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# BACKCROSS BREEDING METHOD

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**Abstract:** Backcross breeding approach can be a system of repeated backcrosses to transfer a specific character to a well-adapted variety for which the variety is deficient of. It has been widely used for the development of disease resistant varieties in both SCP and CPC and also for inter-specific gene transfer and development of multiline varieties in SCP.

**Key Words:** SCP = self-pollinated crop, CPC= cross-pollinated crop, QTL= Quantitative trait loci

## INTRODUCTION:

In backcross method, the hybrid and the progenies in the subsequent generations are repeatedly backcrossed to one of the parents of $F_1$. The variety that receives gene is recipient parent/ recurrent parent as it is being used repeatedly. The variety which is the source of gene is called donor parent/ non-recurrent parent. This breeding approach is used for inter-specific gene transfer and development of multiline varieties in SCP and transfer of specific desirable trait to a well-adapted variety that it was deficient of before.

## IMPORTANCE OF BACKCROSS BREEDING:

- Inter-varietal transfer of simply inherited characters.
- Inter-varietal transfer of quantitative characters.
- Interspecific transfer of simply inherited characters
- Transfer of cytoplasm
- Transgressive segregation
- Germplasm conversion

## GENETIC BASIS FOR BACKCROSS METHOD:

With backcrossing, homozygosity for the alleles from the recurrent parent will increase at the same rate as is seen with the approach to homozygosity with selfing (one form of inbreeding).

The formula for calculating this rate is given:

$$\left(\frac{(2^n-1)}{2^n}\right)^m$$

Where, n= no. of backcross generations and
m= no. of loci

The amount of remaining genetic information (the non-target genes) on an average, from the non-recurrent parent (donor parent) is reduced by 50% with each backcross. The calculation for this data is:

(RR, Rr) Percentage of non-target genes from donor parent = (1/2) n+1

Where, n = number of backcrosses

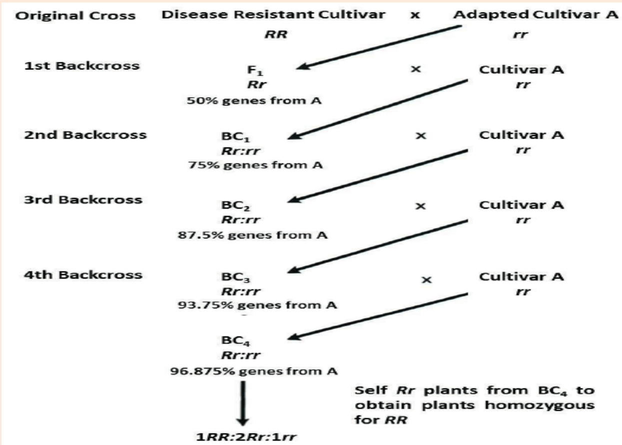


Figure 1: Conventional backcross breeding method.

## LINKAGE DRAG:

This refers to the reduction in fitness in a cultivar due to deleterious genes introduced along with the beneficial gene during backcrossing. Linkage drag refers to the (usually undesirable) effects of genes linked to the genes or QTL we are trying to introgress.

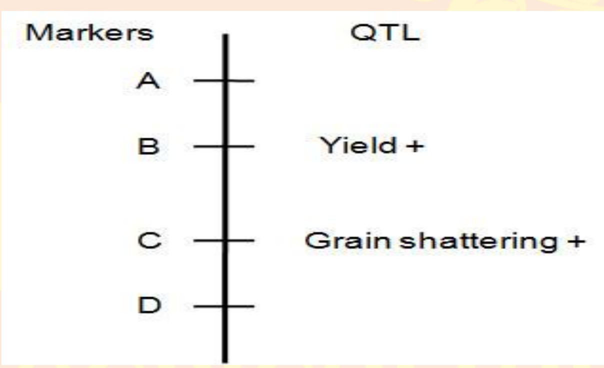


Figure 2: Linkage Drag in a genotype

**MARKER-ASSISTED BACKCROSS BREEDING (MABC):** Marker assisted backcrossing (MABC) is one of the most promising approaches is the use of molecular markers to identify and select genes controlling resistance to those factors, MABC is newly developed efficient tool by which using large population size (400 or more plants) for the backcross $F_1$ generations, it is possible to recover the recurrent parent genotype using only two or three backcrosses. So for, many high yielding, biotic and abiotic stresses tolerance, quality and fragrance rice varieties have been developed in rice growing countries through MABC within the shortest timeframe.

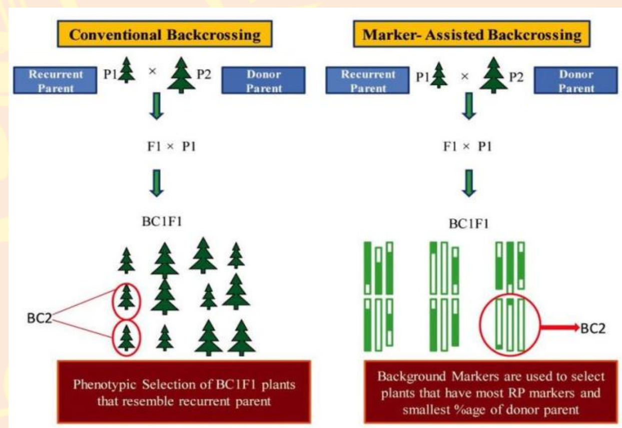


Figure 3: Conventional backcrossing v/s marker-assisted backcrossing (MABC).

**Merits of Backcross Method:**

- ✓ **The** genotype of the new variety is nearly identical with that of the recurrent parent, except for the genes transferred. Thus, the outcome of a backcross programme is known beforehand, and it can be reproduced any time in the future.

- ✓ It is not necessary to test the variety developed by the back cross method in extensive yield tests because the performance of the recurrent parent is already known. This may save upon 5 years' time and a considerable expense.

- ✓ Defects, such as, susceptibility to disease of a well-adapted variety can be removed without affecting its performance and adaptability. Such a variety is often preferred by the farmers and the industries to an entirely new variety because they know the recurrent variety well.
- ✓ This is the only method for interspecific gene transfers

**Demerits of Backcross method:**

- ✓ The new variety generally cannot be superior to the recurrent parent, except for the character that is transferred.
- ✓ Undesirable genes closely linked with the gene being transferred may also be transmitted to the new variety.
- ✓ Hybridization has to be done for each backcross. This is often difficult, time taking and costly.
- ✓ By the time the backcross is over, the recurrent parent may have been replaced by other varieties superior in yielding ability and other characteristics.

**DO YOU KNOW???**

**Recently** some of the varieties have been developed by backcross method by IIHR, Bangalore. They are:

**In watermelon**: Arka Manik, developed by backcross method having parents IIHR-21 and Crimson Sweet. It has got triple disease resistance from downy mildew, powdery mildew and anthracnose.

**In okra:** Arka Abhay has been developed by interspecific hybridization followed by backcross method between *A. esculentus* and *A. manihot*.

In garden pea: Arka Ajitas been developed by backcross method and pedigree method where the parents were Bonneville and Freezer 656.

**Source: IIHR, BANGLORE**

**CONCLUSION:**

The backcrossing method remains an efficient tool for transferring genes into established crop varieties. With each succeeding backcross generation, a greater proportion of the recurrent non-target genes remain along with the donor's gene of interest. There are several considerations and other absolute requirements to take into account when developing a backcross program to ensure a successful end result.

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