AgriCos e-Newsletter
ISSN: 2582-7049
Open Access Multidisciplinary Monthly Online Magazine
Volume: 03 Issue:04 April 2022 Article No: 25

# A Novel Study on Application of Hybridization Techniques in Plant Breeding

**Srikanth G.A., Thomas jabaraj D., Tejashwini N., Anagha J Naik., Lokesh G.M., Dinesh B. and Basavaraj V.H.**
Assistant Professor, Department of Plant Physiology, Sampoorna International Institute of Agricultural Science and Horticultural Technology, Belekere, Channapatna, Karnataka

**SUMMARY**

Plant breeding can be roughly characterised as changes in plants caused by human use, ranging from unintended modifications generated by the introduction of agriculture through the use of molecular tools for precision breeding. Plant breeding based on observed variation by cultivation based on natural variants showing up in nature or within traditional varieties; plant breeding based on controlled mating by planting presenting recombination of desirable genes from different parents; and plant breeding based on monitored recombination by selection of particular genes or marker profiles. Continuous use of traditional breeding methods in a given species may reduce the gene pool from which cultivars are derived, making crops more susceptible to biotic and abiotic challenges and impeding future advancement. Several approaches for integrating exotic variation into elite germplasm without causing unwanted effects have been devised. Case studies in rice are used to demonstrate the benefits and drawbacks of various breeding procedures.

## INTRODUCTION

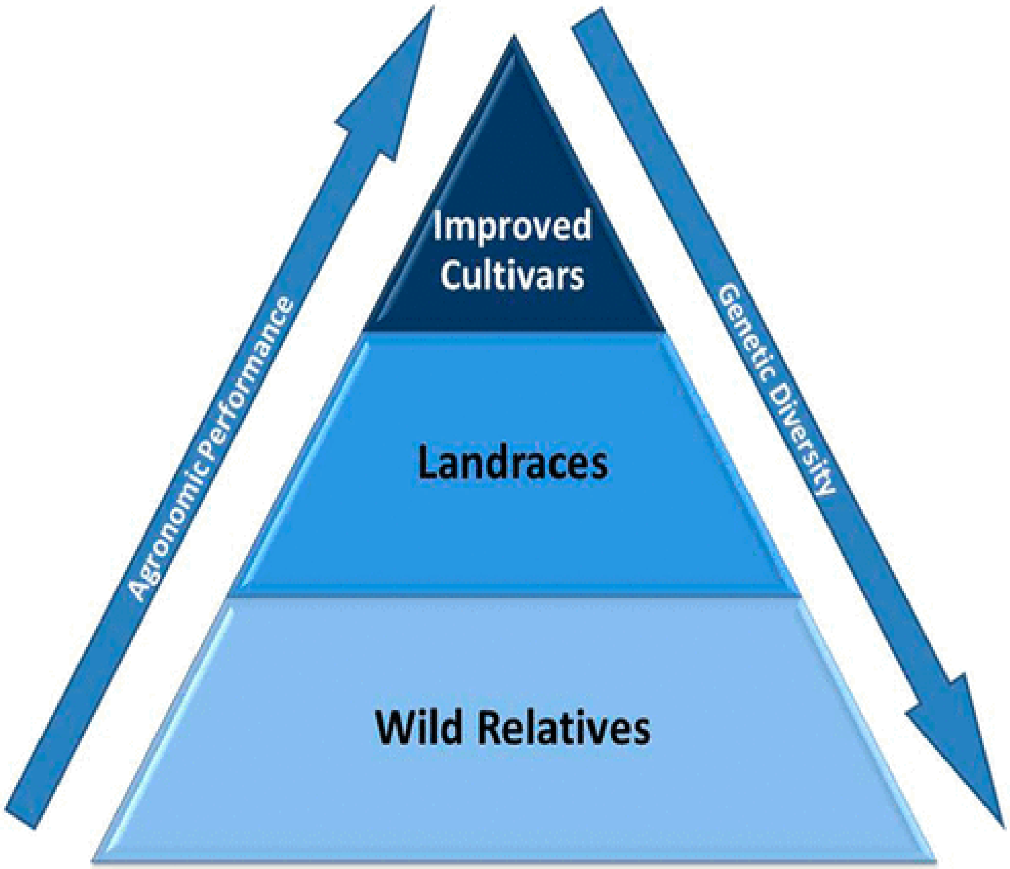
Plant breeding were seen of as a form of coevolution between people and edible plants. Changes in the plants utilised for agriculture were caused by people, and these new plant types allowed for changes in human populations. Plants that produced more abundant harvests freed up part of the people's time to pursue art, handcrafting, and science, which finally led to modern human life as we know it. Civilization would be impossible to continue without agriculture, while agriculture would be impossible to support without contemporary crop types. Agriculture employs only a small percentage of the population in industrialised countries. For the most part, individuals rely on an unspoken social agreement that someone will give food in exchange for some kind of service or gift. This agreement is so fundamental to modern life that it is taken for granted that food will always be available at the nearest store. Agriculture failure, on the other hand, might jeopardise the deal, putting people in danger of starvation. As a result, safeguarding agriculture entails ensuring the cornerstone pact of contemporary society. The selection of improved types among variants in terms of crop productivity of edible components; ease of growing, harvest, including processing; resistance to environmental challenges; and pest resistance is at the heart of plant breeding. Each of these features of agronomic or nutritional value can be broken down into a number of distinct traits, each with its own set of variations. Manipulation of a single attribute while ignoring all others is simple; yet, this is likely to yield useful variation.

### Based on Observed Variation

Selection of found naturally varieties in the wild then, later, in cultivated areas, was the most primitive type of plant breeding. The selection pressure on food collection or planting–harvesting cycles was constantly applied to genetic variation. In some cases, like as the derivation to maize from teosinte, this procedure led in significant alterations in plant phenotypes. This early stage of plant breeding includes everything from the dawn of agriculture to Kölreuter's first hybridization efforts in the 1760s. Hybridization is the breeding or crossing or two plants or lines with different genotypes. Pollen grains in one genotype, the male parent, are placed on the stigma of flowers from the other genotype, the female parent, to cross. It's critical to avoid self-pollination as well as accidental cross-pollination in the female parent's blooms. Simultaneously, it must be assured that pollen from the selected male parent contacts the stigma the female flowers in order for fertilisation to be successful. Hybrid or F1 refers to the seeds and even the progeny that arise from the hybridization. Segregating generations are F1 progeny formed by selfing or intermating F1 plants, as well as succeeding generations.

### Intuitive Farmer Selection:

Landraces are plant populations that have been grown in a specific place for many generations and have been modified by biotic and abiotic stressors, crop management, seed handling, and eating preferences. They are constantly changing genetic entities as a result of purposeful and inadvertent selection, seed combination, and pollen exchange. A balance of stabilising selection, which maintains the landrace's uniqueness in a particular location, and mild directional selection, which leads to modest adaptations to environmental changes, shapes landraces. Quick alterations can occur in some circumstances, especially when the landrace is transplanted to a new region or new materials are grown in close proximity to the original landrace. If verified seed production is maintained, landraces can still be derived from current cultivars.




**Objectives of Hybridization**

The main goal of hybridization will be to create genetic diversity. The genes from both parents is brought together in F1 when two genotypically distinct plants are crossed. In F2 and subsequent generations, i.e. segregating generations, segregation and recombination yield a large number of novel gene combinations. As a result, the amount of diversity created in successive generations would be determined by the number of mutant genes in the F1. This, in turn, is dependent on the amount of genes that differ between the two parents. If the two parents is closely related, only a few genes are likely to differ. However, if they are unrelated or distantly related, we may differ in dozens, if not hundreds, of genes. However, it is unlikely that the two parents' DNA will ever diverge completely. As a result, when the F1 is said to be 100% heterozygous, it solely refers to the genes in which the biological parties differ.

**Combination Breeding:**

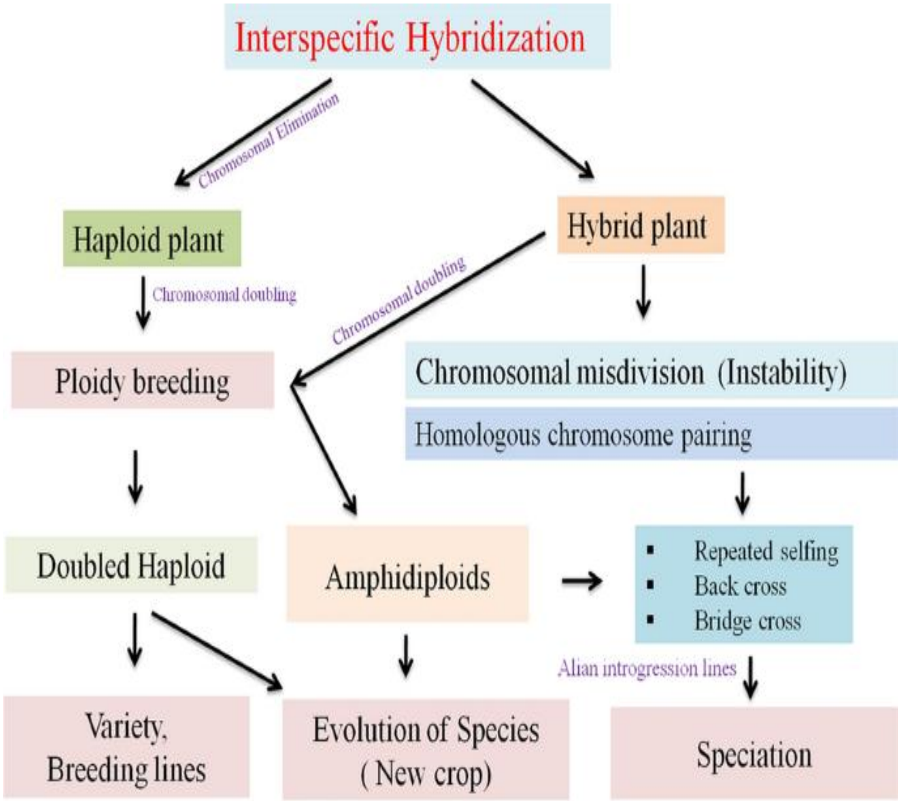
The fundamental goal of mixed breeding is to transfer one or more traits from various kinds into a single variety. Oligogenes or polygenes may be in charge of these traits. The new variety's intensity of the trait is either comparable to this or, more broadly, lower than that of the parent variety upon which it was transferred. In this method, a variety's yield is increased by fixing flaws in yield-contributing features such as tiller number, grains per spike, and disease resistance test weight. Backcross breeding was created through combination breeding, and the pedigree approach frequently serves the same purpose.

**Transgressive Breeding:**

Through transgressive segregation, transgressive breeding tries to improve yield or contributing traits. The creation of plants during an F2 generation those are superior to both parents for one or more traits is known as transgressive segregation. Such plants are created by the accumulation of positive or beneficial genes from both parents, which must complement each other and be genetically varied, i.e., extremely distinct. In this fashion, each parent is predicted to contribute various plus genes, which, when combined through recombination, result in transgressive segregants. As a result, the transgressive segregant's character intensity.

Plants or lines hybridised may be from the same variation, various varieties from the same species, subspecies of the same genus, or distinct species across different genera. Hybridization can be divided into two categories based on the biological relationship between the two parents:

1. Intervarietal and
2. Distant hybridization

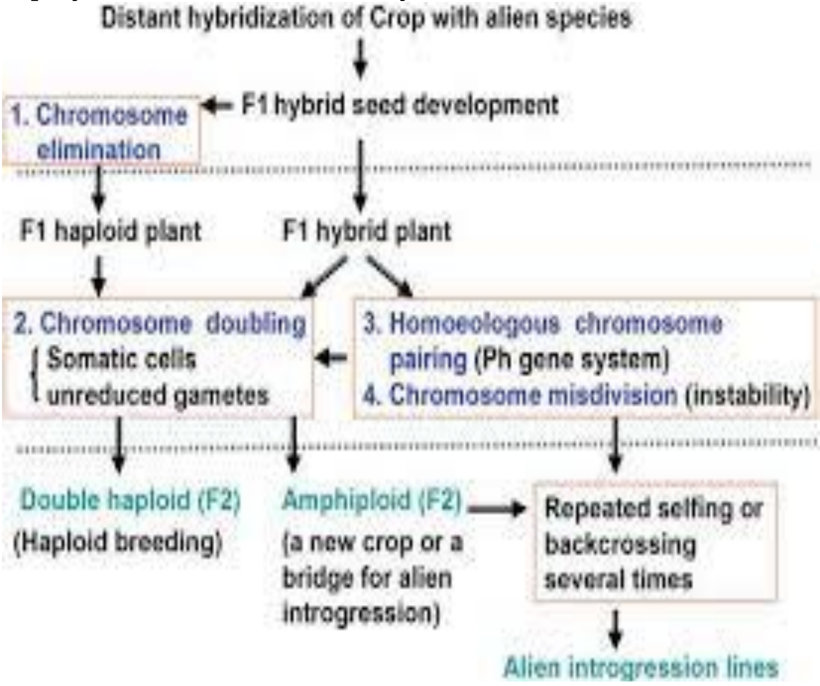



**Intervarietal Hybridization:**

Both parents in a hybridization are from the same species; they could be two strains, varieties, or races of the same spice. Intraspecific hyrbidization is another name for it. Intervarietal breeding is the most prevalent technique utilised in crop development programmes. In fact, it's just so ubiquitous that it may seems to be the sole form of crop enhancement hybridization. Crossing two types of wheat, rice, or another crop is an example. Depending on the number of families involved, intervarietal crosses can be easy or complex. Agricultural varieties would accrue even more favourable genes as crop improvement progressed. Even unrelated types would become more similar as a result of this. As a result, it's reasonable to predict that complex crosses will become increasingly essential in the future. Complex crossings are now a widespread procedure in the breeding of highly enhanced self-pollinated crops such as corn and rice. With the advancement in the level of improvement of all other self-pollinated crops, complex crosses will become commonplace in the near future.

**Distant Hybridization :**

Crosses between distinct species of the very same genus or separate genera are known as distant hybridization. Interspecific hybridization occurs when two species from the same genus cross; however, intergeneric hybridization occurs when two species from different genera cross. The goal of those crosses is usually to impart one or a few easily acquired traits, such as disease resistance, to a crop species. Interspecific hybridization is sometimes employed to create a new variety.




The superiority of mixture individuals over inbred individuals is known as heterosis. The higher the heterosis of their kids, within certain restrictions, the more divergent the parents are. Hybrid vigour declines significantly over generations of inbreeding, demonstrating that heterosis is caused by the existence of heterozygous loci, whatever the mechanism is. As a result, today's maize breeding initiatives are focused on creating competitive F1 hybrids with the highest level of heterozygosis.

## CONCLUSION

Natural genetic variation during native plant species, resulting in dramatic alterations in plant phenotypes. Throughout millennia of traditional farming, purposeful or unintentional selection resulted in a variety of genetic variation tailored to various human requirements. This development, however, moved at a pace that no longer corresponded to the challenges of modern civilization. The introduction of modern plant breeding has hastened the pace of varietal development, and it is hard to forecast the boundaries of this strategy at present time. Molecular technologies now allow researchers to track the kinetics of genomic recombination, allowing for gene-by-gene breeding.

## REFERENCES

Doebley, J., Stec, A., Wendel, J., Edwards, M. 1990. Genetic and morphological analysis of a maize-teosinte F2 population: implications for the origin of maize Proc. Natl. Acad. Sci. U.S.A.87: 9888– 9892

Kok, E. J., Keijer, J.;, Kleter, G. A., Kuiper, H. A. 2008. Comparative safety assessment of plant-derived foods *Regul. Toxicol. Pharmacol.* 50: 98-113

Tang, H., Sezen, U., Paterson, A. 2010. Domestication and plant genomes Curr. Opin. *Plant Biol.* 13:160– 166

Zamir, D. 2001. Improving plant breeding with exotic genetic libraries Nat. Rev. Genet. , 2:983– 98.

Yuan, W.; Peng, S.; Cao, C.; Virk, P.; Xing, D.; Zhang, Y.; Visperas, R. M.; Laza, R. C. 2011. Agronomic performance of rice breeding lines selected based on plant traits or grain yield. *Field Crops Res.* 121: 168-174