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Plant Genetic Resources and Its Conservation for Crop Improvement

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INTRODUCTION

The sum total of genes present in a crop species is referred to as genetic resources or gene pool. In other term, it refers to a whole library of different alleles of a crop species. It is also known as gene pool or genetic stock. Germplasm or gene pool is the basic material for a plant breeder to initiate his breeding programme for crop improvement. The Convention on Biological Diversity (CBD) defines genetic resources as genetic material of actual or potential value. The term 'Genetic material' means any material of plant, animal, microbial or other origin containing functional units of heredity. So, conservation of the genetic resource of any crop species is of utmost important for improving the crop. In other terms genetic resource represents the entire genetic variability or diversity of a particular crop in the form of both cultivated and wild species or relatives of crop plants. Germplasms are collected from centre of diversity, gene banks, gene sanctuaries, farmers' fields, markets and seed companies etc. Germplasm may be indigenous (collected within country) or exotic (collected from foreign countries). In India National Burou of Plant Genetic Resource (NBPGR) is responsible for identifying trait-specific pre-adapted climate resilient genotypes, promising material with disease resistance and quality traits which the breeders use for various crop improvement programmes (*Singh* et al., 2020). Loss of these genetic material is a threatening to human kind as it will cause loss or deletion of beneficial genes along with the germplasm. So, conservation of each and every genetic material or germplasm irrespective of its kind or type is the most needed approach for crop improvement. The overall activities of plant genetic resource are collection, conservation, study or documentation and utilization.

Kinds of Germplasm and its importance:

The germplasm consists of various plant materials of a crop such as land races, advanced (homozygous) breeding materials, obsolete cultivars, wild forms of cultivated species, modern cultivars, wild relatives, mutants etc. All these types of genetic resources are equally important for its utilization in crop improvement. Utilization of plant genetic resource is a base broadening exercise which gradually improves current adaptation of breeding material and has the potential to cater to unforeseen breeding needs (Bains et al., 2012). Land races are nothing but primitive cultivars which were selected and cultivated by the farmers for many generations without systematic plant breeding efforts. Land races have high level of genetic diversity and high degree of resistance to biotic and abiotic stresses. The main drawbacks of land races are that they are less uniform and low yielders. Land races were first collected and studied by N.I. Vavilor in rice. Obsolete Cultivars are the varieties developed by systematic breeding effort which were popular earlier due to its various desired traits and now have been replaced by new varieties. Example: Wheat varieties K65, K68, pb 591 were most popular traditional tall varieties before introduction of high yielding dwarf Mexican wheat varieties. Modern cultivars are **t**he currently cultivated high yielding varieties also known as improved cultivars or advanced cultivars. These varieties have high yield potential and uniformity as compared to obsolete varieties land races. As these are good sources of genes for yield and quality, they are extensively used as parents in the breeding programmes. Advanced breeding lines are pre -released lines which have been developed by plant breeders in modern scientific breeding programmes. This group includes, nearly homozygous lines, lines derived from biotechnology programmes i.e. transgenic plants and mutant lines etc. Wild forms of cultivated species are available in almost all crop plants. Although these are not under cultivation but such species have generally high degree of resistance to biotic and abiotic stresses and hence utilized in breeding programme for transferring stress resistance genes. Wild Relatives are those naturally occurring plant species which have common ancestry with crops and can cross with crop species. Wild relatives include all other species, which are related to the crop species by descent during their evolution. Both these groups are sources of valuable genes for biotic and abiotic stress and for quality traits and yield. Mutants forms the extra variability which is created through induced mutations and it constitutes important components of genepool. Mutation breeding is used when the desired character is not found in the genetic stocks of cultivated species and their wild relatives. Mutations do occur in nature as well as can be induced through the use of physical and chemical mutagens. The mutant for various characters sometimes may not be released as a variety, but they are added in the genepool.

Types of seed collections for Genetic Resource Conservation: Based on the use and duration of conservation, seed collections are of three types: base collections, active collections and working collections.

Base collections: It is also known as principal collection. These consist of all the accessions present in the germplasm of a crop. They are stored at about -18C or -20C with 5 + 1% moisture content; they are disturbed only for regeneration. High quality orthodox seeds can maintain good viability up to 100 years.

Active collections: The accessions in an active collection are stored at temperatures below 15C (often near 0C), and the seed moisture is kept at 5%. The storage is for medium duration, i.e., 10-15 years. These collections are actively utilized in breeding programmes.

Working Collections: The accessions being actively used in crop improvement programmes constitute working collection. Their seeds are stored for 3-5 years at less than 15C and they usually contain about 10%

moisture. These collections are maintained by the breeders using them.

Core collection: The concept of core collection was proposed by Franked it refers to a subset of base collection which represents the large collection. Or a limited set of accessions derived from an existing germplasm collection.

Germplasm conservation: Conservation refers to protection of genetic diversity of crop plants from genetic erosion. Genetic erosion refers to loss of genetic diversity between and within populations of the same species over a period of time. There are two important methods of germplasm conservation or preservation *viz.*, In situ conservation and Ex situ conservation. Conservation of germplasm under natural habitat is referred to as in situ conservation. This is achieved by protecting this area from human interference, such an area is often called as natural park, biosphere reserve or gene sanctuary. A gene sanctuary is best located within the center of origin of crop species concerned, preferably covering the microcenter with in the center of origin. NBPGR, New Delhi is making attempts to establish gene sanctuaries in Meghalaya for Citrus and in the North-Eastern region for *Musa, Citrus, Oryza*, *Saccharum* and *Megifera.* The main drawback of this method is that the 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.



Fig: 1 Field Gene Bank in Ranchi Fig: 2 Structure of Seed Gene Bank Fig: 3 Cryopreservation

On the other hand conservation of germplasm away from its natural habitat is called ex situ germplasm conservation. In this method it is possible to preserve entire genetic diversity of a crop species at one place. Preservation in the form of seed is the most common and easy method, relatively safe, requires minimum space and easy to maintain. Glass, tin or plastic containers are used for preservation and storage of seeds. Organizations associated with germplasm conservation are International Plant Genetic Resources Institute (IPGRI) located at Rome, Italy, National Bureau of Plant Genetic Resources (NBPGR**)** at New Delhi, India, National Research Centers of different crops in different parts of India etc. Gene banks are established in above mentioned places for conservation of genetic resources. The purpose of gene banks is to collect, conserve and make genetic resources available. There are different kinds of gene banks including seed banks, field banks, *in vitro* banks, cryo banks, vegetative banks and DNA banks. Gene banks around the world hold collections of a broad range of plant genetic resources, with the overall aim of long-term conservation and accessibility of plant germplasm to plant breeders, researchers and other users. Another technique for conservation of genetic resource is cryopreservation. It is a technique that ensures safe, long-term conservation of genetic resources of plant species with recalcitrant seeds, of vegetatively propagated species and of biotechnology products such as somatic embryos, cell lines and genetically transformed material. Tissue culture procedures are usually required to multiply super cooled material via axillary shoots or somatic embryogenesis, and were improved for use with tree species in recent years.

CONCLUSION

Conservation of genetic resource is very important for crop improvement programme because genetic resources contains many important genes for both biotic and abiotic stress resistance which will ultimately increase crop yield. So, all forms of genetic resources in all crops present in gene pool should be collected, evaluated, documented, conserved and utilized so that new crop varieties with better yield and quality can be achieved and made available for human population.

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