1st Lecture

Animal Breeding and some Statistical Role in Animal Breeding

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Animal Breeding

- **Breeding** is a branch of animal science concerned with the genetic improvement of animals, and the science of genetic improvement depends on several sciences besides genetics, such as: statistics, cell science (biology), molecular genetics, and others as well as the nutritional and health aspect.
- **Breeders** select and breed animals using their knowledge of genetics and animal science to produce offspring with desired traits and characteristics, such as: producing more milk, meat wool and eggs
- **Breed** is a group of animals of a certain species that through generations of selective breeding has become uniform in performance
- **Species** is the largest group of animals that are capable of interbreeding and producing fertile offspring

Animal Breeding applied through

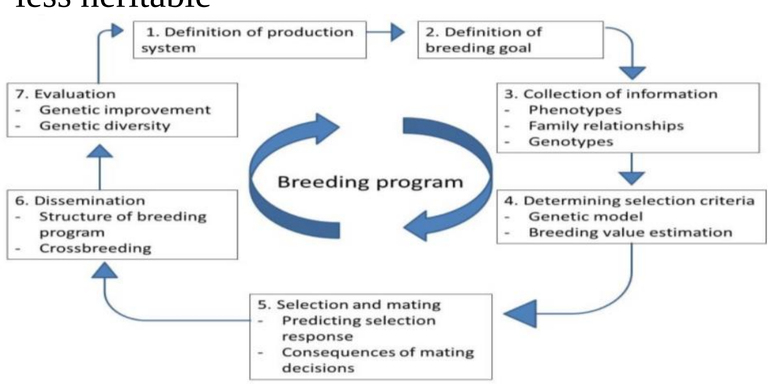
- Selection of desirable animals based on the best genetic traits, like an animal with a good ability to produce milk
- Producing genetically superior animals by following the methods of mating

❖**Breeding Program includes two systems**

1. Management systems
2. Breeding systems

Animal breeding program

- Animal breeding is based on the fact that traits of parents are reflected more or less in their offspring.
  - ❖This is caused by the fact that traits are more or less heritable



Statistics and their Application in Animal Breeding

Probability

- Probability is the chance that a trait will occur.
- The probability of event (A) is the number of event (A) can occur divided by the total number of possible outcomes.
- Probabilities predict the possibility that certain events will occur such as the inheritance of a particular trait in an organism. This can help animal breeders develop more desirable traits in their products.

Probabilities calculated by:

- ❖ Addition Rule: When two events, A and B, are mutually exclusive, the probability that A **or** B will occur is the sum of the probability of each event. (One prevents other)

- ❖ Multiplication Rule: is a way to find the probability of two events A **and** B happening at the same time (both may or may not occur).

Example (1)

From these mating Aa x Aa

What's the probability to get (AA):

Aa x Aa

AA Aa Aa aa

probability events (AA)=½ x ½= 1/4

Example(2)

From the mating Bb x Bb

What's the probability to get Bb or BB

P. Event Bb =½ x ½ +½×½=¼+¼=**½**

P. Event BB= ½ x ½=**¼**

p. Event (Bb or BB)= **½+¼=¾**

Example(3)

From the mating AaBb xAaBb

What's the probability to get

AABB=½x½×½×½=1/16

AaBB=(1/2x1/2+ 1/2x1/2) x 1/2x1/2=1/8

AABb=1/2x1/2x (1/2x1/2+ 1/2x1/2)=1/4x1/2=1/8

AaBb=(1/2x1/2+ 1/2x1/2)x (1/2x1/2+ 1/2x1/2)=

1/2x1/2=1/4

AAbb==(1/2x1/2x 1/2x1/2) =1/16

- **Combination**

$$C^{n}_{r} = \frac{n!}{r!\,(n-r)!} (P)^{r} (q)^{n-r}$$

Example

What the probability to get 6 male and 4 female

6+4=10 (p=1/2, q= 1/2)

$$C^{10}_{4} = \frac{10!}{4!(10-4)!} (1/2)^{4} (1/2)^{10-4}$$

=210(1/16)(1/64)

210/1024=0.2   20%

- Example
- If black color (BB,Bb)is dominated on (bb) red color from this mating Bb*Bb

Calculate the probability to get 4 black on 10 birth

P=3/4 q=1/4

$$C_{4}^{10} = \frac{10!}{4!(10-4)!} (3/4)^{4} (1/4)^{(10-4)}$$

210 (81/256)(1/4096)= 17010/104857=0. 16

16%

• Correlation(r)

- The correlation coefficient is a measure of the strength of the relationship between two variables, it is denoted by rxy The range correlation between (1- to 1+)
- They are two type of correlation
- 1-positive correlation increase one character leads to increase next
- Increase Birth weight ⇨ increase weaning weight in lamb
- 2-Negative correlation increase character lead to decrease other character

Increase Milk production ⇨ decrease fat percentage in milk of sheep

- Correlation(r)

$$rxy \frac{\sum(x-\bar{x})(y-\bar{y})}{\sqrt{\sum(x-\bar{x})^2 * \sum(y-\bar{y})^2}}$$

- Or

$$rxy = \frac{\sum xy - \frac{(\sum x)(\sum y)}{n}}{\sqrt{\sum x^2 - \frac{(\sum x)^2}{n}} * \sqrt{\sum y^2 - \frac{(\sum y)^2}{n}}}$$

- Regression (b)

The are two type of variable

Independent variable (X)like dam weight.

Dependent variable (y)like birth weight.

$$bxy = \frac{\sum xy - \frac{(\sum x)(\sum y)}{n}}{\sum x^2 - \frac{(\sum x)^2}{n}}$$

- Example
- Calculate correlation and regression from initial animal body weight with final body weight of lambs in the experiment.

X	y	x^2	y^2	XY
32.2	39.1	1 036.8	1528.8	1259.0
31.8	42.6	1011.2	1814.7	1354.1
45.6	52.9	2079.3	2798.4	2465.1
38.8	45.5	1505.4	2070	1765.4
36.5	43.5	1332.2	1892.2	1567.7
34.8	41.7	1211.0	1738.8	1451.1
34.6	45.1	1197.6	2034.0	1560.4
37.5	45.6	1406.2	2079.3	1710
29.8	38.2	888.0	1459.2	1138.3
31.7	36.7	1004.8	1346.8	1163.3
34.9	45.5	1218.0	2070.2	1587.9
$\sum X$=388.2	$\sum Y$=476.4	$\sum x^2$ = 13890.52	$\sum y^2$= 20833.12	$\sum xy$= 16990.4

- Correlation(r)

$$rxy = \frac{\sum xy - \frac{(\sum x)(\sum y)}{n}}{\sqrt{\sum x^2 - \frac{(\sum x)^2}{n}} * \sqrt{\sum y^2 - \frac{(\sum y)^2}{n}}}$$

$$rxy = \frac{16990.4 - \frac{(388.2)(476.4)}{11}}{\sqrt{13890.5 - \frac{(388.2)^2}{11}} * \sqrt{20833.1 - \frac{(476.4)^2}{11}}}$$

- rxy= 0.91

- Regression (b)

$$bxy = \frac{\sum xy - \frac{(\sum x)(\sum y)}{n}}{\sum x^2 - \frac{(\sum x)^2}{n}}$$

$$bxy = \frac{16990.4 - \frac{(388.2)(476.4)}{11}}{(13890.5) - \frac{(388.2)^2}{11}}$$

- bxy=0.93