

## CSIR NET Life Science Unit 12

### Breeding in Animals & Plants

#### Marker Assisted Selection

- The use of DNA markers to target the loci to assist phenotypic screening is known as **Marker Assisted Selection (MAS)**.
- MAS helps to make selection decisions before phenotypes are available.

#### **A broad terminology is: -**

- Marker-Assisted Breeding (MAB) which includes apart from MAS.
- Several modern breeding strategies like marker-assisted recurrent selection (MARS).
- Marker-assisted Backcrossing (MABC)
- Genomic selection (GS).
- MAB (Marker-assisted breeding) is the application of molecular markers along with linkage maps and genomics to alter and improve plant or animal traits based on genotypic assays.

#### **QTL**

- An ideal marker is the one that allows inheritance to be followed across generations.
- Recent advances in molecular genetics offer methods to dissect the genetic variability of complex traits into Quantitative Trait Loci (QTL).
- Generally, a marker is associated to a QTL.
- The best scenario is when the marker and QTL are in same locus.
- For practical purposes the marker and QTL should be closely located so that recombination between marker and QTL is rare.
- Most traits of economic importance are complex quantitative traits controlled by many genes.
- QTL strictly applies to genes might have a large effect than the others and are called as major genes located at QTL.

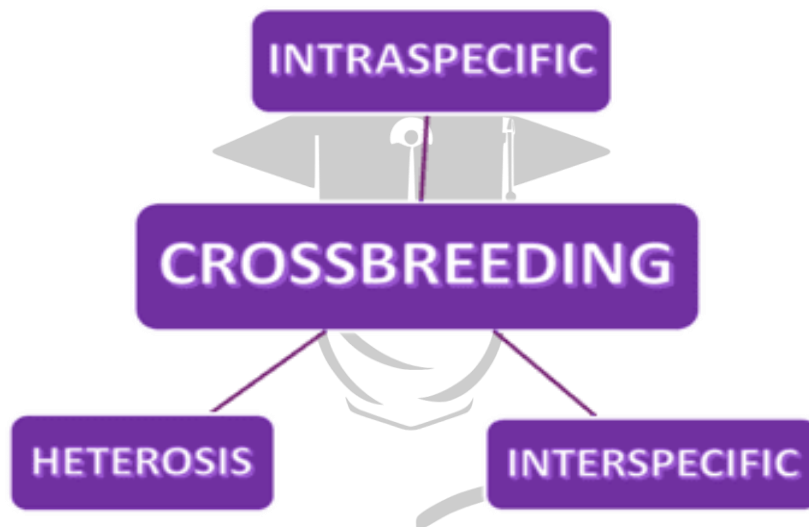
- The pattern of inheritance of such genes may assist in selection.

## Breeding Methods

### 1. INBREEDING

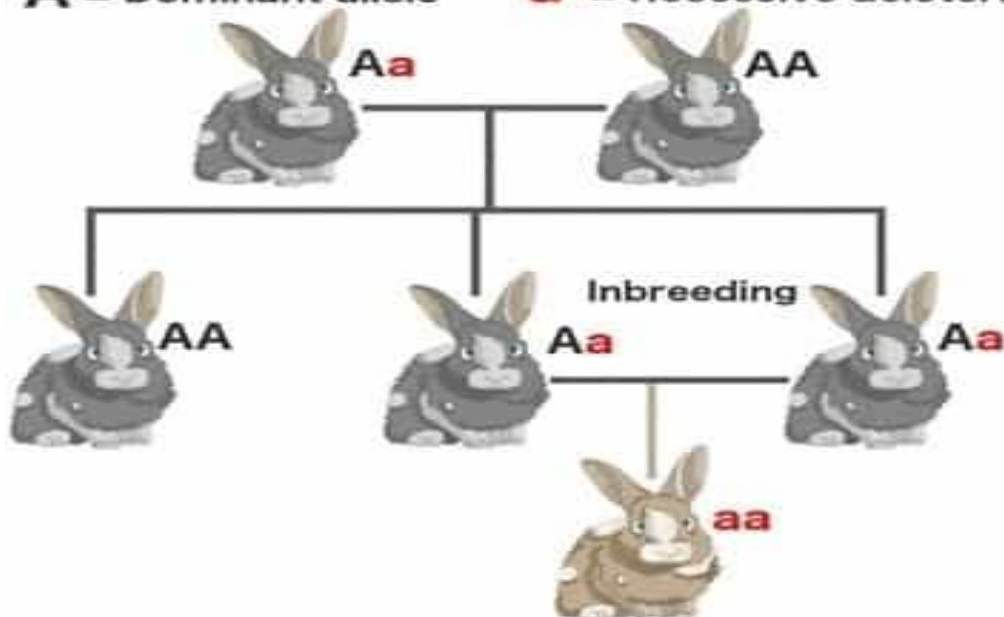


### 2. OUTBREEDING ⇒ CROSS BREEDING



### 3. HETEROSIS

**A** = Dominant allele      **a** = Recessive deleterious allele



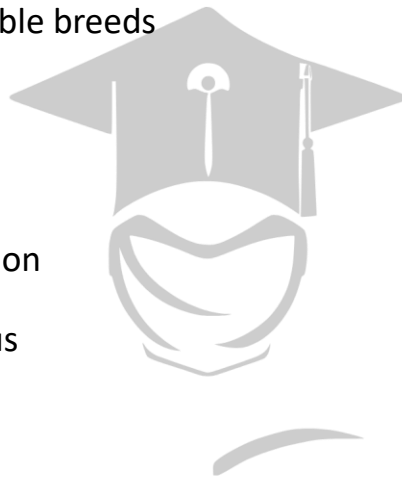
- Mating of parents which are genetically related
- Pure line maintains the original characters.
- Inbreeding is when breeding is between offspring of same family as shown in diagram Aa breeds with Aa rabbit which are offspring of same family Aa and AA.

### ADVANTAGES

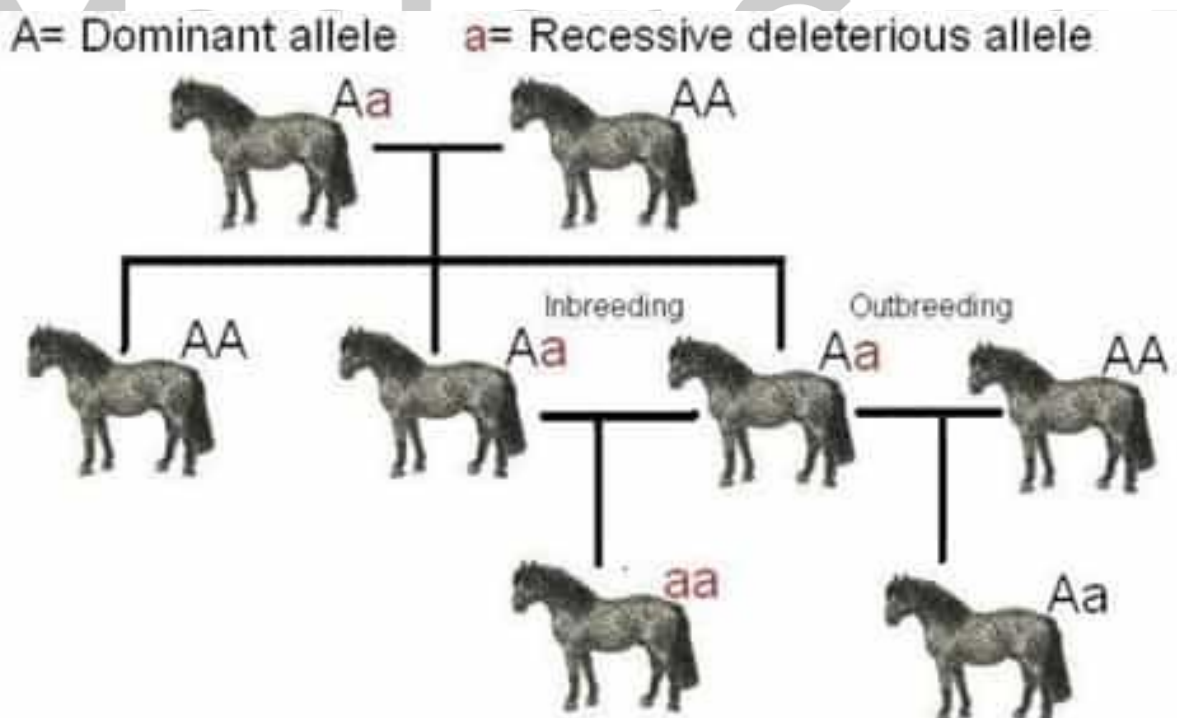
- Increase homozygosity
- Production of pure lines
- Elimination of deleterious characters
- Production of valuable breeds

### DISADVANTAGES

- Low yield
- Inbreeding depression
- Loss of heterozygous
- Less variation



### Outbreeding

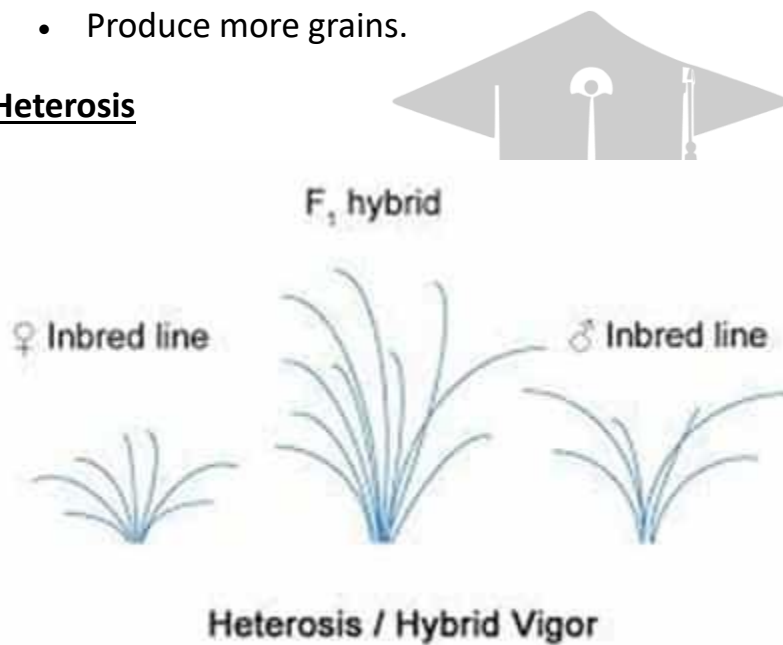


- Mating of unrelated individuals or not so closely related individuals.
- Crossbreeding occurs.
- Here breeding doesn't occur within offspring of same family, here breeding occurs between members of different family. (As shown in diagram)

### **Result of outbreeding**

- Heterogeneity or heterozygosity
- Variation
- High yield
- Produce more grains.

### **Heterosis**



- Increased growth vigor or yield of hybrid over the parents called hybrid vigor.
- It brings superiority in F1 generation.

### **Dominance Hypothesis**

- Hybrid vigor result from bringing together the maximum number of dominance favorable gene.

### **Overdominance Hypothesis**

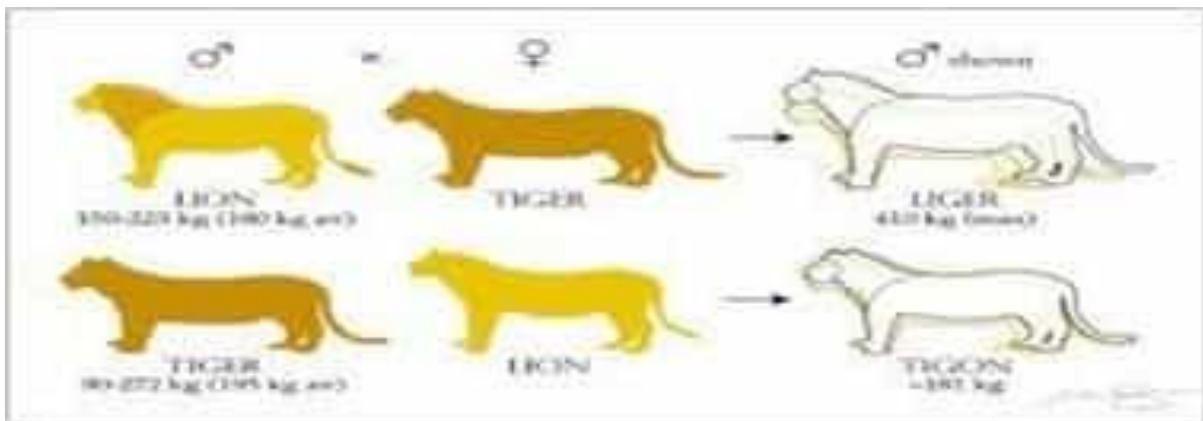
- Hybrid vigor due to superiority of heterozygous over the homozygous.

## Animal Inbreeding

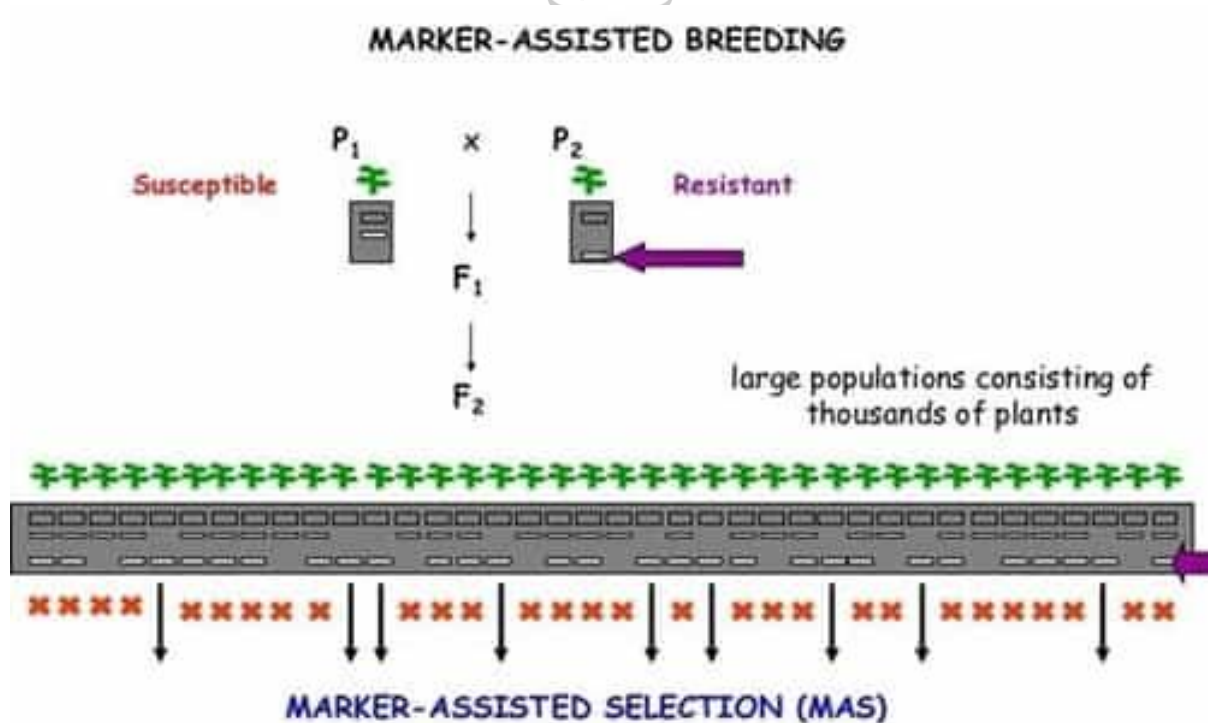
- All Hybrids are INFERTILE.

### EXAMPLES: -

1. Female horse + male = MULE
2. Female tiger + Male Lion = TIGON
3. Female Lion + Male Tiger = LIGER (as shown below)



## Marker-Assisted Selection



Method whereby phenotypic selection is based on DNA markers

- Marker is a DNA Sequence.
- Serve as signal/flag host.
- Linked to gene of interest.

STEPS: -

