chinese cabbage.

CONCLUSION

Plant genetic resources or genetic stock is very much useful in wide hybridization breeding, it is preliminary used genetic stock as a parent in disease resistance or insect /pest resistance breeding

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