

Pre-breeding: role in crop improvement

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What is Pre breeding?

All activities aimed at identifying desirable characteristics and/or genes from unadapted materials that cannot be used directly in breeding populations and transferring these traits to an intermediate set of materials that breeders can use to produce new varieties for farmers are referred to as pre-breeding. It's an important first step in "connecting genetic variety to use," or the use of diversity derived from wild relatives and other unimproved materials. These actions are cooperation between a germplasm curator and a plant breeder who must work together to comprehend the extent and usefulness of germplasm collections, as well as how new features from these collections might be developed 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 endeavour, that is buttressed by communication, between gene bank curators and breeders.

Methods of Pre-Breeding

1. Introgression through the back cross:

- Recurrent backcross
- Inbred backcross
- Congruity backcross

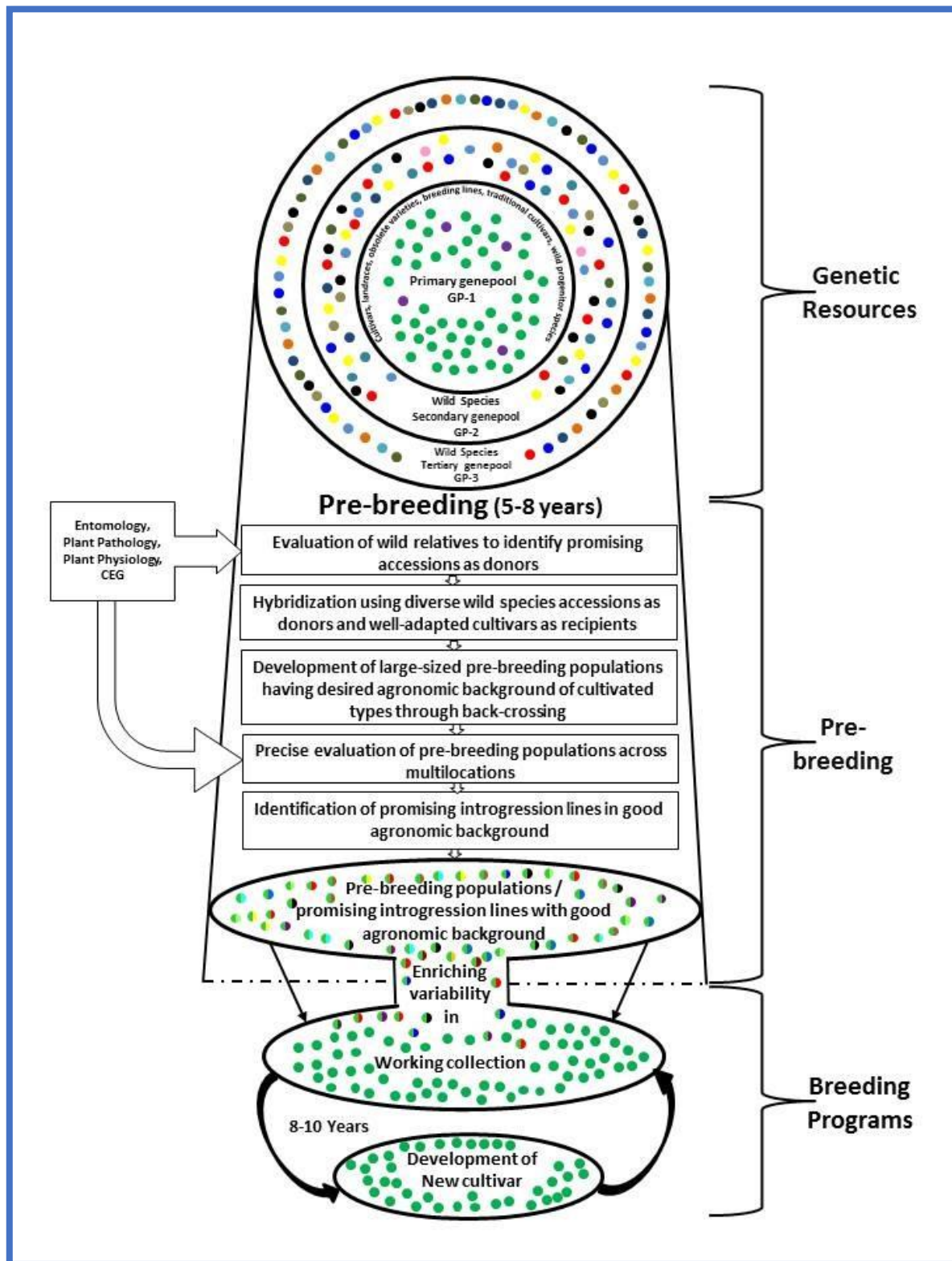


Figure- Procedure of pre breeding and breeding programmes

2. Incorporation

- a. Direct hybridization or wide hybridization or natural crossing
- b. Biotechnological tools

1. Vector aided transformation or direct transfer

- Agrobacterium-mediated gene transfer
- Viral vector-mediated gene transfer

2. Direct transfer

- Biolistic transformation or particle bombardment
- Lipofection or liposome-mediated gene transfer
- Microinjection
- Macroinjection
- Electroporation
- PEG method
- Transformation using pollen or pollen tube
- Fibre mediated DNA delivery or silicon carbide mediated gene transfer

Major applications of pre-breeding in crop improvement:

1. Increasing the genetic diversity of the population to lessen vulnerability
2. Identifying features in exotic materials and transferring those genes to material that breeders can more easily access.
3. Wild-type genes are introduced into breeding populations.
4. Using genetic transformation techniques, identify and transfer novel genes from unrelated species.

Challenges in adopting pre-breeding:

Though pre-breeding is playing a key role in crop improvement, there are several factors that become obstacles in adopting pre-breeding as the first step of crop improvement.

- Lack of characterization and assessment data—it is impossible to use this accession in pre-breeding due to a lack of/false data.
- Genetic variety knowledge—in order to use accessions in pre-breeding, a thorough understanding of individual and population genetic diversity is required.



- The key barrier limiting the usage of different species in transferring important genes across species is interspecies relationship-cross incompatibility.
- A strong breeding program with a variety of funding options.
- Linkage drag-The use of gene bank accessions in breeding programs is limited due to the high level of difficulty and time required to separate desirable genes from undesirable genes.

References

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