Role of Pre-breeding and Its Applications in Crop Improvement

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Pre-breeding refers to the transfer of beneficial alleles from unused germplasm into elite breeding materials and the term "pre-breeding' was first used by Rick (1984). Pre-breeding refers to all activities designed to identify desirable characteristics and/or genes from unadapted materials that cannot be used directly in breeding populations, and to transfer these traits to an intermediate set of materials that breeders can use further in producing new varieties for farmers. It is a necessary first step in the "linking genetic variability to utilization" use of diversity arising from wild relatives and other unimproved materials. These activities are a collaboration between the germplasm curator and the plant breeder who need to work together to understand the scope and value of germplasm collections and how new traits from these collect ions can be bred into new varieties

The Main Objectives of Pre-Breeding

Improved germplasm and associated genetic knowledge that enhance resistance expression and diversity Improved parental stocks which can be readily utilized within breeding programs Improved selection methodologies Identify potentially useful genes in a well organized and documented gene bank Design strategies to develop improved germplasm that are ready to use in varietal development Pre-breeding is a collaborative endeavor, that is buttressed by communication, between gene bank curators and breeders.

Methods of Pre-Breeding

1. Introgression through back cross: a) Recurrent backcross b) Inbred backcross: c) Congruity backcross: 2. Incorporation a) Direct hybridization or wide hybridization or natural crossing b) Biotechnological tools i) Vector aided transformation or direct transfer (1) Agrobacterium mediated gene transfer (2) Viral vector mediated gene transfer ii) Direct transfer (1) Biolistic transformation or particle bombardment (2) Lipofection or liposome mediated gene transfer (3) Microinjection (4) Macro injection (5) Electroporation (6) PEG method (7) Transformation using pollen or pollen tube (8) Fibre mediated DNA delivery or silicon carbide mediated gene transfer

Major Applications of Pre-Breeding in Crop Improvement

1. Broadening the genetic base, to reduce vulnerability
2. Identifying traits in exotic materials and moving those genes into material which are more readily accessed by breeders
3. Introgression genes from wild species into breeding populations
4. Identification and transfer of novel genes from unrelated species using genetic transformation techniques Challenges in Adopting Pre-Breeding Though pre breeding is the playing key role in crop improvement, there are several factors which become obstacles in adopting pre breeding as the first step of crop improvement.

Lack of characterization and evaluation data- with lack/ false data of accession it is not possible to use this accession in the pre breeding. Knowledge of the genetic diversity- to use the accessions in the pre breeding extensive knowledge about genetic diversity of individual and population is essential. Inter species relationship-cross incompatibility is the major factors which limits the use of different species in transferring gene of importance across the species. Strong breeding program and funding sources. Linkage drag-The use of gene bank accessions in breeding programmes is limited by the high degree of difficulty and length of time often associated with separating the desirable genes from the undesirable ones.

Usefulness of Germplasm in Pre-Breeding

Germplasm plays a vital role in improving crop cultivars utilizing the useful traits. Traits focussed in major food crops includes

- ♣ Broadening the genetic base
- ♣ Improving the level of resistance to biotic and abiotic stresses
- ♣ Improving the yield and grain quality traits
- ♣ Improving the biomass yield

- ♣ Developing short duration varieties

Limitations of pre breeding

- ♣ Require longer time (5 to 10 years more)
- ♣ Accessibility and exchange of germplasm is difficult due to intellectual property rights (IPR)
- ♣ New types of production practices emerge
- ♣ Cross incompatibility through wide hybridization
- ♣ Linkage drag
- ♣ Low levels of recombination in the hybrids
- ♣ Evolve new pest or disease problems
- ♣ Needs establish new market demands
- ♣ Climate shock problems.

References

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