

ANIMAL GENETICS & BREEDING

UNIT - III

The Principles of Animal Breeding Theory

Outbreeding

Dr Anil Meel

Department of Animal Genetics & Breeding
MJF Veterinary college

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

- Close breeding
- Line breeding

Outbreeding

- outcrossing
- crossbreeding
- Grading up
- Top crossing
- Species hybridization

OUTBREEDING

- 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

OUTCROSSING

- 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.

GRADING UP

- 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.

Parents	ND 100% Dam x Sahiwal 100 %sire
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.

Disadvantages –

- 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) x Mare (female horse)

↓
Mule

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

↓
Hinny

3. Zebra
(*Equus zebra*)

x

Horse
(*Equus caballus*)



Zebroid

4. Zebra
(*Equus zebra*)

x

Donkey
(*Equus asinus*)



Zenkey

5. Cattle
(*Bos Taurus*)

x

Yak
(*Bos grumnies*)



Pienniu (in Tibet)

6. Mithun x cow



Jatsa (F1 male)

7. Mithun x cow



jatsamin (F1 female)

8. Mithun x siri cow



jechha (F1 males)

9. Mithun x siri cow



jessam (F1 females)

- 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.
- Accidentally reproduce traits that are damaging the health of the animal.

THANK YOU