

2. **HYBRIDIZATION** → Hybridization is the method of producing new crop varieties in which two or more plants of unlike genetical constitution are crossed together. They may belong to the

some species, different species as different genera.

The main purpose of hybridization is to create variation by bringing in new combination<sup>ii</sup> of genes already present in the parental stock.

### ④ Hybridization Produces ~~cross~~ $F_1$ →

Various steps involved in hybridization are as follows —

- Selection of parents.
- Selfing of parents.
- Emasculation.
- Bagging, tagging and labelling of males as well as females.
- Crossing.
- Collection of seeds from the crossed plants after maturity.
- Handling of  $F_1$ .

⑤ Hybridization Methods → The further selections from  $F_1$  to  $F_6$  are made by different selection methods of hybridization which are different for self and cross pollination crops as enumerated below —

### ① Self Pollinated Crops →

↳ Pedigree Method → The individual plants are selected from the  $F_1$  population on the basis of desired characters.

Seeds are collected separately

and sown in the separate rows in the next year to raise the  $F_2$  generation.

Again the desirable plants are collected separately and the produce of each plant is sown in a separate row in the next year to raise  $F_3$  generation.

This process is continued upto  $F_4$  or  $F_5$  generation.

At  $F_6$ , due to successive self pollination most of the genes became homozygous and fairly conform.

(iii) **Bulk method** → On the basis of desired characters heads and panicles of desired plants are collected and sown in Bulk plot.

Desirable heads are selected from  $F_2$  grown population and again sown in bulk. In  $F_3$ , again the suitable plants are selected, collected and bulked together. This bulking is done for six generations. In  $F_6$  the desired individuals are selected and harvested separately. After comparative trials they are released as new varieties.

(iv) **Back cross method** → Selected plants are crossed and its progeny is crossed with either of the one parent which possess good characters. This process of backcrossing is repeated till the

desirable time having good qualities are not obtained.

(iv) **Multiple or Composite Cross** → It consists in crossing of several pure lines are first combined into crosses as  $A \times B$ ,  $C \times D$ ,  $E \times F$ ,  $G \times H$  and so on.  $F_1$  of these single crosses are then combined in to double crosses as  $(A \times B) \times (C \times D)$  and  $(E \times F) \times (G \times H)$ . Finally the  $F_1$  of double crosses are crossed with each other to produce the hybrids  $[(A \times B) \times (C \times D)] \times [(E \times F) \times (G \times H)]$ . This cross is known as multiple cross and further breeding in these hybrids is carried out according to either pedigree or bulk method.

### (B) **Cross Pollinated Crops**

(i) **Single cross ( $A \times B$ )** → This is the cross between two inbreds such as  $A \times B$ .

A single cross is made by planting two rows of female line to one row of male line alternatively so that two third of the field can produce hybrid seed.

The number of single crosses produced from various inbreds can be calculated by a simple formula given below —

$$\text{Number of single crosses} = \frac{n(n-1)}{2}$$

where,  $n$  = number of inbreds.

(ii) **Three way cross**  $(A \times B) \times C \rightarrow$  This is a cross between a single cross used as female and an inbred used as male. i.e., it involves three inbreds.

(iii) **Double cross**  $(A \times B) \times (C \times D) \rightarrow$  This is the cross between two single crosses involving four different inbreds. A double cross is produced by alternate planting of two single cross plants in one isolated plot and detossing of the single cross used as female parent.

Usually the ratio of the female to male rows has been 4:1.

$$\text{Number of double crosses} = \frac{n(n-1)(n-2)(n-3)}{8}$$

When,  $n$  = number of inbreds involved. It is the most widely used commercial hybrids.

(iv) **Top cross**  $(A \times \text{variety}) \rightarrow$  This is a combination between an open pollinated variety and inbred line. Either the inbred or the variety may be used as female parent, but to use variety as female is preferable.

(v) **Synthetic cross**  $\rightarrow$  This is the combination of a number of inbreds, sifted lines, or clones to utilize the desirable characters from different sources.