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PRE-BREEDING PLAY IMPORTANT ROLE IN CROP IMPROVEMENT

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Introduction

The term genetic enhancement was first used by Jones in 1983. It refers to transfer of useful from exotic or wild types into agronomically acceptable background. In 1984, Rick used the term pre-breeding to describe the same activity. Now term genetic enhancement and pre-breeding are used as synonyms and interchangeable.

Pre-breeding

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 use of diversity arising from wild relatives and other unimproved materials. Pre-breeding is the most promising alternative to link genetic resources and breeding programs. As pre-breeding is being carried out, the resulting materials are expected to have merit to be included in ordinary breeding programs.

Although there are some different concepts of exotics, Hallauer & Miranda Filho (1988) consider that exotics for pre-breeding purposes include any germplasm that does not have immediate usefulness without selection for adaptation for a given area. In this sense, exotic germplasms are represented by races, populations, inbred lines, *etc*. Consequently, the results of crosses between adapted and exotic materials, where different proportions of introgression are obtained and evaluated, have been denominated as semi-exotic materials. According to Hallauer (1978), the utilization of semi-exotic populations has been the most common procedure to evaluate exotic germplasms. In order to obtain promising results with exotics their reproduction is necessary for a few generations in order to allow genetic recombination accompanied by mild selection. Before useful recombinants can be selected a minimum of five generations of random mating with mild selection pressure is indicated (Lonnquist, 1974).

The Gene Pool Concept (Harlan and de Wet, 1971)

"The gene pool is the total genetic variation in the breeding population of a species and closely related species capable of crossing with it'. The gene pool of a crop is made up of botanical varieties, landraces, inbred lines, ancient landraces, obsolete and modern cultivars, related wild species, subspecies, and weedy companion species (Haussmann *et al.*, 2004).

1. **Primary gene pool:** Same species cultivated and wild
2. **Secondary gene pool :** Different species than the cultivated

3. **Tertiary gene pool:** More distantly related
4. **Quaternary gene pool:**Unrelated plant species and/or other organism

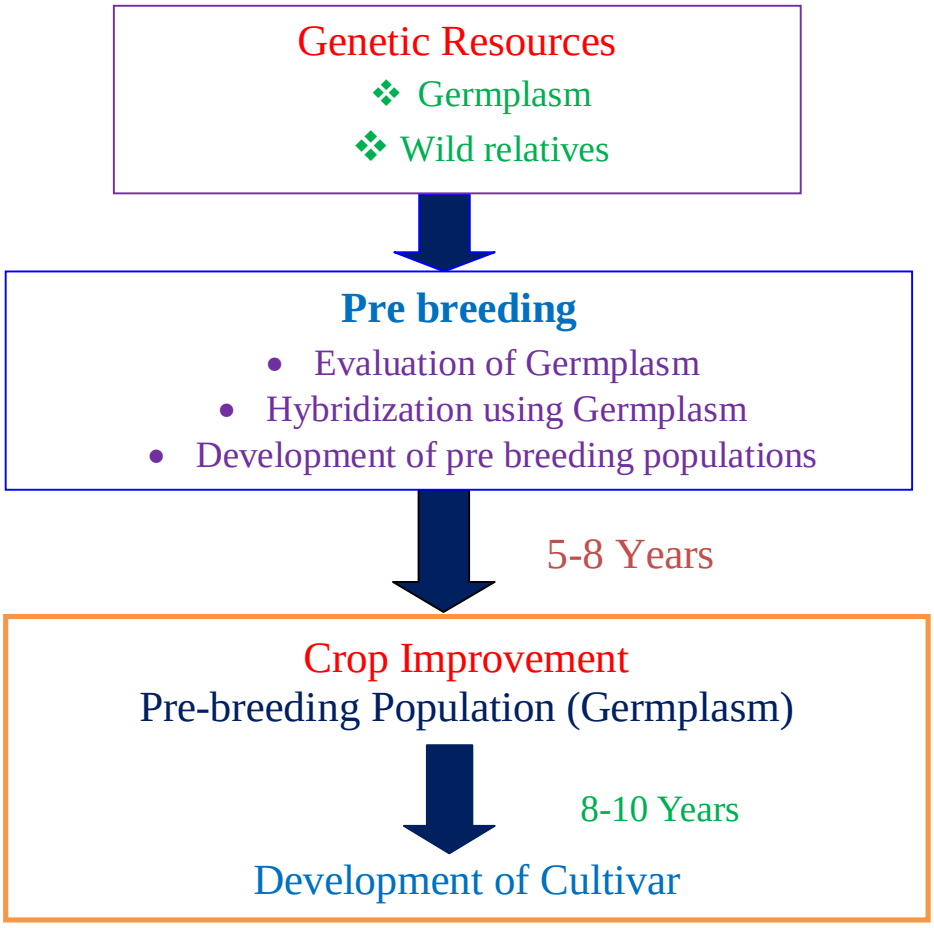

Figure 1. Pre-breedingas a bridge between genetic resources and crop improvement

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 more readily accessed by breeders

(3) Moving genes from wild species into breeding populations when this appears to be the most effective strategy and

(4) Identification and transfer of novel genes from unrelated species using genetic transformation techniques.

There are three ways of using PGR in plant breeding (Simmonds, 1993; Cooper *et al.*, 2001):

1. Introgression involves the transfer of one or few genes or gene complexes (chromosome segments) from the PGR into breeding materials;
2. Incorporation (also named genetic enhancement or base broadening) describes the development of new, genetically broad, adapted populations with large variation and acceptable performance level;

3. Pre-breeding refers to more basic research activities with the goal of facilitating use of 'difficult' materials.

Limitations

There are several problems that are associated with genetic enhancement programmes particularly when genes are introgressed from wild relatives. Some problem listed below:

1. In the Introgressive hybridization using wild species, there are problems of cross incompatibility, hybrid inviability and hybrid sterility.
2. Linkage between desirable and undesirable alleles passes problems in utilization of desirable alleles.
3. Generally, the genetic recombinations are restricted in Introgressive breeding.
4. Small populations are available due to poor seed setting in interspecific crosses.

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