# ANIMAL GENETICS & BREEDING

UNIT - III
The Principles of Animal Breeding
Theory

Outbreeding

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# Mating system

- ➤ Two basic tools for genetic improvement- selection & mating systems
- Selection is non random differential reproduction and survival of genotype in which certain individuals in a population are allow to reproduce next generation and other are prevented.
- ➤ **Mating** is the process that determines which selected males are bred to selected females.
- There are many different methods for mating animals, and each method can be defined by a **set of mating rules**: a **mating system**.

### Mating system

#### Random mating

- +ve assortative mating
- -ve assortative mating

### Non random mating

#### **Inbreeding**

- a. Close breeding
- b. Line breeding

#### **Outbreeding**

- a. outcrossing
- b. crossbreeding
- c. Grading up
- d. Top crossing
- e. Species hybridization

# <u>OUTBREEDING</u>

- The mating of unrelated individuals is called as outbreeding or genetic dissortative mating.
- This is opposite or complementary to the inbreeding.
- Outbreeding is the mating of animals which are distinctly less closely related to each other than the average of the population mean.
- The individuals that have no common ancestors for at least 4 to 6 generations in their pedigree.

# Classification of outbreeding

- 1. Outcrossing
- 2.Crossbreeding
  - a. Specific crossing
  - i. Two breed crossing
  - ii. Three breed crossing
  - iii. Back crossing
  - b. Rotational crossing
  - i. Criss -crossing
  - ii. Three-way rotational crossing
  - iii. Four-way rotational crossing, etc.
- 3. Grading up
- 4. Species hybridization
- 5.Top crossing

# <u>OUTCROSSING</u>

- This is the mating system when the mating occur among the unrelated individuals of the same breed.
- Most common breeding system practiced by breeders.
- The progeny produced by out crossing are called outcross.
- Outcrossing with in herd by use of selected sire is known as selective breeding.
- Outcrossing with selection capable for genetic change and improvement.
- This system of selection and outcrossing is very effective for characters governed by additive effect of genes having high heritability.
- It doesn't allow the fixation of undesirable genes and hence bring improvement.

## <u>GRADING UP</u>

- This is one type of crossbreeding.
- Progressive improvement of non-descript females by use of descript sires for several generations is known as Grading up.
- Grading up is the practice of mating purebred sires of a given breed to non-descript females and their female progeny in subsequent generations.
- The first generation offspring carry 50 percent inheritance of the pure breed.
- The next generation offspring results with 75% hereditary material of the purebred.
- The proportion of the inheritance from non-descript females is halved with each cross in subsequent generations.

#### Mating design of Grading Up programme:

Sahiwal, the best dairy breed of India, is taken for genetic improvement of non-descript cattle.

F1 ND50% : S50% F x Sahiwal 100 %M

F2 ND25 %: S75 % F x Sahiwal M

F3 ND12.5% : S87.5% F x Sahiwal M

F4 ND6.25 %: S93.75 %F x Sahiwal M

F5 ND3.125% : S96.875% F x Sahiwal M

F6 ND1.6 %: S98.4 %

F = female , M = male & S = Sahiwal

NB: Graded animal at 6th generation resemble the purebred

#### Advantages-

- Produce purebreds after a few generations.
- It is less expensive.

#### <u>Disadvantages –</u>

- Genetic environmental interaction.
- Lack of adaptability of purebred used for grading up programme particularly of exotic origin

## **SPECIES HYBRIDIZATION**

- The crosses between the animals of two species.
- widest(extreme) possible type of outbreeding ,this is known as species hybridization.

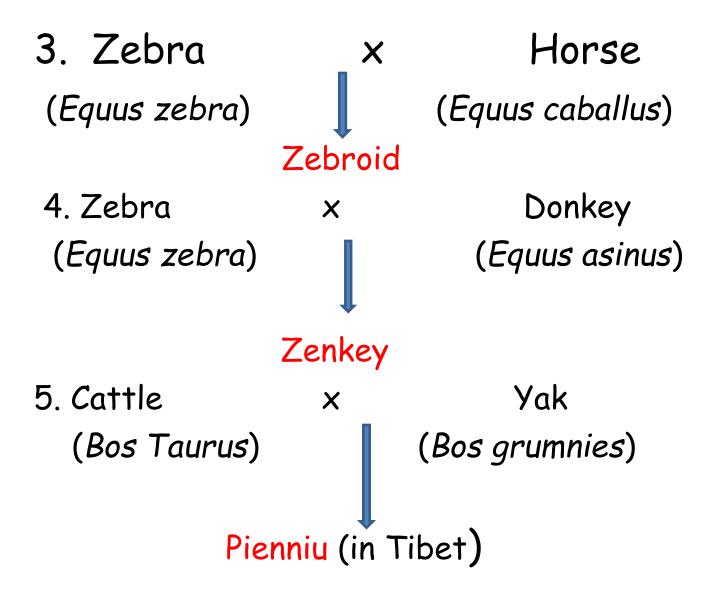
#### **Examples** –

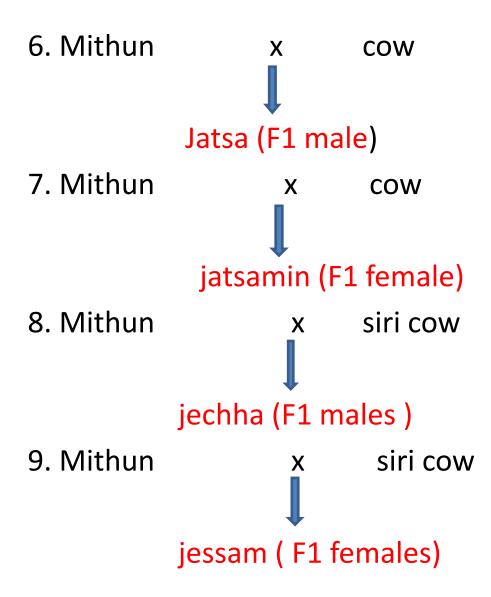
1. Jack (male ass) × Mare (female horse)

Mule

2. Stallion (male horse) x Jennet (female ass)







- > The species hybridization generally results in sterile progeny.
- > The mules and hinny are sterile.
- The crossing of bison with B. taurus cow produces sterile males but female are fertile.

### TOP CROSSING

- This mating system is a form of outcrossing and is like grading up.
- It is the mating of females to the last male in the top side of the pedigree.
- Mating of purebred males with unrelated females.
- The mating of females of new strain with purebred sire of HF breed will be known as top crossing.
- It is done for one generation only.

### ADVANTAGES OF OUTBREEDING

- Populations usually show more variation than inbreeding.
- Increases the no. of heterozygous individuals.
- New and high yielding gene can be introduced in the population through out breeding.

### DISADVANTAGES

- Introduction of new genes into population.
- Animal discomfort.
- Accidently reproduce traits that are damaging the health of the animal.

# THANK YOU