Plant Genetic Resources

Dr. Sithara K Urumbil Assistant Professor In Botany Little Flower College Guruvayoor

Plant Genetic Resources

The sum total of the hereditary material, ie., all the alleles of various genes, present in a crop species and its wild relatives is known as genetic resource, germplasm, gene pool or genetic stock of that species

Features.....

It represents the entire genetic variability or diversity available in a crop species

- It consists of land races, modern cultivars, absolute cultivars, breeding stocks, wild forms, and species of cultivated crops
- It is collected from centres of diversity, gene banks, gene sanctuaries, farmers fields, markets and seed companies
- It is the basic material for launching a crop improvement programme

It may be indigenous or exotic

Genetic erosion- Gradual loss of genetic diversity

International Bureau of Plant Genetic Resources-1974 Headquarters' in Rome

Germplasm Conservation

Conservation of germplasm entails the protection and preservation of the genetic resource and diversity of crop plants from genetic erosion

IBPGR

National Germplasm Repository •Ex-situ Conservation •In-situ Conservation

IN-SITU

- 1. Protected Areas
 - National Parks
 - Sanctuaries
 - Biosphere Reserves
- 2. Sacred Forests and Lakes

- EX-SITU
- 1. Seed Banks, Gene Banks
- 2. Long Term Captive Breeding
- 3. Animal Translocations

Biodiversity Conservation

- 4. Tissue Culture Banks
- 5. Cryopreservation of Gametes and Embryos
- 6. Botanical Gardens
- 7. Zoological Gardens or Zoos.



) -----

In situ conservation

Maintain genetic variation on site (wild or traditional farming systems)

Genetic reserve conservation

Conservation of wild species in situ

This is the most appropriate strategy for most wild species In-situ conservation is on site conservation or the conservation of genetic resources in natural populations of plant or animal species, such as forest genetic resources in natural populations of tree species.

- It is the process of protecting an endangered plant or animal species in its natural habitat, either by protecting or cleaning up the habitat itself, or by defending the species from predators.
- It is applied to conservation of agricultural biodiversity in agro forestry by farmers, especially those using unconventional farming practices. In-situ conservation is being done by declaring area as protected area.

In situ

Genetic reserve (e.g. protected National Park)

On-farm Glenveagh National Park Home gardens Ballycroy National Gentiana verna Park, Co. Mayo Connemara National Park The Burren National Park Wicklow Mountain National Park Killarney National Park Kerry slug Geomalacus

On farm conservation

The maintenance of traditional crop varieties (landraces) or animal breeds

Landraces are sown and harvested; breeds are maintained

(subsidise farmers to farm old varieties/breeds)

Home garden conservation

Smaller scale, generally more species diverse

Mainly medicinal, flavouring, or vegetable spp.

Eg. Chelsea Physic Garden, London

In India following types of natural habitats are being maintained:

1. National parks 2. Wildlife sanctuaries 3. Biosphere reserves INDIA has over 600 protected areas, which includes over 90 national parks, over 500 animal sanctuaries and 15 biosphere reserves.

1. National Parks:

A national park is an area which is strictly reserved for the betterment of the wildlife and where activities like forestry, grazing on cultivation are not permitted. In these parks, even private ownership rights are not allowed.

Their boundaries are well marked and circumscribed. They are usually small reserves spreading in an area of 100 Sq. km. to 500 sq. km. In national parks, the emphasis is on the preservation of a single plant or animal species.

2. Wildlife Sanctuaries:

A sanctuary is a protected area which is reserved for the conservation of only animals and human activities like harvesting of timber, collecting minor forest products and private ownership rights are allowed as long as they do not interfere with well-being of animals. Boundaries of sanctuaries are not well defined and controlled biotic interference is permitted, e.g., tourist activity.

3. Biosphere Reserves:

It is a special category of protected areas where human population also forms a part of the system. They are large protected area of usually more than 5000 sq.km. A biosphere reserves has 3 parts- core, buffer and transition zone.

1. Core zone is the inner zone; this is undisturbed and legally protected area.

2. Buffer zone lies between the core and transition zone. Some research and educational activities are permitted here.

3. Transition zone is the outermost part of biosphere reserves. Here cropping, forestry, recreation, fishery and other activities are allowed.

The main functions of biodiversity reserves are:

1. Conservation:

To ensure the conservation of ecosystem, species and genetic resources.

2. Development:

To promote economic development, while maintaining cultural, social and ecological identity.

3. Scientific Research:

To provide support for research related to monitoring and education, local, national and global issues.

Biosphere reserves serve in some ways as 'living laboratories' for testing out and demonstrating integrated management of land, water and biodiversity.

Advantages of in-situ conservation:

1. The flora and fauna live in natural habitats without human interference.

- 2. The life cycles of the organisms and their evolution progresses in a natural way.
- 3. In-situ conservation provides the required green cover and its associated benefits to our environment.
- 4. It is less expensive and easy to manage.
- 5. The interests of the indigenous people are also protected.

Ex-Situ Conservation:

Ex-situ conservation is the preservation of components of biological diversity outside their natural habitats. This involves conservation of genetic resources, as well as wild and cultivated or species, and draws on a diverse body of techniques and facilities. Such strategies include establishment of botanical gardens, zoos, conservation strands and gene, pollen seed, seedling, tissue culture and DNA banks.

i. Seed gene bank:

These are cold storages where seeds are kept under controlled temperature and humidity for storage and this is easiest way to store the germ plasma of plants at low temperature. Seeds preserved under controlled conditions (minus temperature) remain viable for long durations of time.

TYPES OF SEED COLLECTIONS

Types of Seed Collections

Based on the use and duration of conservation, seed collections are of three types:

1) Base collections

2) Active collections

3) Working collections

1. Base Collections

Base collections include maximum number of accessions available in a crop. These are meant for long term conservation (upto 50 years or more) and are stored at 18- or 20 0C in hermetically sealed containers. The seeds are dried to 5+-1 percent moisture and have more than 85% initial seed viability. These collections are distributed only for the purpose of regeneration. These are used only when germplasm from other sources is not available for use in breeding. It is also known as principle collection refers to the whole collection.

2. Active Collections: This category of germplasm is actively utilized in breeding programme are conserved for medium term (8-10 years or more). These collections stored at zero degree celcius with moisture content around 8%. Germination test is carried out after every 5-10 years to assess the reduction in seed viability.

There collections are frequently utilized by breeders in their crop programmes. These are stored for short term (3 to 5 years). The seed is stored at 5-10 with moisture content of 8-10%. This is another category of seed collections called core collection. It refers to subset of base collection which represents the large collection or base collection. In other words, core collection is a limited set of accessions derived from existing germplasm collections, chosen to represent the genetic in the whole collection.

1. Sources of Collection:

There are five important sources of germplasm collections: viz
1) Centre of diversity,
2) Gene banks,
3) Gene sanctuaries,
4) Seed companies, and
5) Farmers field's. Moreover, collections can be local exploration trips to the of crop diversity.

ii. Gene bank:

Genetic variability also is preserved by gene bank under normal growing conditions. These are cold storages where germ plam are kept under controlled temperature and humidity for storage; this is an important way of preserving the genetic resources.

iii. Cryopreservation:

This is the newest application of technology for preservation of biotic parts. This type of conservation is done at very low temperature (196°C) in liquid nitrogen. The metabolic activities of the organisms are suspended under low temperature, which are later used for research purposes.

iv. Tissue culture bank:

Cryopreservation of disease free meristems is very helpful. Long term culture of excised roots and shoots are maintained. Meristem culture is very popular in plant propagation as it's a virus and disease free method of multiplication.

Plant Banks(Field Banks)

An orchard or a field in which fruit trees and vegetatively propagated crops are grown and maintained

Shoot-tip banks

Slow growing cultures of shoot tips and note segments



Cell and Organ Banks

These are germplasm collections of cryopreserved (at -196 degree Cel in liquid nitrogen) embryonic cell cultures or somatic or zygotic embryos

v. Long term captive breeding:

The method involves capture, maintenance and captive breeding on long term basis of individuals of the endangered species which have lost their habitat permanently or certain highly unfavorable conditions are present in their habitat.

vi. Botanical gardens:

A botanical garden is a place where flowers, fruits and vegetables are grown. The botanical gardens provide beauty and calm environment. Most of them have started keeping exotic plants for educational and research purposes.

vii. Animal Translocation:

Release of animals in a new locality which come from anywhere else.

Advantages of ex-situ preservation:

- 1. It is useful for declining population of species.
- 2. Endangered animals on the verge of extinction are successfully breeded.
- 3. Threatened species are breeded in captivity and then released in the natural habitats.
- 4. Ex-situ centres offer the possibilities of observing wild animals, which is otherwise not possible.
- 5. It is extremely useful for conducting research and scientific work on different species.

Germplasm cataloguing, data storage and retrieval



Gene banks for various crops in India Institutes

- 1. Central Institute for Cotton Research, Nagpur
- 2. Central Plantation Crops Research Institute, Kasargod
- 3. Central Potato Research Institute, Simla
- 4. Central Tuber Crops Research Institute, Trivandrum
- 5. Central Rice Research Institute, Cuttack
- 6. Directorate of Oilseeds Research, Hyderabad
- 7. Directorate of Wheat Research, Karnal
- 8. Indian Agricultural Research Institute, NewDelhi
- 9. Indian Grassland and Fodder Research Institute, Jhansi

 National Research Centre for Sorghum, Hyderabad
 International Crops Research Institute for Semi Arid Tropics

Crops Cotton Plantation crops Potato Tuber crops Rice Oilseeds Wheat Maize Forage and fodder crops. Sorghum Groundnut, pearl millet, sorghum, pigeon pea and Bengal gram.