# MODULE-1: INTRODUCTION TO SWINE FARMING

Learning objectives

This module discuss about,

- Role of swine in human nutrition and nutritive value of pork
- Advantage and disadvantage of swine farming
- Population of swine in India and abroad
- Important breeds of swine (both native and exotic)

## INTRODUCTION TO SWINE FARMING

- The challenges faced by our country in securing the food as well as nutritional security to fast growing population need an integrated approach for Livestock farming. Among livestock species, piggery is the most potential source of meat production and more efficient feed conversion after the broiler. Apart from providing meat, it is also provide bristles and manure.
- Pig farming is a promising source of meat production in India with their inherent characteristics of faster multiplicity, higher growth rate and feed conversion ability. Pig rearing in India is carried out under diverse social, Climatic and environmental conditions. Presently in India there are about 12.80 million pigs which is hardly 1.5 percent. of world's population and rank 12$^{th}$ in the world pig population (872.91 million) Hand book of Animal Husbandry, 2002.
- In, Tamil Nadu, the total pig population is around 0.67 million with Kancheepuram District alone contributing 33,000.
- Pigs are more acceptable to rural people contributing substantially to the rural well being and self sufficiency due to the profitable returns to the small and marginal farmers.
- Pig rearing in Tamil Nadu is still backyard venture and the revenues earned from pork production have been limited due to the lack of input to modern technology to the rural pig raisers.
- Pig industry remains under developed compared to other livestock enterprises mainly due to religious taboos and prejudices. Moreover, due to unhygienic practices prevailing in pig production and marketing. most meat consumers tend to avoid pork consumption. How ever, the animal protein requirements of the growing human population cannot be met by mutton, chicken and beef alone. In this connection, the pig which is a quick growing animal comes handy to augment the pig production potential, a synthesis of modern management and profitable farming practices has to be adopted. In this context, the extension activities initiated by the Government and the introduction of exotic breeds like Large White Yorkshire have paved the way for adoption of Pig farming as a livelihood by many small and marginal farmers. As a result of these efforts: a number of small scale piggeries are coming up in different parts of the state and the consumption of pork has considerably increased in the recent years. Significant improvements in swine production can further be made by adopting appropriate management and feeding techniques. This will enable pig industry to provide cheaper and nutritious meat when compared to other meat enterprises.

- Contribution of pork products, in terms of value worked out to0.80.% of total livestock products and 4.32 % of meat and meat products. About 934 tonnes of pork and pork products were exported during the year 1995 -96. The value of pork and pork products exported in Rs.262 lakhs against the total value of Rs.61604 lakhs on account of meat and meat products exports (Saxena 2003)

## ZOOLOGICAL POSITION OF PIGS

| Indian wild boar |  Domestic pig (improved) |  Domestic pig (Desi) |
|---|---|---|

| | | |
|---|---|---|
| Kingdom | : | Animalia |
| Phylum | : | Chordata |
| Sub phylum | : | Vertebrata |
| Class | : | Mammalia |
| Order | : | Ungulata |
| Sub order | : | Artiodactyles |
| Family | : | Suidae |
| Genus | : | Sus |
| Species | : | Vittatus, domesticus |
| Sub species | : | • Scrofa<br>• Philipinesis<br>• Cristatus<br>• Strotzai |

- Scientific name of modern pig
- Indian wild boar *Sus scrofa*
- Period of domestication 4900 B.C. in China and 800 B.C. in England

*Zoological name of Indian wild boar is Sus Scrofa*

## POPULATION AND DISTRIBUTION OF SWINE

- India has a pig population (as on 2003) of 13.519 million (Basic Animal Husbandry Statistics, 2006) and constitutes around 1.50 % of the total world pig population and rank 12th in the world pig population (956 million).

**STATE WISE PIG POPULATION (In thousands)**

| Sl.No. | States / Union territories | Total | Remarks |
|---|---|---|---|
| 1 | Andhra Pradesh | 570 | |
| 2 | Arunachal Pradesh | 330 | |
| 3 | Assam | 1543 | 2nd |
| 4 | Bihar | 672 | 5th |
| 5 | Chhatisgarh | 552 | |
| 6 | Goa | 87 | |
| 7 | Gujarat | 351 | |
| 8 | Haryana | 120 | |
| 9 | Himachal Pradesh | 3 | |
| 10 | Jammu & Kashmir | 2 | |
| 11 | Jharkhand | 1108 | 4th |
| 12 | Karnataka | 312 | |
| 13 | Kerala | 76 | |
| 14 | Madhya Pradesh | 358 | |
| 15 | Maharashtra | 439 | |
| 16 | Manipur | 415 | |
| 17 | Mehalaya | 419 | |
| 18 | Mizoram | 218 | |
| 19 | Nagaland | 644 | 7th |
| 20 | Orissa | 662 | 6th |
| 21 | Punjab | 29 | |
| 22 | Rajesthan | 338 | |
| 23 | Sikkim | 38 | |

| | | | |
|---|---|---|---|
| 24 | Tamil Nadu | 321 | |
| 25 | Tripura | 209 | |
| 26 | Utter Pradesh | 2284 | 1st |
| 27 | Uttaranchal | 33 | |
| 28 | West Bengal | 1301 | 3rd |
| 29 | A & N Island | 52 | |
| 30 | Chandigarh | 0.29 | |
| 31 | Dadra & N. Hareli | 3 | |
| 32 | Daman & Dies | 0.49 | |
| 33 | Delhi | 28 | |
| 34 | Lakshadweep | - | |
| 35 | Pondicherry | 1 | |
| | All India | 13519.3 | |

* Indicates the rank of Pig population in India.

*13.52 million pigs in India, highest population in UP*

Last modified: Sunday, 3 June 2012, 01:14 PM

## SCOPE OF PIG FARMING

- Pig farming is well adapted to both diversified and intensive agriculture in rural and semi-urban areas.

- Pig requires comparatively small investment on housing and equipment compared to other Livestock
- They are efficient converter of agricultural byproducts and waste material into high quality protein.
- Pigs are considered the only litter bearing animal among meat producing livestock having shortest gestation period of 111 days.
- They are prolific breeders with 2 farrowings every 1 ½ years and commonly farrowed from 8 – 12 piglets.
- The pork is an important source of high quality protein and carcass return is quite high as 65 – 80 % of live weight.
- The bristles are used in making brushes and the faeces of pig are useful in maintaining soil fertility and feed for fishponds.
- Pork is most nutritious, because of the higher content of fat and the lower content of water, the energy value of pork is higher than that of beef or lamb.
- Gilts may be bred at 8 months of age and the pigs can be marketed at 6 months of age after farrowing.
- There is good demand from domestic as well as export market for pig products such as pork, bacon, ham, sausages, lard etc.,
- Pig store fat rapidly for which there is an increasing demand from poultry feed, soap, paint and other chemical and leather industry.

*Suitable for diversified rural farming, good converter of agricultural byproducts, high quality animal protein, early sexual maturity*

## CONSTRAINTS OF SWINE FARMING

- To make a swine enterprise successful, Its limitactions must receive due considerations. These are as follows:
    - When grains are the only source of energy, the production cost will naturally be high. Besides, the pig is in direct competition with man for food. Under such situations efforts are made to raise pigs on non-cereal diets, which again is a limitation.
    - Pigs are sensitive to unfavourable rations.
    - Swine are highly susceptible to diseases and parasites particularly the roundworm. Ascaris *lumbricoides*. Management practices to maintain a disease-free herd are thus very important for a successful swine enterprise.
    - Skilled attention is needed at the time of farrowing. Many pigs are lost if the attendant is not careful in removing the remnant of placenta from newborn piglet mouths, and teaching them to suck immediately after birth.
    - Pigs are not suited to permanent pasture areas. They are also hard on pasture because of their rooting and close grazing habits. So they are not adapted to areas where grazing is extensive and vegetation is sparse.

*Competition with human food (grain), disease problem, skilled attention at farrowing, not suitable for permanent pasture*

## CHARACTERISTIC OF INDIAN WILD BOAR (SUC SCROFA)

- Their colour is Rusty grey in young, dark chestnut brown in adult.
- The snout is long, short ribs, long ears, distinct sparse coat and full crest or mane of black bristles running from nape down to back.
- Male have upper and lower tusks curving outward from mouth. They live in group of 10-20

## BIOLOGICAL DATA OF SWINE

| | |
|---|---|
| Age at maturity | 7 – 8 months |
| Breeding age of gilts | 8 – 11 months |
| Weight at breeding | 90 – 110 kg |
| Age of breeding boar | 18 – 24 months |
| Ratio of boar to sow | 1 : 10 |
| Oestrus cycle | 21 days |
| Heat period | 2 – 3 days |
| Mating time | First day for gilt, 2$^{nd}$ day for sow |
| Gestation period | 111 – 114 days |
| Suckling period | 56 – 60 days |

| | |
|---|---|
| Average litter size at birth | 10 – 12 pigs |
| Average age to castrate pigs | 4 – 8 weeks |
| Market age of fattening | 6 months |
| Market weight at 6 months | 70 – 75 kg |
| Farrowing interval | 7 – 8 months |
| Breeding life of sow | 6 – 10 years |
| Volume of ejaculate of semen | 200 ml to 500 ml |

*Gestation period is 114 days (3 months, weeks, days), estrus period 2-3 days, weaning at 56th day, market age 6 month*

## PORK AS A HUMAN FOOD (Click here)

- Pork supplies nearly one – half of the meat production from domestic animals in the world.
- It is an excellent source of high quality protein and some of the mineral elements.
- It is high in phosphorus, potassium, iron, zinc, manganese and magnesium and lower in calcium and sodium.
- Organs such as brain, heart and live r are good source of protein, vitamins and minerals.

*Pork supplies nearly one – half of the meat production from domestic animals in the world.*

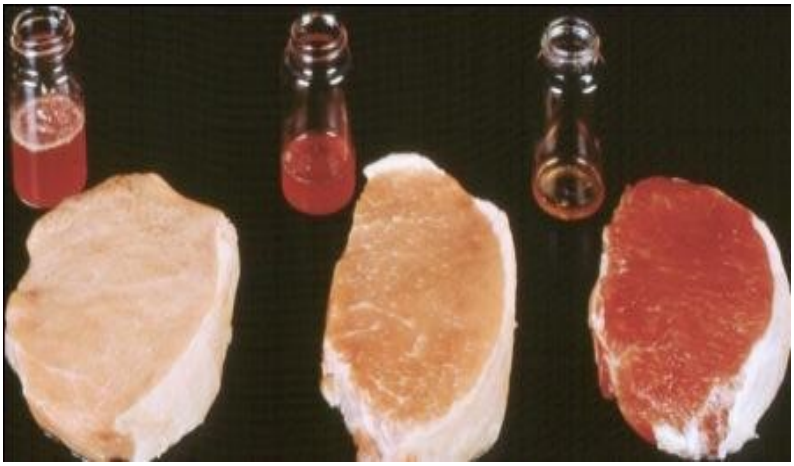
### Chemical composition of pork

- Fresh – lean & fat unseparated - 100 gm portion contains following contents

| S.No | Content | Quantity |
|---|---|---|
| 1. | Water (g) | 47.9 |
| 2. | Energy (k.cal/100 g) | 398 |
| 3. | Protein (g) | 13.4 |
| 4. | Fat (g) | 37.8 |
| 5. | Calcium (mg) | 5 |
| 6. | Iron (mg) | 0.7 |

| | | |
|---|---|---|
| 7. | Phosphorus (mg) | 152 |
| 8. | Potassium (mg) | 244 |
| 9. | Thiamine ($B_1$) (mg) | 0.57 |
| 10. | Niacin (mg) | 3.9 |
| 11. | Riboflavin $B_2$ (mg) | 0.21 |
| 12. | Saturated Fatly acid (g) | 13.8 |
| 13. | Monounsaturated (g) | 17.6 |
| 14. | Polyunsaturated (g) | 4.2 |
| 15. | Cholesterol (mg) | 74 |

## FACTORS AFFECTING THE ACCEPTABILITY OF PORK



- Pork quality
  - Quality of pork depends on it palatability factors such as – Tenderness, Juiciness, colour, aroma, flavour.
  - Desirable quality of pork has a firm, dry surface with pinkish red colour.
- Pale, Soft, Exudative pork (PSE)
  - The pale colour and excessive exudation of PSE pork create marketing problems in the retail stores. This condition is partly under genetic control and partly associated with stress resistance in live animals.
  - A Stress susceptible pig is prone to sudden death when exposed to excitement in warm environment.
  - The muscles of these animals show the typical PSE syndrome.
  - The syndrome can be controlled through good husbandry practices.
- Boar odour
  - Meat from mature boar has an objectionable odour and flavours when looked upon physical examination. This odour is produced by one fat soluble substance (5 alpha androst – 16 ene 3 one).

    - This odour is detected in most boars weighing more than 90 kg, but occasionally in gilts, sows and boars. This odour can be prevented by castrating male pigs at an early stage.
- Trichinosis
    - Consumption of improperly cooked Trichinosis spiralis in infected pork causes Trichinosis in humans. This can be prevented by proper garbage cooking, heating of pork to an internal temperature of 77°C and freezing of the pork at 15°C for 20 days.
    - Administration of the drug thiobendazole treats infected animals and human beings.

*Pale, Soft Exudative port, Boar oder and Trichinosis affects pork acceptability*

## INDIGENOUS DOMESTICATED PIGS

- They have no distinct breed features.
- They characteristics vary with topography and climatic conditions from region to region.
- They are black, brown, grey, rusty grey or blending/admixture of two or more colours.
- They are traditionally raised by weaker section of the community.

*Raised by weaker section, black, brown, rusty grey in colour; character varies with climate*

## EXOTIC / IMPROVED BREEDS OF PIGS

| Classification of swine breeds based on utility | |
|---|---|
| **Lard type** | **Bacon type** |
| Duroc | Tamworth |
| Poland china | Yorkshire |
| Chester white | |
| Berkshire | |
| Hampshire | |
| Spotted Poland china | |

| Exotic breeds experienced in India |
|---|
| Large White Yorkshire<br>Middle white Yorkshire<br>Saddle back<br>Tamworth<br>Berkshire |

| Classification based on colour | |
|---|---|
| White breed | Yorkshire , Landrace, Chester White |
| Black with some white | Hampshire, Berkshire, Poland china |
| Black and white | Spot |
| Red breed | Duroc and Tamworth |
| Red with some white | Hereford |

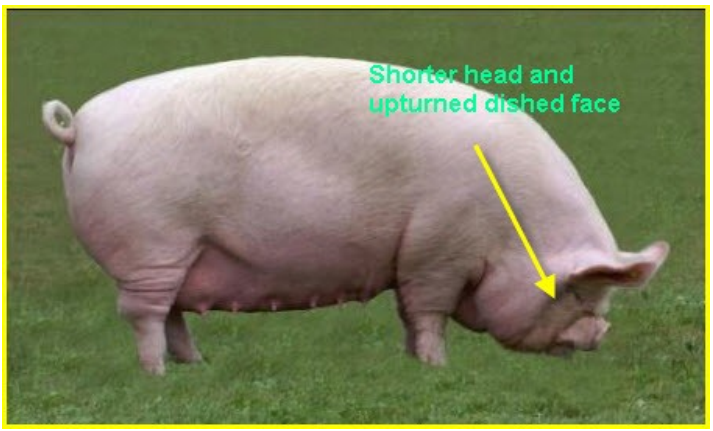
## LARGE WHITE YORKSHIRE (View image)

- The large White Yorkshire is a popular English Bacon breed, which had its origin nearly a century ago in Yorkshire and neighboring countries in northern England.
- Yorkshire sows are noted as *good mothers*. They not only farrow and raise large litters, but they are great milkers.
    - Bacon type breed
    - The body colour is solid white with occasional black pigmented spots called ‘freckles’
    - Other distinguishing characteristic are erect ear, snout of medium length, larger in size and slightly dished face
    - Skin is pink coloured and is free from wrinkles with long and moderately fine coat
    - Neck is long and full to the shoulder
    - Back is slightly arched
    - Matured body weight boar: 300-400kg and sow 230-320kg
    - Most extensively used exotic breed in India.

- The Yorkshire is a prolific breeder.
- The sows have good milking and mothering ability.
- Carcass quality, growth rate and feed conversion ability are generally good.
- It is an excellent breed for the purpose of crossbreeding.

*Prolific breeder, good mother, bacon type, excellent breed for crossbreeding*

## MIDDLE WHITE YORKSHIRE




- This breed was evolved in Yorkshire of Northern England by crossing the Large White Yorkshire with smaller breed of Yorkshire extraction.
- The breed is accepted as excellent pork pig, reaching slaughter weight early and with a high percentage of lean meat to bone.
- The breed is hardy, grows rapidly, but is not as prolific as the Large White Yorkshire.
    - Medium size
    - Shorter head and upturned dished face, short snout
    - White in colour, skin is free from coarseness, wrinkles or spots.
    - Neck is blended neatly from head to shoulder
    - The back is long and level to root of the tail with well sprung ribs
    - Legs are straight and fairly short, well set apart, fine and flat bone
    - Ears are erect and some what inclined forward
    - Adult body weight boar: 250-340kg and sow 180-270kg

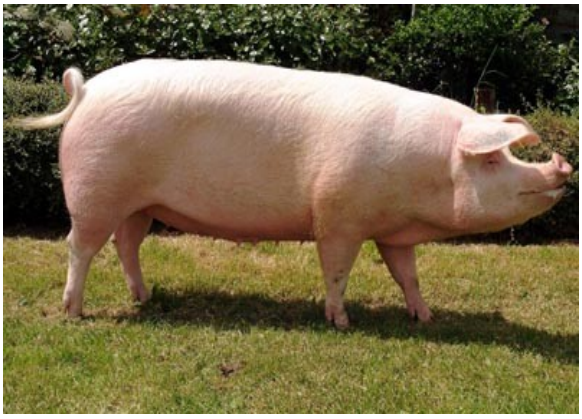
*High percentage of lean meat to bone, upturned dished face, short snout*

## BERKSHIRE


- The breed originated in and takes its name from Berkshire, a county in south central England, which was the center of its development.
- The breed is now highly valued as producer of good quality pork. In India especially in the South the breed is popular for the upgrading programme.
    - Medium size generally smooth and of good length and depth
    - Animal black in colour with "six white points" that is white on feet, nose and tail but more than 10% white of an animal disqualifies it.
    - It has a short head with dished face and its ears are erect.
    - The back is long, level arched and narrow back.
    - Legs are straight and set long
    - Matured body weight boar 270-380kg and sow 200-290kg

*Origin : England, Six white points, dished face, erect ear*

## LANDRACE



- The origin of this breed is Denmark, where it has been bred and fed to produce the highest quality bacon in the world.
    - Large, long body.
    - The breed is white in colour, although black skin spots 'freckles' rather common.
    - White bristles in white body
    - The breed is characterized by its long, deep side; square ham
    - The legs are relatively short
    - Lop ears
    - The carcass is more lean than that of the meat. There is less back fat and lard
    - The head with a slightly concave nose line
    - The breed is noted for prolificacy and for efficiency of feed utilization
    - Matured body weight boar 270-360kg and sow 200-320kg

*Denmark, lop ears, less back fat and lard, slight concave nose, known for prolificacy and feed efficiency*

## HAMPSHIRE

- Hampshire breed originated in Kentucky(USA).
- In the beginning it was called 'thin rind' but later the breed was changed to Hampshire.
    - Medium framed animal with upright ears.
    - The breed is black with a white belt which entirely encircles the body including both front leg and feet, the head and neck are black
    - Long head with slightly dished snout

- They are known for excellent carcass quality with large longissimus dorsi muscles and leaner carcass as compared to Yorkshire and Duroc
- Matured body weight boar 320kg and sow 280kg

*Upright ear, black with white belt, dished snout, excellent carcass quality*

## DUROC

- Duroc is the red breed of pig developed in North-Eastern states of USA (New York and New Jersey) using 2 distinct strains of hogs.
- Duroc is a breed of large pig with fast economic gain.
  - Larger frame
  - Mono coloured cherry red ranging form light red to rich reddish brown
  - The ears are two third lop, slightly concave nose line, arched back
  - The pigs are popular for their size, hardiness, and prolificacy. The sows are excellent mothers.
  - The carcass is considered as good meat type.
  - The weight of matured boar is around 400 kg and sow is normally 350 kg.

*Cherry red (light red to rich red), two third ear lop, arched back, sows are excellent mothers*

## TAMWORTH (View image)

- The breed is originated from central England.
- The breed drives its name from the town of Tamworth.
    - The animals are golden red in colour varies from light to dark.
    - They are good bacon type.
    - The individuals are long-legged with long, smooth sides and strong back.
    - The head is strikingly long and narrow with a long snout and fairly larger ears that are carried somewhat erect.
    - The sows are prolific and careful mothers, and the pigs are excellent foragers.
    - The matured boar weighs 350 kg and sow between 250-300 kg.

*Golden red colour, good bacon type, careful mothers, excellent foragers*

## CHESTER WHITE

- The breed has its origin in the southeastern Pennsylvania, principally in Chester and Dela counties of U.S.A.
- The foundation stock included important pig of English Yorkshire, Lincoinshire and Cheshire breeds.
- As the name indicates, the breed is white in colour with some bluish spot sometimes found on the skin.

*White colour with some bluish spot*

## HEREFORD

- It is one of the newer breeds of swine.
- The breed was originated in Missouri in the USA.
- The most distinctive characteristic of the Hereford breed is their colour marking, which is similar to that of Hereford cattle.
- It is two-thirds red in colour, either light or dark with constant white face.
- The white colour must appear on at least two feet and extend up to an inch or more above the hoof.

*Colour similar to Hereford cattle (two third red in colour with constant white face)*

## POLAND CHINA

- Poland China is another breed with black colour and some white patches.
- The breed is similar to Berkshire and as such Berkshire must have been used in the development of this breed.
- The native home of this breed is southwest Ohio in Miami valley.
- Poland China or Poland is one of the largest American breeds and ranks high in gaining ability.
- Poland is black with six white points viz., face, 4 feet and a brush in the tail.
- The ears are two third drooping. They are quiet by temperament and rugged in constitution.
- The carcass quality is very good.
- The breed has good growth and good mothering ability.
- Sometimes Poland are criticized for small litter size.

# MODULE-2: SWINE PRODUCTION AND REPRODUCTION MANAGEMENT

### Learning objectives

This module discuss about,

- Different pig production adopted in western countries, and suitable method for India.

- Important points of optimize the reproduction in pigs
- How to select male and female pigs for breeding
- Preparation of sow/boar for breeding, estrus detection and mating management
- Signs of pregnancy, nearing parturition and management during, at and after farrowing
- Management of mother sow with piglets
- Management of newborn piglet like care of naval, needle teeth clipping, castration, environmental requirement of piglets, piglet anaemia, weaning and care after weaning.

## PIG PRODUCTION SYSTEMS

- Systems of pig production commonly classified into
  - Small scale system
  - Large scale system
  - Integrated system

## SMALL SCALE SYSTEM

### Scavenging system

- This is the most traditional system of rearing pigs in large part of the tropics and simplest and cheapest system.
- Each family in a village keeps a few pigs, which are allowed to wander freely and pick up food. Such type of food consists of low nutritional quality especially banana, rice bran, local herbaceous plants and kitchen waste.
- Indigenous pigs are predominating on the scavenging system, because they are adapted to local environment.
- The productivity of pig is normally low with erratic feed supply resulting in irregular breeding of sows, high rates of piglet mortality and low growth rates.
- A particular hazard of scavenging system is that pigs have access to source of parasite eg. human excreta, which can be transmitted back to man when he eats the meat.
- The majority of scavenger pigs are owned by subsistence farmers. /div>

*Most traditional system, reared with kitchen and agricultural waste, predominantly scavenging system, high rate of parasite, poor growth rate, high piglet mortality*

### Semi-intensive system

- This type of system is also known as backyard system. Hence the pigs are confined in rearing pens and sties are mainly of simple construction.
- In this system, sometimes pigs are constrained by tethering in larger yards or paddocks.


*Backyard system, utilize agricultural waste*

## LARGE SCALE SYSTEM

### Intensive system

- It is the most common system of large scale production.
- Units are generally capital intensive and may involve more number of animals.
- Modern high performance breeds of pigs are used and provided with optimum conditions of housing, feeding and management in order to ensure maximum output.


*Large scale production, high rate of output*

**Extensive systems**

- This system also known as outdoor system, keeping sows in paddocks and providing individual huts for farrowing and shelter. This type of system commonly exist in the tropics.
- Advantage of this system is less capital investment and sows can gain access to bulky foods such as pastures and crop residues etc., Moreover it is essential that adequate shade and wallows are provided and parasite infestation should be controlled with proper feeding.

## INTEGRATED SYSTEM

- Integration of pig production with other enterprises has long been widely practical in the tropics, involving various combinations of fish farming, production of algae, methane gas production, ducks, water hyacinth and vegetable production. Such tri-commodity operation enhance the efficiency of resource use and increase output for overall operation.

**Example**

- Sufficient water is available for fish ponds, pig sties can be constructed above the ponds. So that manure can drop straight into the water and fish can utilize the manure.

- If pig effluent is insufficient, ducks can be used to augment the fertilization of the ponds with the manure.

*More suitable for tropical countries, utilization of waste efficiently*

## MANAGEMENT FOR OPTIMAL PRODUCTION

- The fertility of sow and litter size farrowed and weaned are very important factors in determining the viability of swine projects. The cost of raising 6 pigs or 10 pigs from birth to weaning is more or less similar since the maintenance requirement of the sows is the same to both cases. Breeding and selection alone are not very certain methods of improving the production of swine. Time spent on improving the management of the sow and litter, on increasing the efficiency of feed utilization and the control of diseases are parasites may contribute more to the income of the enterprise than an equal time spent to increase herd productivity by following complex method of breeding and selection.
- To ensure that the maximum number of bred gilts and sows farrow large litter of living pigs the following measures are suggested.
    - Gilt may be bred to farrow at 12-14 months of age. Gilts should weigh at least 100 kg before breeding.
    - Gilts come into heat during first few days after weaning. When weaned after 3 weeks breed on the first heat.
    - In hand breeding sows are bred twice during the heat period. Once when they come into heat and again after 24 hours. In pen mating sow may be put with a boar till the heat lasts.
    - The commercial pig may be bred to several boars in the same heat period. 2 boars are run together with the same female in heat or 1 boar for 1 day and second for next. With this procedure the chance of conception will increase.

- Though the heritability of litter size is low. Selecting for this trait should be continued. In order to increase the litter size by 1 pig we may have to select pigs for this trait for 20 generations.
- The female selected for breeding must **have at least 12 functional and well spaced teats** and a good body length.

*Breeding gilt to farrow at 12-14 month, two mating within 24 hours of estrus, minimum 12 functional and well spaced teats*

- While selecting the breed for a swine enterprise the litter size must be kept in mind. Yorkshire pigs are on the top in this regard with 10-11 pigs per litter. In most breeds litter size is 9-10 but in few breeds it may be as low as 6-8.
- If old boars are to be used for breeding, one with a good conception rate with large litters may be used.
- Both the gilts and sows must be thrifty and in medium condition before breeding, of too fat, the condition may be reduced and if too thin, the condition may be improved.
- During hot summer months one must keep the breeding and gestating sows cool by water sprinkling or by the use of wallow.
- **Intense inbreeding** may be avoided as for each 10% inbreeding there is one-third less pig per litter farrowed and one-half pig less at weaning.
- Before breeding check the females for brucellosis and leptospirosis. One must avoid breeding sows suffering from flu. During early gestation high body temperature at breeding time may cause abortion.
- Gilts and sows may be kept in the farrowing stall or pen 5-7 days before due to farrow.
- A well trained attendant is needed for farrowing. As soon as newborn pigs are dried after removing membranes, it is made sure they breath. Overlying should be prevented. Greatest losses occur with in 3 days after farrowing, so a close watch on the sows and pigs must be maintained during that period. The death may be due to starvation (26%), digestive problem (2%) and unknown cause (13.%).

- The sow is at her best in milk production at about 3 weeks lactation after which milk quantity is reduced. So a creep feed may be used from 3 weeks till weaning to supplement milk. The ideal weaning weight at 8 weeks age is 15 kg.

*Select boar from large litter, avoid inbreeding, checking females for brucellosis and leptospirosis, use of trained attendant to minimize piglet mortality, early introduction of creep feed, aim to achieve 15 kg at weaning*

- The farrowing and nursing facilities between groups of females farrowed must be cleaned and kept vacant for at least a week.
- The sow and pigs must be put on 'clean pasture'. More than 6 sow and litter per lot may not be put on the pasture.

## AGE OF BREEDING STOCK

- Fertility of an individual is affected by age. Well-developed gilts may as a general rule be bred to farrow when 12 to 14 months old. This depends more on development than on age.
- Gilts should weigh at least 100 kg before breeding. Ovulation rate increases during successive oestrous periods (up to fifth) following puberty. Thus, it is advantageous to delay breeding of gilts until the second or third oestrus.
- Litter size increases, on an average, in succeeding pregnancies up to fifth or sixth litter.
- It is, therefore, advantageous to cull the sow from a breeding herd or a commercial herd after her fifth or sixth litter, as the litter size goes down thereafter.

*Gilt should farrow at 12-14 months, weight of gilt should be 80-100 kg at breeding, breed gilt at third estrus, cull the sow after fifth or sixth litter*

Last modified: Sunday, 3 June 2012, 03:34 PM

## SELECTION OF A BREED

- No particular breed of pig can excel other in all points of swine production. Each breed has its own peculiarities. Thus, Hampshire excel in carcass quality whereas Yorkshire do so in prolificacy. Most of the exotic breeds raised in temperate climates do well in tropical and sub tropical climates.
- Middle and Large White Yorkshire do very well under Indian condition and so Durocs and Hampshire.
- White colour being most preferred one. Middle white Yorkshire, Large White Yorkshire and Landrace are most commonly used in India.

*Large White Yorkshire and Middle White Yorkshire are more suitable to India*

## BREEDING SYSTEMS

- There are a number of breeding systems that can be adopted depending on the, requirements under the prevailing situations. However, the following procedures should be adopted for breed improvement.
- *Selection and out-crossing:* This can be adopted in all pig-breeding farms and by farmers who produce breeding stock. This is a common method of breeding and multiplying purebred swine. The best procedure is intensive selection and out-crossing (mating of unrelated individuals of the same breed). Generally the results are quite good as some *vigour* will be obtained in the offspring with some gain in litter size, livability and growth rate. Out crossing is also done frequently to introduce a trait, which is lacking in a herd.
- *Grading Up:* The non-descript indigenous pig forms the bulk of the pig population in the country. It would be advantageous to grade up this population by the successive use of boars of either Yorkshire or Landrace breed, depending on the suitability of the breed to be used in the area. This would bring about an improvement in the productive traits of indigenous pigs in graded stages. This method is also suited to many areas when management and feeding conditions do not justify the introduction of high-quality purebred stock.
- *Cross breeding:* In a number of areas, particularly in the neighbourhood of bacon factories, pig production with purebred stock of Yorkshire or Landrace breed has been introduced. It would be advantageous in these areas to introduce crossbreeding, e.g. crossing Yorkshire sows with a Landrace boar and *vice versa*. While there are several systems of crossbreeding, under the prevailing conditions either single crossing or criss-crossing would be suitable and can be practiced in intensive areas.
- Single crossing is the mating of a boar and a sow of two different breeds. The resulting crossbred pigs are all marketed and the cross is repeated for the next crop of pigs. This system has one disadvantage in that the sows as well as boars have to be purchased and brought into the herd, which can be a means of spreading diseases.
- Criss-crossing is the alternating use of boars of two breeds on the female stock produced in a herd. For instance, Yorkshire gilts are bred to a Landrace boar. The resulting crossbred gilts are mated to a Yorkshire boar. The next cross is bred back to a Landrace boar, and so on. The gilts and sows, which are sired by a boar of one breed, are always mated to the boar of the second breed. This system of crossbreeding works well and is widely used.
- Crossbreeding can increase litter size (crossbred sows farrow and wean larger litters.), livability (greater resistance to environmental stress) and rate of growth. .

*Criss crossing is widely used, cross breeding increases litter size, livability and growth rate, non-descript pigs can be used for grading up*

## SYSTEMS OF CROSS BREEDING

### Two – Breed Rotational Cross

- This system is often called the back cross or crisscross method. Boars of two different breeds are used in alternate generations.
- Crossbred gilts are retained and mated to boars from one of the two-parent breeds.
- The two breeds should complement to each other eg. litter size, growth, carcass characteristic etc.

### Three – Breed Rotational Cross

- The three – breed rotational cross is most widely used system. It increases the hybrid vigour by use of three breeds instead of two.
- A third breed can strengthen certain performance characteristic is the crossbred offspring.

## SYSTEMS OF FARROWING

- Two litter a year system
  - *Advantages:* Both fall and spring pigs are raised from the same sow. The pigs can thus be marketed at two different times of the year. The capital investment in building and equipment is made used to the maximum. There is also better distribution of labour and farm income.
  - *Disadvantages:* The cost of maintaining tried sows throughout the year is high. By the time their useful life is over and their market value may be too low. The pig losses in two litter in a year is more.
- One litter in a year
  - *Advantages:* In this system gilts are used and pigs are farrowed in spring. As soon as first litters are weaned the gilts are finished to market. Thus the return value of female is more in this system. Other advantages are
    - The management problem is less
    - Less capital is tied up in buildings and equipment and less grain storage is needed
    - The weather is more favourable at the farrowing time and as such pig losses are less
    - The labour requirement is less
  - *Disadvantages:* The maximum use of available buildings and equipment is not made. The improvement is not as rapid as in the two – litter system since the females are after each farrowing. Moreover the distribution of labour and farm income is not uniform throughout the year.
- Multiple farrowing system
  - This programme can increase the size of the enterprise. The sow herd is split into 2 or 3 groups with each group farrowing twice or thrice in a year. With these groups the farrowing schedule may be as follows.
    - *First group:* January, July
    - *Second group:* March, September
    - *Third group:* May, November
  - In this system there is regular flow of pigs to market, a better use of existing facilities and distribution of labour evenly throughout the year. Two main disadvantages of the system are possibility of frequent disease outbreak and necessity to a competent help for prolonged farrowing.

- Two litter system - efficient uitilization of building, equipment and labour
- One litter system - better management, less capital, less labour
- Multiple farrowing - better utilization of labour, building

## SELECTION OF BREEDING STOCK

- The important characteristics which need to be considered in developing a good sow herd are: size of litters, strength and vigour of -litters, milking ability, temperament,weight gain and feed efficiency of the progeny, longevity, fertility and freedom from defects.
- The selection of individual animals from a herd is more important than the selection of a particular breed.
- Certain breeds do excel in the various productive traits. No one breed is superior in all economical traits.
- Each producer at the time of establishing his herd should purchase animals from a reliable disease free herd and should obtain as much information on the

animals as possible.

- Once the herd is established, the selection of gilts and boars for replacement in the breeding herd should be based on the type and the performance.Selection can perhaps best be dealt with in three separate phases, viz. selection of gilts, culling of sows and selection of boars.

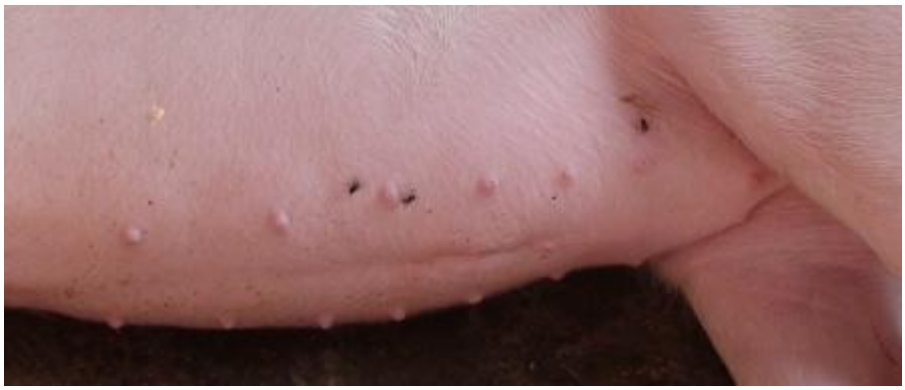
*Litter size, strength, vigour, weight gain, feed efficiency, fertility, free from defects*

Last modified: Monday, 4 June 2012, 02:24 PM

## SELECTION OF GILTS

- The selection of gilts for the breeding herd should be made at market weight, viz. when the animals weigh about 90 kg.
- It is important that the gilts to be selected should have been kept under similar feeding and management conditions so that any differences observed will truly be hereditary differences.
- It is also important that the gilts are managed in a manner similar to other animals proposed for market, because their performance will then be a better indication of what to expect from their offspring.

- No honest appraisal can be made of the breeding worth of gilts given special feed, care and management.
- Selected gilt should be from sows, which have consistently farrowed, and weaned large litters, have reached market weight in minimum time, and have desirable market type.
- In addition, it would be desirable to choose gilts whose litter mates and other full-sibs have given good performance in daily gain in body weight and feed-conversion efficiency.
- The gilt should posses minimum 6 pairs of teats



*90 kg body weight, minimum 6 pair of teats, select from a large litter, good feed conversion efficiency*

## SELECTION OF BOARS

- The selection of a herd boar is extremely important, particularly for a small breeding farm or unit.
- In a swine-breeding station, with adequate sow strength, it should be possible to maintain separate boar lines.
- In a strictly commercial enterprise, such as small piggery units maintained by farmers in the villages, the boar will probably be purchased.
- The performance of the herd boar to be selected should be of high standard and it should be purchased from a breeder or a farm maintaining adequate information on its performance.

- The herd boar should be from a dam, which has consistently farrowed and weaned large litters. A good boar will weigh 90 kg in about 6 to 7 months, will be of good type, and will be strong on feet and legs.
- Efficient feed utilization, although not mentioned in the selection of gilts, is a valuable aid in appraising a prospective herd boar.
- The boar's feed-conversion record from weaning to 90 kg weight would be the most desirable, but if this lacking then the feed conversion of tested litter mates full sibs or the tested progeny of both sire and dam would be a reasonable second best.

- Fortunately, rapid growth rate and efficient feed utilization are highly correlated, which means that the selection of a rapidly growing boar should improve the efficiency of feed utilization to some extent.
- It is desirable to buy a boar weighing about 90 kg, for it will be possible to have a more accurate appraisal by then.
- Some of the Standards to be observed while replacing boars and gilts are as follows:
    - The mother of the pig to be selected should have had large litters, of 8 piglets or more. The minimum 56 days weaning weight of a litter(10-12 kg), in case of gilt should be 120 kg and in the case of sow it should not be less than 150 kg.
    - The gilt or the boar should have reached a body weight of about 90 kg in about six to seven months.

    - The pig should have adequate length and depth of the body, thick, well-muscled hams, and should be firm and trim; it should have a prominent neck.
    - The pig should have sound feet and legs with good bone.
    - The back-fat probe in live animals is not yet being practiced in this country. Where it is proposed to be done following standards may be followed:
        - gilts, 4 cm or less;
        - boars, 3-2 cm or less.
        - In addition ,Gilts should have a minimum of 12 evenly spaced, functional teats. An animal with blind teats should be avoided as there will be little or no milk from these teats and the defect is heritable.Negative blood test for both brucellosis and leptospirosis should be made, and the animals immunized against swine fever.The pigs should be free from other diseases and physical defects.

*90 kg at 6-7 months of age, select from large litter (more than 8), free from leg defect*

## CULLING OF SOWS AND BOARS

### Culling of sows

- One third of the older sows annually (33% of sows).
- Gilts or sows not settled after 4 days breeding period.
- Nervous and irritable nature.
- Produce smaller litter.
- Sows with defective teats and poor milkers.
- Sows with small vulva, often is an indication of internal reproductive defect.
- Sows/gilts with inverted teats.
- Gilts and sows which do not meet the standard of meaty hogs.

*Older sow 33%, poor reproduction, small litter, defective teat, small vulva*

**Culling of boars**

- Infertile one (lack of libido)
- Boar of over 5 years of age
- Irritable nature and nervous disposition
- Over fat and too heavy, finds difficult to mount
- Not true to breed
- Cryptorchid
- Weak limbs

*Lack of libido, aged boar, over fat boar, not true to breed*

## MANAGEMENT AT BREEDING OF PIGS

- Feeding gilts and dry sows liberally to increase energy intake 10 to 15 days prior to mating is called *flushing*. It may be done as follows:
    - Feed leguminous hay (Cowpea / lucerne / berseem) for it supplies more protein, minerals and vitamins)
    - Extra allowance of grains.
    - Give multivitamin injection along with "flushing".

**Advantages of flushing**

- Improvement in physical condition of female.
- Prompt post weaning oestrus.
- Shows prominent heat symptoms.
- Increases ovulation rate.
- Good litter size.
- Shortens period between weaning to successful conception.
- High numbers born.
- More uniform litter size.

*Feeding extra concentrate prior to mating, ensures multiple ovulation, large litter, healthy litter*

## FLUSHING AT BREEDING

- It is important to give proper attention to the feeding of sows and gills before breeding.

- ‘Flushing’ (feeding liberally before breeding) sows and gilts at breeding time increase their ovulation rate.
- A good grower ration self fed to sows and gilts seven to ten days before breeding is excellent for flushing.
- After breeding, sows and gilts should be fed a limited but well-balanced ration until the last six weeks of pregnancy and then full feeding should be resumed.

## FLUSHING OF GILTS

- It is the practice of increasing the energy intake in gilts 7 to 10 days (1 – 2 weeks) before breeding or at about 7 ½ months of age. They should be fed to 6 to 8 lbs (2 ½ - 3 ½ kg) / day to provide the flushing effect.

### Advantages

- Shedding more no. of fertile ova - large litter
- The sows come to heat more promptly (Regularity)
- Conception is more certain.
- Gilts should be removed from the breeding pens as soon as they are bred and placed on a restricted diet to reduce embryonic mortality. It the sows are already over fat.
- The best preparation for breeding consists of exercise / access to lush pasture, at the same time the grain feeding should be decreased.

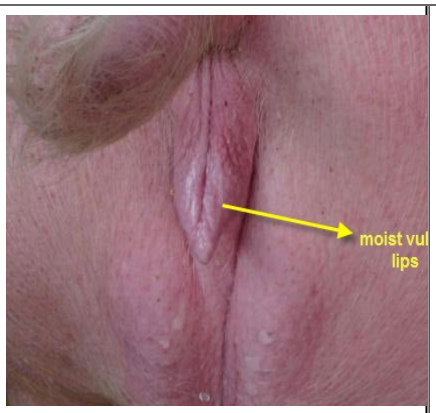
## INFLUENCE OF BOAR CONTACT ON AGE AT PUBERTY IN GILTS

- Five minutes of daily contact with mature boar is sufficient to stimulate early puberty in gilts providing gilts have adequate opportunity for physical contact with the boars.
- Gilts that are of 165 days of age appear to require daily boar exposure to obtain rapid and maximum puperal response.

*To attain early puberty, postpartum estrus*

## DETECTION OF HEAT

- Successful swine breeding and high conception rate depend on the ability to identify sows and gilts in heat.
- No two pigs are alike but the broad pattern of oestrus is always the same. The average length of oestrous cycle in pigs is 21 days (range, 16-25 days).
- The oestrous symptoms last for five to seven days beginning with vulval swelling and vaginal discharge.
- In true oestrus, there is frequent urination, reduced appetite, mounting and standing for service detected by the erection of ears, and immobility when normal pressure is applied to the back (lumbo-sacral region) or when someone sits on the back. (This is referred to as the standing heat or riding test.) This criterion, i.e. the application of pressure on the back is used to determine the correct breeding time.
- Animals with a predisposition for weak oestrus should be brought near the boar to exhibit heat symptoms a little more clearly.
- For effective detection, the herd should be observed in smaller groups.

| | | |
|---|---|---|
|  |  |  |
| **Normal vulva** | **Swollen vulva during** | **Standing heat** |

| | estrus | |
|---|---|---|

*Observation under smaller group, erect ears, standing for back pressure*

## TIME TO BREED

- Age to breed gilts -8 months
- Weight to breed gilts- 100-120 kg
- Length of heat period -2-3 days (range 1-5 days)
- Best time to breed- in Gilts- first day heat period- Sows, second day
- Number of services sow -2 services at interval of 12-14 hours
- Period of oestrous cycle -18-24 days
- Occurrence of heat after weaning -2-10 days
- Gestation period -114 days (range 109-120 days)

- Since sows ovulate 16 to 48 hours after the onset of oestrus, with the rapid loss of fertility after ovulation, it is best to breed during the latter half of the first day or early on the second day of oestrus. In many cases the gilts and sows continue to exhibit the 'standing heat' on the next day. In such cases the animals should be re-bred and the interval in the case of re-breeding should be 12 to 14 hours. This procedure will ensure a high conception rate in the herd.
- Sows come into oestrus one to four days after farrowing, but they should not be bred at this time. Sows may also come into heat two to ten days after weaning and may be bred at this time. But better results can be obtained by breeding them in the second post-lactational oestrus.
- With the help of records, the animals which have been bred should be observed for the appearance of subsequent oestrus. If animals repeat more than twice, it is desirable to cull them from the herd.

*Breeding sow on second day & gilt on first day, mating at standing heat, re-breeding with in 12-24 hours, if sow/gilt repeat twice cull them from herd*

## METHOD OF MATING

- Hand Mating
  - Is the practice of bringing the sows to the boar for individual service when they are standing heat. It is the most common method of mating is purebred animals.
  - *Advantages of hand mating*
    - More efficient use of boar power.
    - More accurate farrowing dates.
    - Repeat breeders can be detected more easily.
    - Breeding defects such as limber penis, weak hind legs are detected.
    - Sterile boars are quickly detected.
    - Provision can be made for breeding large boars to gilts or small boars to large sows.
    - Reduced embryonic mortality, if sows are removed from the boar immediately after breeding.

- Pasture mating
  - In this system of mating, the boar is permitted to run with sows. An aggressive yearlings or mature boar can actually serve 15 to 20 sows in a pasture mating system.
  - Young boars should be limited to not more than 8 to 10 gilts.
- Artificial Insemination
  - This method has more advantages.Hand breeding with additional opportunity of exploiting the effective boar performance.
  - Normal ejaculate if a boar is 200 ml to 500 ml of semen containing 20 to 50 billion spermatozoa. When suitable methods for storage and extenders are developed, 15 to 20 sows could be inseminated / or bred per ejaculate.

*Hand mating is the best method; AI exploit the efficiency of bore performance*

Last modified: Sunday, 3 June 2012, 03:38 PM

# CARE OF THE BOAR

- The boar reaches sexual maturity when 6 to 8 months old.
- The exotic boar under Indian conditions may take a month or two more to attain sexual maturity.
- A 9-month-old boar which exhibits libido should be of use in either hand or pen-mating systems.
- Young boars must be used with caution and they should be hand mated (the boar should be taken out of his pen to serve the gilt or sow in an individual pen). A yearling boar can be turned in with 10 to 15 females and can be expected to serve 7 to 8 gilts per week.
- Hand mating of individual boars should be preferred to field mating or pen-mating. The maximum number of services during the breeding season per boar should be four or five per week in case of mature boars and two or three in case of yearling boars.
- It is difficult to determine the normal breeding load for boars because of the variation in individual, aggressiveness and ability of the individual boar.

*Boar should be used at 9 months of age, young boar should be hand mated, 4-5 mating per week is allowed*

- If field- or pen-mating is practiced the following two methods are recommended, viz.
    - To split the sow or gilt herd so as to have duel boar for each group of 15 to 20 sows, and
    - To alternate boars in the sow or gilt herd, i.e. use one boar or a set of boars one day and another` boar or set of boars the next day
- If a new boar is introduced into a herd, he should not be used until after a minimum of 30 days of isolation period. Boars not familiar with each other should not be put together in a pen.
- Each boar should be provided with 1·5-2.0$m^2$ of dry, draft-free, well-ventilated sleeping area. Outdoor exercise throughout the year is one of the essentials in keeping the boar virile and in thrifty condition.

*In field mating sow/gilt should be split in two groups of 15-20*

- The tendency to overfeed a boar should be avoided. This is a wasteful practice that results in overweight, decreased libido and sluggishness. The new boar should be fed 2.0 to 2.5 kg of 14 per cent protein ration. If he is over or under condition during the breeding season, this amount should be changed to maintain thriftiness and vigour.
- Young boars in breeding condition usually grow well on 2-5 kg of feed during the first breeding season and can be maintained adequately on 2 kg of feed when not in service. The boar should be conditioned by increasing his ration to 2-5 kg, six to eight weeks prior to the breeding season.
- A fertility check should be made on each boar at least 30 days before introducing him in the herd. One of the best ways is to mate him with five or six healthy gilts that are to be marketed. If more than one of these gilts returns to heat within 28 days after mating, the fertility of the boar will be unquestionable.
- When the temperature exceeds 27°C hand mating should be done early in the morning and/or late in the evening. The boar should be fed twice a day, preferably after service.
- The sow should be bred at least twice, preferably during late hours on the first day and early hours on the second day of heat. The two services increase the conception rate by 30 per cent on the first heat and the litter size by one.
- Patience and good judgment is necessary in handling the breeding animals, for rough treatment may cause old boars to become vicious or young boars to become timid, and they may not mate readily when needed.

*Fertility check before 30 days of intoduction of new boar, sow should be bred twice.*

Last modified: Sunday, 3 June 2012, 03:38 PM

## MANAGEMENT OF PREGNANT PIGS

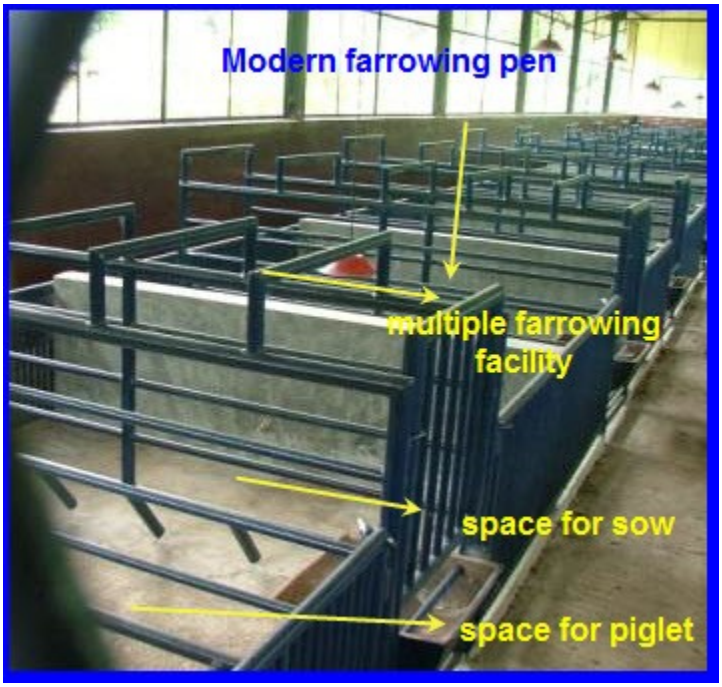
- The gestation period of a sow varies from 109 to 120 days, with an average of 114 days. Pregnant animals should be housed in groups in separate enclosures and should not be mixed with new animals to avoid fighting, which at times may result in abortion. It would also be advisable to house pregnant gilts and sows in separate groups during gestation.
- About 3 $m^2$ of dry draft-free housing should be available for each sow. The pregnant animals should be allowed to move about every day in the morning on a free range or a pasture, if available.

- A pasture area is presumed to be clean if a cultivated crop was raised since pigs were last kept on it. It is advisable to limit the size of pastures to one area.

*Fighting should be avoided, exercise to pregnant sow, provision of clean pasture.*

## MANAGEMENT AT FARROWING

- Farrowing time is the critical time in pig production. Even in well managed farms 25 to 30 per cent of the pigs born never reach the market.
- Death rate is high during farrowing and the first week after farrowing. Sows may be farrowed in pens equipped with guardrails and a creep space, in farrowing crates or in farrowing stalls.
- A pen equipped with guardrails and a creep space (with heating lamps in the creep space for northern part of the country) is adequate.
- The pen should be maintained *at* 24° to 28°C until the piglets are three or four days old and at 18° to 22°C until the pigs are approximately six weeks old.
- The heat lamps should be hung 45 cm from the floor and suitably protected.




*Provision of guardrails, creep space, farrowing crates, heating lamb at 45 cm from floor is essential*

- The farrowing pens should be thoroughly cleaned before the sow is brought in. This will prevent a large number of diseases of piglets.
- The sow should be brought to the farrowing pen at least one week prior' to farrowing so that it becomes familiar with the surroundings. She should be washed thoroughly before being brought to the farrowing pen.
- Then two changes should be made in sows, ration.
    - The ration should be made bulky by substituting one-third of the regular ration with wheat bran.
    - The amount of ration fed should also be reduced by one-third till the sow farrows.

- The sow should be watched closely for determining the approximate time of farrowing and feed should not be given 12 hours before farrowing.

*Clean farrowing pen, one third ration substituted with wean bran is essential*

## FEEDING SOWS AT FARROWING AND AFTER FARROWING

- When the time for farrowing is nearing more and more care is needed to wards feeding.
- About 4 to 5 days before farrowing, the sows ration should be reduced to nearly half. They should be prevented from becoming constipated by including laxative feeds like wheat bran, linseed meal etc, in the ration.
- The amount of high energy feeds like corn to be reduced and to be substituted by wheat bran.
- On the day of farrowing, it is better to give no feed at all. But enough of clean fresh water should be available throughout the period.
- It is essential not to feed the brood sow heavily after farrowing. If fed too much, she may produce milk in excess of the needs of the piglets which will lead to scours in piglets.
- The sow may be fed the same bulky ration as fed before farrowing for 3 – 4 days after farrowing.
- It is best to feed 50% of the ration on the first day and increase the ration by 200 – 300 gms daily until she is full fed.

*At 4-5 days before farrowing reduce the ration to half, substitute with bran or linseed to give laxative effect, gradual increase in ration after farrowing*

## PREPARATION FOR FARROWING

- About 3 – 4 days prior to farrowing, the sow should be isolated from the rest of the herd. Moderate exercise to be continued while the animals is in farrowing quarters.
- Sanitary measures - Before being moved to the farrowing quarters, the sow should be throughly scrubbed with soap and warm water, home should be thoroughly cleaned with boiling hot solution orKMNO4 solutions.
- Guard Rail – A Guard rail around the farrowing pen is an effective means of preventing sows from crushing their pigs. The rail should be raised 8 to 10 inches from the floor and should be 8 – 12 inches from the wall.
- Bedding – The farrowing quarters should be bedded with clean, fresh, good absorbent material eg. chopped hay and wood shavings.
- Artificial light – During the time of inclement weather, artificial heat must be provided. It is designed to maintain the temperature of $55^{o}$ – $65^{o}$ F during winter farrowing.

## SIGNS OF APPROACHING PARTURITION

- The immediate indications that the sow is about to farrow are extreme nervousness and uneasiness, an enlarged vulva, a possible mucus discharge she usually makes' a nest for youngones and milk is present in teats.

| | | |
|---|---|---|
| | | |

| Early pregnancy | 3rd month pregnancy | 3rd month pegnancy |
|---|---|---|

## PRESENCE OF ATTENDANT AT THE TIME OF FARROWING

- An attendant should be on hand when the sows farrow. Many piglets to be lost can be saved if someone is on hand to assist.
- It take generally 2 – 4 hours (maximum 6 hours) for complete farrowing to take place. Placenta drop one after the other and within 2 hours this is completed.
- Piglets should be removed as they are farrowed and kept warm in the creep space until farrowing is complete.
- Each piglet should be cleaned of all mucus to ensure that the breathing passage is clear.
- Piglets should be allowed to be nursed after birth. Within 2 days ,all the piglets settle down to their individual teats.
- They nurse 8 to 10 times in 24 hours in their initial period.

## FARROWING TROUBLES

- The major troubles at farrowing are mastitis or inflammation of udder which can be treated with effective antibiotic
- Next is agalactia, the causes of agalactia are not always same. It may be due to in sufficient secretion of oxytocin, which results in poor secretion of colostrum. This may be treated by the intravenous injection of 5 to 10 IU of oxytocin. Failure of milk secretion may be due to constipation, which may be cured by administration of suitable laxative like caster oil.
- The inflammation or injury of vulva at the time of farrowing may cause fever, which may also cause reduced feed intake and subsequently results in poor secretion of milk.
- Under such condition it is better to rear the piglets by foster mother or by hand feeding.

*Major troubles are mastitis, agalactia, metritis*

## CARE AND MANAGEMENT OF SUCKLING SOWS

- Sows should be fed more during suckling than pregnancy since the brood sow needs feed not only for its body maintenance but also for the formation of enormous quantity of milk it secretes to nurse the piglets .Each sow gives about 2.5 to 4 kg of milk per day.
- A good sow should give about 150 to 200 kg of milk during the 8 week suckling period. Sow's milk is much more concentrated than cow's milk and sow requires more feed.
- The sow is greedy by nature. So overfeeding should be generally avoided. However, it should never be allowed to lose weight at any cost. Since heavy lactation may continue even at the lost of body tissues, a sow may lose weight if proper care is not taken in feeding.
- A sow requires about 4 to 6 kg of feed daily depending on its nursing ability and litter size.
- A practical hint to be followed is to allow 1.5 kg of feed for the sow and add 0.5 kg of feed per every piglet to a maximum of 5 to 6 kg of the total ration.

- Ten days after farrowing, the sow may be allowed to graze along with its litter. Good pasture is most desirable for suckling sows.
- Plenty of Lucerne hay or succulent fodder may be provided to the sow if it is not allowed on pasture.
- The concentrate feed meant for piglets should be protected by creep arrangement to prevent the sow from eating it.
- The feed should contain 14 per cent protein for mature sows and 15 per cent protein for gilts.
- Maize or other grains, groundnut cake, fishmeal, meat scrap, dairy products, etc., may be included in the ration.
- The feed should be sufficient in various minerals and vitamins to offset any deficiency in the sow or the piglets.
- A few days prior to weaning time, the quantity of feed is gradually reduced so as to restrict the milk flow and to dry out the udder. In this way, complications like mastitis may be avoided.

*2.5 to 4 kg milk secreted by a sow daily, feed should contain 14-15% CP,*

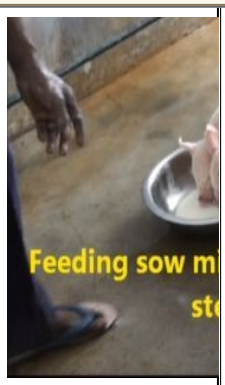
## CARE AND MANAGEMENT OF PIGLETS

- The baby pig begins to explore his environment with in a few minutes after birth and soon finds his way to nipple and begins to suckle.
- Because of his curiosity, it is essential that the pen environment should be clean to minimize chance of exposure to disease and parasite.
- Normally individual piglets identify themselves with a particular teat during the first few days of life and jealously protect their access to it. The teat order will be set with in 10 days. But in small litter it is common for a piglet to claim more than one nipple. On the other hand in larger litters, the weakest pig may starve because they cannot compete for a nipple.
- The normal nursing behavior pattern is for a uniform time interval between each feeding over a 24 hours period. The average nursing interval is less than 1 hour so that suckling piglets receives more than 24 feeding daily, each feeding consist of only few minutes and it decreases when lactation advances.
- To prevent ‘naval ill’ the naval card should be tied off to prevent loss of blood and it should be cut 3-5 cm distal to the legation and this portion should be dipped in a solution of 2% iodine or 70% ethyl alcohol.

| | | | |
|---|---|---|---|
|  |  |  |  |
| Naval care | Cutting a naval care | After cutting | Application of disinfectant |

*Teat order sets in 10 days, average nursing interval is less than 1 hour*

## RAISING ORPHAN PIGLETS

| | |
|---|---|
|   |  |
| **Feeding with cow milk** | **Nipple feeding** |

## Orphan pig hand feeding

- The death of a sow after farrowing is mainly due to lactational failure and mastitis.
- The orphan piglets are raised by the use of foster mother or foster sow or by use of milk replacers.
- In the foster sow technique, transfer of orphan piglets must be made within few days after farrowing.
- To ensure the acceptance of new pigs, the sow should be separated from her own litter for a short time and the new piglets are brought to the sow.
- A good sow milk replacer consists of one egg yolk thoroughly mixed with one litre of cow's milk. This mixture supplies well balanced diet.


*Death of sow or lactation failure leads to orphan pig, can be reared by cow milk or sow milk replacer*

## REMOVAL OF NEEDLE TEETH

Needle teeth

Clipping of needle teeth

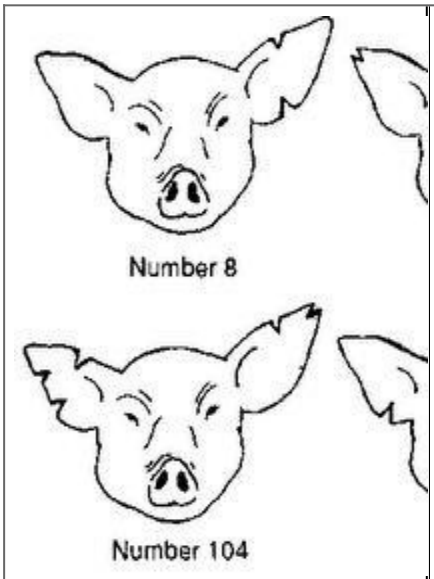
After clipping the needle teeth

- Piglets are born with four pairs of sharp teeth with two pairs on each jaw. These are known as wolf teeth.

- These teeth has no practical value to piglets and they irritate the sow's udder during nursing or cause injury to other piglets at the time of nursing. So, it is good practice to clip or remove the needle teeth shortly after birth (0 – 3 days).

## EAR NOTCHING OF PIGS

- Pigs should be ear notched at the time of birth.
- Ear notching is required for registering pure bred pigs for identification.
- The pig ear is considered in two halves.
- Four areas are available for notches.
- Each of the notches is assigned a number, thus notch in the lower edge indicates the number 1, while a similar notch in the lower edge of the tip half indicates number 3.
- Each notch in the upper edge of the tip half count as number 9 and notches on the base half are 27, a notch in the tip of the ear has a value of 81.
- Combination of these notch numbers give a wide variety of numbers for litter identification.
- The right ear is used for litter mark and left ear is used for pig number.




**Ear notching**

**Ear notching forcepts**

**Ear notched pig**

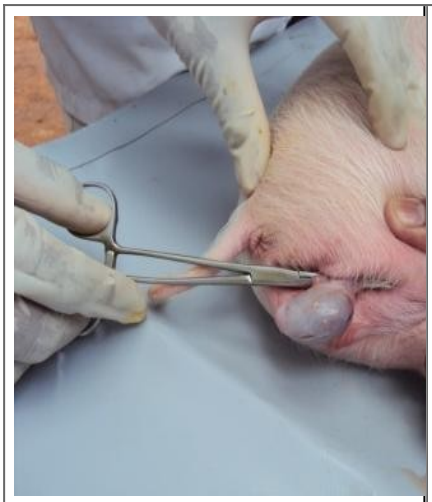
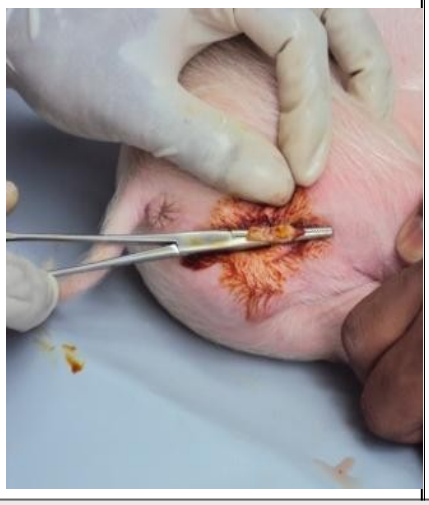
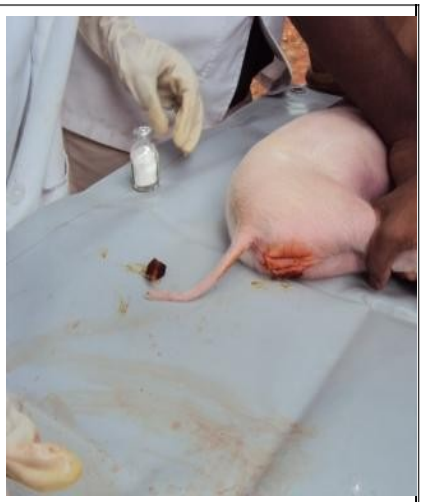
## PIGLET ANAEMIA

|  |  |
|---|---|
| **Iron injection** | **Piglet anaemia** |

- Prevention of anaemia is necessary for all the pigs kept in confined rearing. If the piglets are reared in pasture,they will get iron from the soil. Pigs reared in confinement should be treated for the piglet anaemia at 0 – 3 days of age with an injection of 100 – 150 mg of iron dextran injection at the side of the neck.
- The piglet anaemia condition can also be prevented by oral administration which consist of spraying, swabbing in sows udder with saturated solution of ferrous sulphate (0.5 kg of ferrous sulphate in 10 l of hot water) so that the piglet will get some iron in each time during suckling milk.

## CASTRATION OF PIGLETS

- The male piglets not selected for breeding may be castrated early.
- Castration may be performed at anytime and correct time to perform this procedure when they are 3 – 4 weeks old. At this age problem of controlling the animal is easy.
- Pigs are castrated to maintain the quality of meat and to prevent the uncontrolled breeding and to prevent the boar odour in the cooked meat of uncastrated males.

**Castration of piglet**

## CREEP FEEDING

- Piglets begin to develop an appetite for the dry feed at the age of 2 – 3 weeks.
- Provision of additional nutrients at this time is essential for the maximum growth and development are to be achieved during the period from farrowing to weaning.
- The creep feed should be palatable, rich in nutrients and should be easily digestible
- The creep area may be provided to all piglets in the farrowing pen.

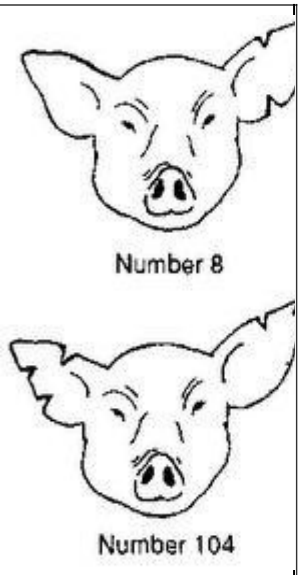
## WEANING, IDENTIFICATION AND DEWORMING OF PIGS

### Weaning

- Normally piglets are weaned at 8 weeks of age.
- Weaning at an early age is a specialized job and should be practiced only by experienced person.
- The standard weight of weaning of piglets is 6 kg and above. Normally in pig farm piglets, are weaned by weight and not by date.

## Identification

- Weaning is the ideal time for giving identification to the piglets(Tatooing and Tagging). The common method of identification of piglets is ear notching at the age of 10-15 days old. The other methods of identification are,
    - *By tattooing:* Using tattooing forceps at the inner side of the ear devoid of blood vessels.
    - *Tagging:* By plastic tags, brass tags and polyurethane tags.

| | | |
|---|---|---|
|  |  |  |
| **Polurethane ear tag** | **Ear tag application** | **Ear notching** |

## Deworming

- The piglets should be dewormed at the time of weaning or 1 or 2 weeks after weaning.
- The ideal drug to deworm the piglets is albendazole given at the rate of 1 ml / 5 kg body weight.

## FEEDLOT STOCK MANAGEMENT

### Fatteners

- Very few piglets are raised for bacon or for lard purpose in tropical and mostly they are reared for pork production and they are generally marketed by 45-63 kg.
- The fattening stock should have uniform size and age and it is better to fatten litter mate
- Normally the fatteners attain 54 kg by 5$^{th}$ month of age. They should again drenched with piperazine by 15$^{th}$ to 16$^{th}$ weak to control internal parasite
- The feed should be in the form of dry or wet. The feeding should be regular otherwise the pigs may be restless and may loose some energy
- They should be fed to their appetite but not to repletion

## WEANING OF PIGS AND GROWER MANAGEMENT

- Normally piglets are weaned when eight weeks of old [56$^{th}$ day]. Weaning at an early stage is a specialized job and should be practiced only by experienced persons.
- At weaning the sow should be taken away from the piglets and not the piglets from the sow.

- Weaning should be a **gradual and not an abrupt process.** At first the sow should be taken away for few hours, then for whole day and finally for all time.
- The grower piglets should be grouped accoring to the size. The group size may vary between 10 and 20.
- Optimum floor space should be provided to minimize tail biting.
- The piglets should be shifted from 18% protein creep ration to 16% protein grower ration.
- The piglets should be drenched with a deworming drug such as piperazine immediately after weaning in order to control internal parasite.

## MODULE-3: HOUSING OF SWINE

Learning objectives

This module discuss about

- Where to locate a pig sty, floor space requirement of pig sty, feeding and watering space requirement.
- Construction details of pig farm
- Other facilities required like farrowing pen, gaurd rails, wallowing tank etc.

## INTRODUCTION TO HOUSING OF SWINE

- When planning pig farming it is essential to provide for housing. Farrowing two litters per sow annually should be attempted. The annual cost of maintaining a sow varies little whether it farrows one or two litters per year. Adequate housing and equipment for raising pigs are necessary to provide shelter against inclement weather, prevent diseases, control parasites and save labour.
- The pattern of houses suitable for a particular area may not be suitable for other areas. However, certain basic considerations in providing housing for the herd should be designed in a way to give maximum comfort to pigs so that their growth is optimum. Dampness, draft and overheating should not be allowed to occur.
- Every effort should be made to utilize the locally available materials in the interest of economy. The flooring should have a rough finish and should be of a regular masonary type made up of waterproof cement mortar or lime mortar. Proper drains should be provided so that the effluents are disposed off.

- Generally under village conditions, the housing can be made up of pens measuring 3m x 2.4m or 3m x 3m, with an open yard of nearly the same dimension or in some cases slightly longer. Walls should be 1.2 to 1.5 m high from the floor.
- For the purposes of farrowing, some of the pens could be converted into farrowing pens by providing guardrails made up of G.I. pipes of 5 cm diameter, along the walls, 20 to 25 cm from the ground and the wall. In addition to guardrails, creep space can be provided for the piglets along the wall by making a partition, or in one of the corners with separate entrances for the piglets. This space is usually of 0.75m x 2.4m area.
- In many of the farms, the yard is provided with regular flooring. While it may be desirable to avoid this procedure and leave the open yard portion of the housing as a natural ground dressed to slope, regular flooring is often made on grounds of sanitation for the control of diseases, particularly in places where exotic pigs from temperate regions are introduced.
- As the piggery-development programme envisages the use of exotic breeds, their management under conditions prevailing in this country needs special attention.
- Prolonged exposure of the animals to bright sunshine may cause swine to become overheated, even during moderate weather. Shade helps in preventing deaths and increasing production efficiency during hot weather. While it is desirable to plant trees in the neighbourhood of pens for reducing the intensity of heat, it is not desirable to plant trees for giving regular shade, because they permit rapid build-up of parasite levels.

## LOCATION OF THE PIG STY

- The pig sty should be located an elevated and well drained site not liable to flooding. The structures should be at least 15 m away from the human dwellings and factories, 30 m away from the dairy farm, poultry houses and food grain storage.
- 40 m away from the fire sources, 1 km away from the garbage dumping grounds, slaughter house and leather factories. The site should have adequate water supply. The site should also have plenty of sunlight and air circulation.

*Should be 30 m away from dairy farm, 15 m away from human dwelling, 40 m away from fire source*

## TERMINOLOGY OF PIG STY

### Sty

- A dwelling place consists of one or more pen for pigs.

### Pen

- It is a part of pig sty for housing single or group of pigs having covered place and an adjoining open yard. The covered place providing feeding and watering trough and also dunging space.

### Dry sow and gilt sty

- It is a dwelling place for dry sow and gilt.

### Farrowing sty

- It is a dwelling place for nursing sows and litter

### Fattening sty

- It is a dwelling place for young pigs kept for fattening purpose

### Sick animal sty

- It is a dwelling place for sick pigs particularly meant for segregated from healthy stock.

### Stud boar sty

- It is a dwelling place for breeding boars.

## SPACE REQUIREMENTS

Covered floor area requirement

| Sl.No. | Type of animal | Covered area per animal ($m^2$) |
|---|---|---|
| 1 | Boar | 6.25 – 7.5 |
| 2 | Farrowing sow | 7.5 – 9.0 |
| 3 | Weaner Fattening pigs | 0.96 – 1.8 |
| 4 | Dry sow gilt | 1.8 – 2.7 |

Open yard requirement

| Sl. No. | Type of animal | Open yard area / animal $m^2$ |
|---|---|---|
| 1 | Boar | 8.8 – 12.0 |
| 2 | Farrowing sow | 8.8 – 12.0 |
| 3 | Weaner Fattening pigs | 8.8 – 12.0 |
| 4 | Dry sow Gilt | 1.4 – 1.8 |

Feeding and watering trough area requirement

| Sl. No. | Type of animal | Feeding space/ animal |
|---|---|---|
| 1 | Boar | 60 – 75 cm |
| 2 | Sow with litter | 75 – 100 cm |
| 3 | Fattening pigs | 30 – 40 cm |

| | | |
|---|---|---|
| 4 | Weaner | 20 – 30 cm |

- In all the types the width of the trough either feed or water trough shall not be less than 50 cm.
- Watering space is 1/10 of feeding space

## FARROWING STY AND GUARD RAILS


### Farrowing sty

- The farrowing sty shall be designed to provide sufficient room for nursing sow to sleep and for the piglets to move. Provided one or two rows along the walls of the farrowing sty compartments for the piglets.
- Each compartments should measure 2.5 x 0.75 x 1.2 m height and opening of 300 x 225 mm space shall be provided in each compartment facing the nursing sow.
- Watering and feeding troughs need to be provided in each compartment. Guard rails shall be provided 25 cm above the floor level.

### Guard Rails

- It is made up of GI pipe of 5 cm diameter and it can be fixed along the wall 20 – 25 cm from the ground and wall

## CONSTRUCTION DETAILS OF PIG STY

Floor

- The floor of the pig sty should be hard and impervious to water and easy to clean and the floor should be laid with concrete and slope towards the drainage.

Roof

- The roof may be RCC flat type or gable roof. Materials for roofing may be asbestos cement sheets or corrugated steel sheets.
- In the regions of extreme climatic conditions, the roof may be insulated by providing a layer of thatching to reduce severity of the heat inside the pig sty.

### Door

- The number of doors provided in each sty shall depends on the dimensions of the house.
- Door made up of iron angle and the width of the individual door to individual pen may range from 0.75 – 1.00 m.

### Drainage

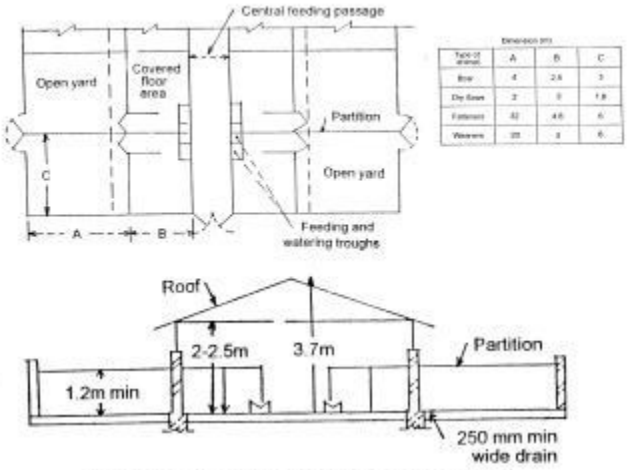
- Each pig sty shall be provided with alleast one drain on each pig pen.
- The drain shall have a minimum width of 250 mm and a slope of 25 mm.

*Impervious concrete floor, insulated roof, sufficient doors, good drainage with 25 mm slope*

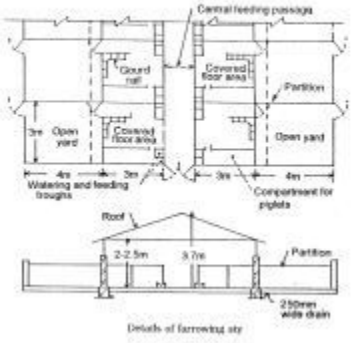
## WALLOWING TANK

- Pigs have very few sweat glands. In areas having warm weather, mature breeding animals and fattening animals need a wallow during summer months. Instead of permitting unsanitary wallows, a masonary wallow with proper drainage would be desirable.
- The size of the wallow will depend upon the number and size of the animals Wallowing tank may be provided in pig breeding farm suited to zones.
- The wallowing tank made of cement concrete and dimension of the tank is less than 2.5 m x 1.2 m x 0.15 m. Alternatively overhead sprinklers and showers may be provided in order to keep the animals cool during summer.

## SWINE FARM LAYOUT




Details of boar, dry sow, fattening and weaner sty

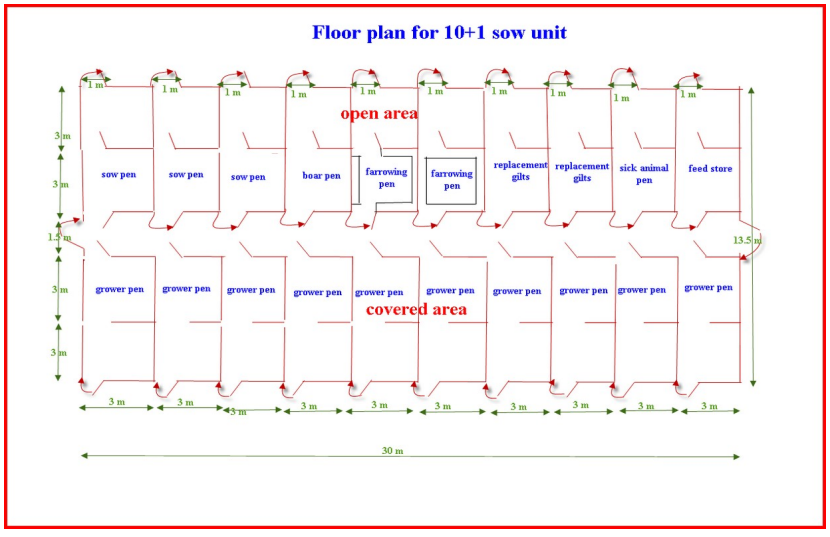



Details of farrowing sty

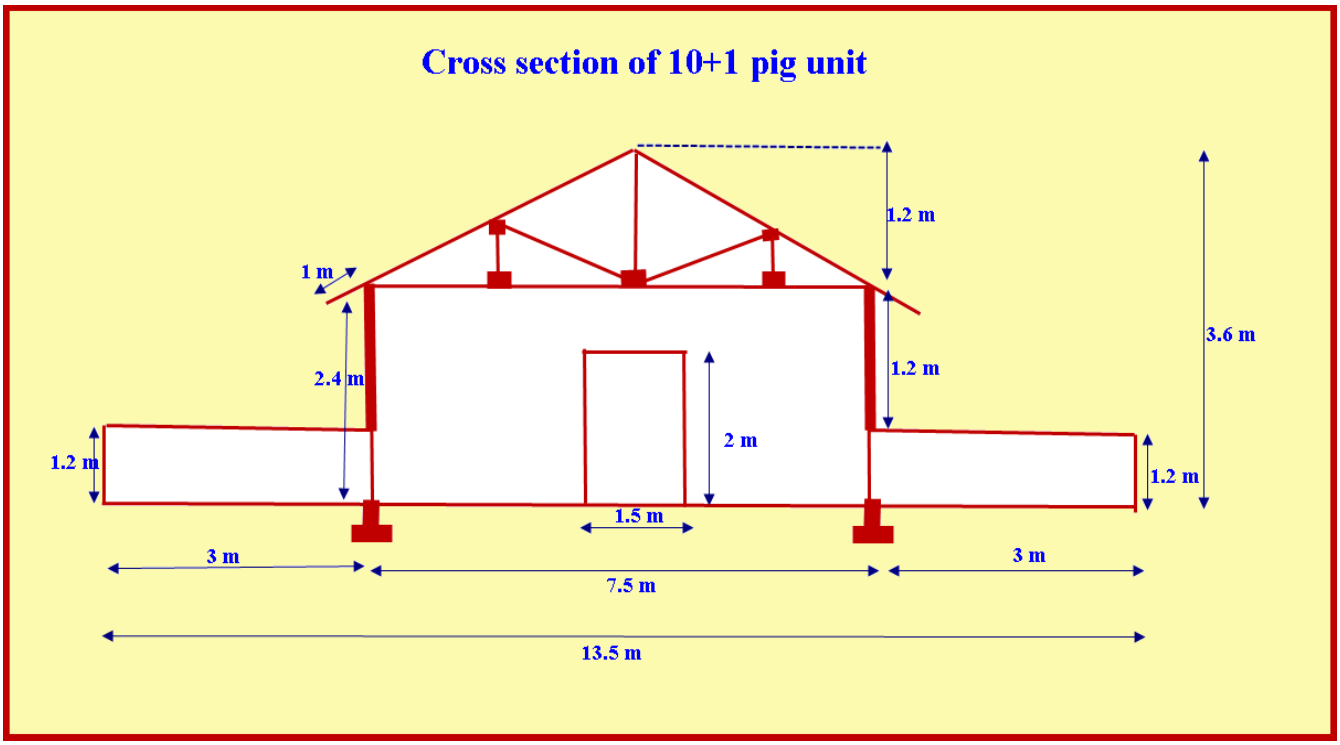
- 

*Farm layout, floor plan and cross section for a smaller unit.*

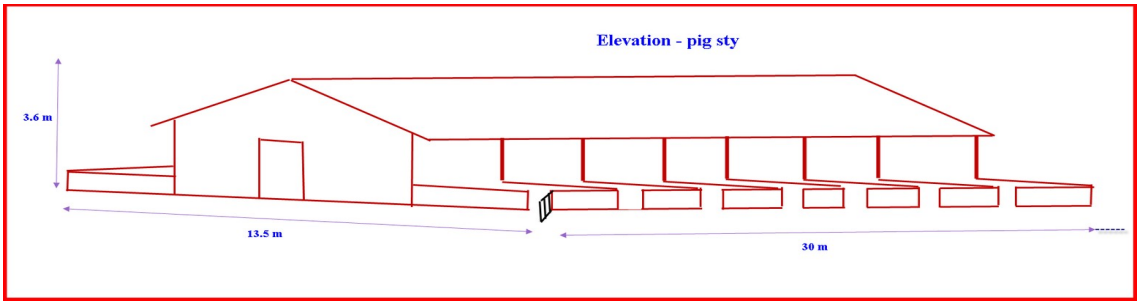
## FLOOR PLAN FOR 10+1 SOW UNIT




## CROSS SECTION FOR 10+1 SOW UNIT




## ELEVATION OF A PIG STY




## FUNCTIONAL UNITS OF STY

- Boars sty
- Dry sow and gilt sty
- Farrowing sty
- Weaner / grower sty
- Fattening sty.

## BOAR STY

- Each boar sty shall normally, have not more than 24 pens under one roof and each pen shall accommodate not more than one animal.
- 6-7 meter square per boar under pen and 9 meter square per boar in the run area

*24 pen under one roof, individual housing*

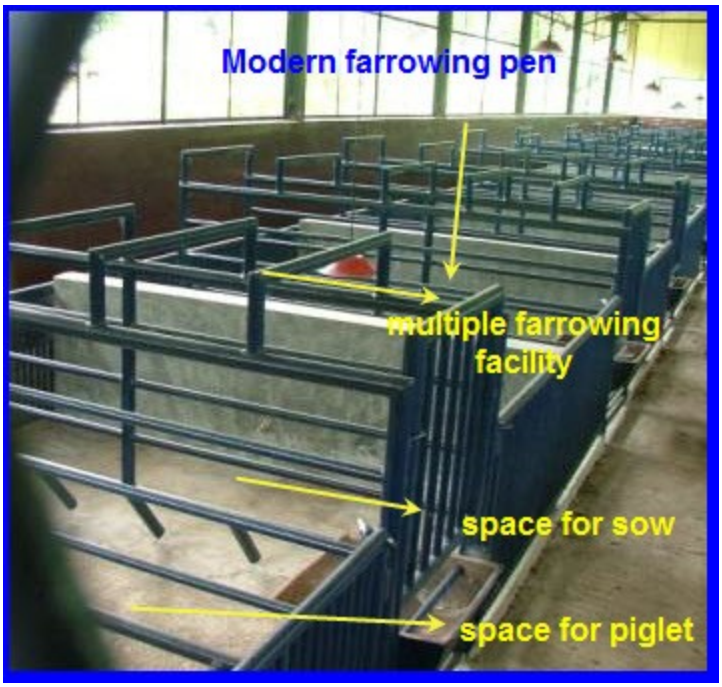
## DRY SOW AND GILT STY

- It is meant for growing gilt or dry sow.
- Each sty shall normally have not more than 40 pens under one roof and these pens shall be arranged in two rows.
- 5-10 pigs can be accommodated in each pen depending upon the stage of pregnancy and age.

*Should not be more than 40 pen under one roof, 5-10 pigs per pen.*

## FARROWING STY

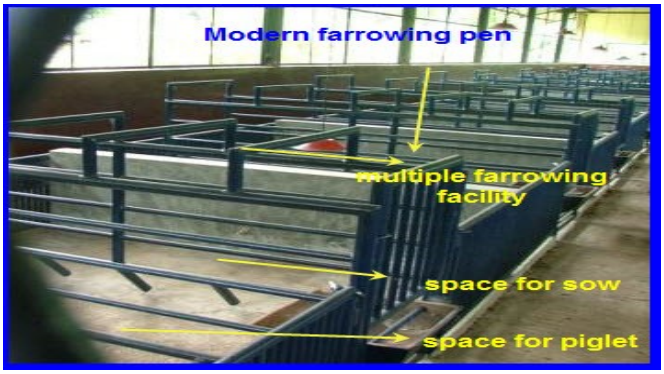
- Pregnant sows are transferred to these sties 7-10 days before the expected date of farrowing and left here up to weaning of their litters (56 days).
- Each farrowing sty shall normally contain not more than 40 pens under one roof and each pen shall accommodate not more than one animal with the litter.
- Number of farrowing pen required is 10 % of the breedable female.
- Floor sapce allowance is 9 square meter both in pen and run
- Each pen should have the facilities of guard rail and creep area



*No. of pens 10% of breedable female, 9 square meter area, maximum of 40 pen under one roof*

**Guard rail**

- The guard rails are made up of tubular iron rod of 2 to 2.5 inches thickness and fixed 25 to 30cm away from the wall and above the floor.
- So that the piglets can run under the rail when the sow lies down so that the crushing of piglets can be avoided in between the sow and walls.




*To protect the piglet from crushing*

**Creep area**

- In corner of the pen creep area should be provided with the help of stone slab should be fitted in the corner of the pen, 25-30cm above the floor level.
- In that area piglet only can enter and get the creep feed. Lighting can also provided in creep area to give warmth to young ones.
- Since piglets having thin layer of subcutaneous fat it is more susceptible to cold stress.

*To provide palatable concentrate feed to piglet*

### Bedding

- For good results 4 to 6" bedding is needed especially in winter and at first 3 days after farrowing to give warmth, softness and non slippery floor.
- It must be kept clean dry and evenly distributed.
- Wallowing tank should not be provided in the farrowing pen in order to avoid trampling of piglets in to the wallowing tank.

*To give warmth and to provide non slippery floor*

## WEANER STY

### Weaner sty

- Piglets that are weaned are housed in these pens up to six months of age.
- Each sty shall normally, have not more than 30 pens under one roof. Each pen may accommodate 30 piglets of age group between two to six months.
- Number of weaner/grower sty is equal to the number for breedable female in the farm.
- 0.9 to 1.8 square meter per animal under pen and run

*30 piglet/pen, 30 pen under one roof, number of pens equal to number of breedable sow*

### Fattening sty

- These are for housing pigs that are being transferred for the market.
- Each fattening sty shall normally have not more than 20 pens under one roof
- and each pen may have 16 to 32 animals kept for fattening purpose.

## STY FOR SICK ANIMAL

- The number of pens under this sty shall depend upon the number of animal kept in farm normally a minimum accommodation for 5 percent of the stock shall be provided for housing the sick animals.

*5% of the stock, away from healthy animal shed*

## SUBSIDIARY ITEMS/ACCESSORY ITEMS

- Apart from the building for the stock, a few subsidiary buildings like weighing yard, store buildings, feed store, loading and unloading ramp, manure pit, garbage boiling vat and Boiler room and wallowing tank.

### Weighing yard


- The specification for the weighing yard may vary from one place to the other.
- A weighing shed shall be provided wherein a weighing scale shall be fitted to record the weight of the animals regularly.

### Store building

- The store buildings may have a store-keepers office, a mixing room to mixture feed of the animal, a room for keeping farm equipment tools.

### Feed store

- The size of the feed room shall vary according to the number of animals kept and it is used to storage of feed items.

### Manure pit

- The manure pits shall be constructed at a distance of not less than 15m away from the sties.
- As regards the liquid manure, including urine and washings a suitable provision shall be made for its disposal for irrigating the cultivated areas.

## MODULE-4: SWINE FEEDS AND FEEDING

Learning objectives

This module discuss about,

- Protein, energy, fat, mineral requirement of various categories of pigs
- Feeding of different classes of pigs, quantity required, protein requirement etc will be discussed

## INTRODUCTION TO SWINE FEEDS AND FEEDING

- Feed plays an important role in successful pig production. Feed costs represent 80 per cent of the cost of producing pigs even under good management conditions.
- The quality of the rations determines to a great extent the rate of growth in young pigs, the general resistance to diseases and parasites, the regularity of breeding, the size and vigour of the litter, the amount and quality of the milk, and the quality of the carcass produced for the market.
- Pigs are the most rapidly growing livestock and suffer more from nutritional deficiencies than the ruminants. A complete diet for pigs, as for other livestock, includes proteins, carbohydrates, fat, minerals, vitamins, and ample good water.

## PECULIARITIES OF SWINE NUTRITION

- Feeding accounts over 75 per cent of the total cost of raising pigs. This may vary according to the type of stock being raised. A study of the cost and returns for 91 producers covering 4059 feeder pigs, conducted by Agricultural Experiment Station of Arkansas University showed that feed cost 67.2 percent, fixed cost came to 17.2 percent and other variables 15.6 percent.
- Since the prices of feeds are higher and labour is cheaper in India, percentage cost of feed will be higher and can safely be assumed to be above 75 percent. Therefore, it is very important that the best use is made of feeds at the most economic level.
- Pigs consume more feed per unit body weight than the lambs, chicken or calves. They are also more efficient in converting feed than other species. This results in faster gain per unit body weight.
- Pig, being an *omnivorous monogastric animal*, can digest only smaller quantity of crude fibre than ruminants. Therefore, their capacity to utilize roughages is limited. However, this does not mean that they do not need any roughage. Far from it, providing good pasture of good quality hay is a nutritional necessity as well as it reduces feeding costs considerably.
- As different from ruminants, the amino acid content (protein quality) and the concentration of B-vitamins in the feed are important for pigs. In formulating rations for pigs, not only the total protein content but the concentration of all essential amino acids have to be taken into account.
- Similarly, the ration should contain adequate amount of vitamins of the B-Complex series like riboflavin, niacin, pantothenic acid and vitamin $B_{12}$ apart from vitamins A and D.
- The type of feed and the methods of feeding greatly influence feed efficiency, growth (rate of gain), breeding efficiency, carcass quality and the health in general.
- The nutritional requirements of swine vary with sex, age and physiological status of the animal. According to the nutritional requirements, swine can be classified into eight groups as follows;
    - Young pigs: 1. Pre-starter pigs (2-5 kg), 2. Starter pigs (5-15 kg)
    - Weaners: 3. Grower pigs (15-35 kg) 4. Growing and finishing hogs (35-90 kg)
    - Adult males: 5. Boars
- Adult females:
    - Gilts,
    - Pregnant sows and gilts,
    - Lactating sows

*75% of production cost is feed cost, vitamin supplementation in feed is important, type*

*and method of feeding influence feed efficiency and growth rate*

## PROTEIN REQUIREMENT

- The starter pigs require more than 20 per cent protein during suckling stage; this declines to about 14 per cent by the time they 45 kg.
- For pigs approaching 90 kg weight 12 to 13 per cent protein in the feed is adequate.
- Higher levels than these are needed if the protein quality is poor, i.e. if one or more essential amino acids are deficient in the diet.
- The protein level needed for pregnant females and young breeding boars is around 15 per cent.

## ENERGY REQUIREMENT

- The energy or the total digestible nutrient component of a ration should be the largest fraction since the pig is not equipped to digest fibrous feeds.
- Starch and fat in the feed form the main source of energy. Rapid gains cannot be obtained if pigs are fed grain rations containing less than 70 per cent of total digestible nutrients.
- Thus, pigs under 40 kg live weight when fed heavy rations containing mainly maize, sorghum, oat, barley, wheat or rice give best performance.
- During the finishing period the use of lighter rations having 65 to 70 per cent total digestible nutrients will often lead to marked improvement .
- Energy and total feed requirements are closely related. Under good conditions, pigs in the period following weaning require about 1.2 kg feed per kg of live-weight gain. This high efficiency naturally declines until 1.8 to 2.8 kg feed is consumed for every 1 kg of gain towards the latter part of the finishing period. This progressive change in feed efficiency underlines the importance of using good rations in the growing period. At this stage, feed efficiencies are high because the development of muscles has priority over fat in the growth of the pig.
- Cereals and millets are the main ingredients of swine rations. The byproducts of cereal grains may also be fed. They have higher fibre, protein and phosphorus but are deficient in calcium and poor in the quality of protein and specific vitamins. Generally the fibre content in swine rations should be around 5 to 6 per cent. If this is exceeded there is a reduction in feed utilization efficiency.

## SALT AND MINERALS IN PIG FEED

- Salt is required by swine in relatively small quantities. A mixed ration should contain 0.5 per cent of added salt.
- A higher level is recommended only when products of animal origin such as meat-meal are used in limited amounts. Excessive salt (about 5 per cent) is not palatable and is toxic.
- Iodized salt, in which iodine has been stabilized, is used to meet both salt and iodine requirements of the pig. If iodized salt is not available, potassium iodide at the rate of 18 g per 100 kg of mineral mixture should be added.
- Swine require somewhat greater percentages of calcium and phosphorus than do cattle or sheep. These requirements can be met by including animal protein supplements, such as meat-meal, tankage, fish- meal and milk byproducts.
- Many rations which supply proteins are largely of plant origin and do not have sufficient calcium.
- It is advisable, in such cases, to include a calcium compound, such as high grade ground limestone in the supplement.
- Swine rations can be improved by adding a phosphorus supplement such as dicalcium phosphate.
- Iron and traces of copper are required to prevent anaemia, as sow's milk is particularly deficient in iron. If suckling pigs do not have access to fresh soil they should receive supplementary reduced iron, either orally or intramuscularly.

- The feeding of 1/8 to 1/4 teaspoonful of ferrous (iron) sulphate or reduced iron per pig is advised. These iron supplements usually contain sufficient copper as an impurity to meet the needs of this mineral.
- When parakeratosis, a type of dermatosis, is occurs as a herd problem, additional zinc in the form of zinc oxide, at the rate of 100-200 g per 100 kg feed.
- Almost any mineral mixture that meets the needs of swine and is palatable enough to be eaten freely is satisfactory.
- A good mineral mixture for pigs can be prepared by adding 5 parts of steamed bone meal, 2-5 parts of ground limestone, 1 part of charcoal, 1 part of hardwood ash and 0.5 part of common salt (28 kg of potassium iodide may be added to 160 kg of the mineral mixture in areas where iodine deficiency is common.)
- Swine feed should contain sufficient vitamin A and vitamin D from the fat-soluble group, and riboflavin, niacin, vitamin B12 and pantothenic acid from the B-complex (water-soluble) group.
- Most feed combinations used for swine feeding are adequate in most of the required vitamins. Swine fed on pasture or fresh greens or fresh green forage get practically all the vitamins they need except vitamin D and vitamin $B_{12}$. With plenty of sunlight vitamin D deficiency is normally not experienced in this country. To supply vitamin $B_{12}$, an animal protein concentrate or a vitamin $B_{12}$ supplement should be included.

## ANTIBIOTICS IN PIG FEED

- Antibotics are widely used in swine rations. Since they do not perform the functions of a nutrient, they are classed as non-nutrient feed additives.
- Antibiotics should be fed at recommended levels. Feeding antibiotics to swine results in increased rate of gain and increased feed efficiency, particularly during early phases of growth.
- In the case of unthrifty or runt pigs and pigs fed upon poor rations, an antibiotic vitamin $B_{12}$ supplement is usually more beneficial.
- The commonly used beneficial antibiotics are chlortetracycline (aureomycin), oxytetracycline (terramycin), penicillin and bacitracin. An effective level of antibiotic is 10 to 20 mg per kg of feed.
- In some cases, a combination of antibiotics is more effective than a single antibiotic.
- Pigs supplemented with these antibiotics may grow 15 per cent faster. The antibiotic supplement is not generally recommended for mature, dry or breeding stock, which seldom have digestive disturbances.

## WATER REQUIREMENT

- Pigs need plentiful water, the amount required depending on size, age, class of animal and climate.
- It also depends on the amount of milk being produced when a sow is nursing a litter. This condition can be fully appreciated when it is realized that a dairy cow requires 4 to 5 litres of water for every litre of milk produced and that a sow nursing 10 pigs usually produces in excess of 200 litres of milk in 56 days.
- Pigs consume more water in hot weather to regulate the body temperature. If they are denied that extra water, the feed intake declines and the rate of growth decreases.
- The animals should receive all they want to drink, at least two or three times a day.

## NUTRITIONAL DEFICIENCIES

| Symptoms | Possible causes |
|---|---|
| Slow growth | Grain deficiency, too little feed, protein level or quality too low, mineral deficiency, vitamin deficiency. Also possible parasite infestation or disease. |
| Poor appetite | Deficiency of protein, calcium, phosphorus, iron, B-vitamins. |
| Abnormal skin and hair conditions | Amino-acid deficiency (improper protein supplements), calcium deficiency or imbalance, salt deficiency vitamin – B deficiency. Mange is a possibility |
| Lameness, rickets, posterior paralysis in sows | Deficiencies of calcium, phosphorus, vitamin A, vitamin D and certain B-vitamins. |
| Scours, diarrhoea, enteritis | Vitamin B deficiencies, ration too fibrous. High ‘disease level’ in barn due to improper sanitation, poor ventilation, etc. |
| Poor reproduction | Either over-fatness or run-down condition, calcium, iodine, vitamin A or vitamin B deficiency. |
| Birth of dead or weak pigs | Deficiency of vitamin A, iodine, protein, calcium or B-vitamins in sow’s ration |

| | |
|---|---|
| Birth of hairless pigs | Iodine deficiency in the sow's ration during pregnancy. |
| Birth of blind pigs, dead and mummified pigs | Vitamin A deficiency |
| Anaemia | Iron deficiency. Copper and certain B-vitamins are also involved. |
| Lactation failure (agalactia) | The exact cause is unknown, but it is significant that sows fed according to recommendations described earlier and well cared for seldom fail to have milk. It is probable that mineral and protein deficiencies in the gestations are involved. |

*Hairless piglet-iodien deficiency, blind piglet Vit. A dificincy, lactation failure - protein and mineral deficiency*

## HOW TO FORMULATE PIG RATION

- There is no single swine ration that is best for all times. Good rations vary in composition according to the market prices of feedstuffs. Maximum advantage should be taken of the farm byproducts, which would otherwise go waste or would have to be disposed of at very low prices. Whichever ration is chosen the following aspects should be kept in view.
    - The most economical ingredients should be selected.
    - Grains like maize, sorghum, oat, other millets, wheat and rice should form the basic ingredient
    - Protein supplements like oilcakes , fish meal and meat-meal should be incorporated
    - No vitamin supplement is necessary if the pigs are allowed to pasture or are fed fresh green legumes. Vitamin $B_{12}$ supplement would be necessary if little or no animal protein is fed.
    - Mineral supplements should be provided.

## FEEDING PRE-STARTER PIGS

- Feeding pre-starter rations to piglets was found to be materially beneficial in that it increases growth rate of pigs and reduced mortality among them. The supplementary feeding reduces the demand on sow's milk and consequently the sow experiences less weight loss than when pre-starter feeding is not done.
- Piglets start nibbling at food when they are about a week old and by the time they are two to three weeks, they will start consuming feed. The milk production of the sow starts declining after third week of lactation. Therefore, it is necessary that the pig is started on a solid feed by that time to meet their nutritional requirements. This is necessary when the litter size is large and when the sows are in poor condition.
- The pre-starter ration should be rich in protein and vitamins and low in fibre content. Adding a higher proportion of antibiotics has also been found to be beneficial. This ration usually has 24 per cent protein. This feeding starts usually when the pigs are one week old, weighing 2-2.1 kg. This extends usually to a period of two weeks during which each pig consumes one and half to two kilograms of pre starter ration and gains about three kilograms, to weigh 5.0 kg at the end of the period.
- These rations are self-fed in a trough or feeder in a pen separate from that of the mother adjacent to it (creep area). The gates may be adjusted so that the piglets can get in and eat but the sow cannot. They need plenty of fresh water.

*24% CP, 2 kg feed consuption and 3 kg weight gain, end of 3rd week the weight should be 5 kg*

## FEEDING STARTER PIGS

- The starter ration should contain 20-22 percent protein. It is fed to pigs between 5.0-15.0 kg live weight.
- Pelleting of feed is beneficial from this stage onwards. This period generally ends when the pigs are 8 weeks old.
- They consume nine to eleven kilogram of starter ration to gain about ten kilograms. They should be provided at least 4 cm feeder space per pig. Fresh water should be provided *ad libitum*. Pigs are weaned at the end of this period

*20-22% CP, from 5 kg to 15 kg weight gain, 9-11 kg feed consumed, 4 cm feeder space, end at 8th week of age*

## FEEDING GROWER PIGS

- When the average weight of pigs is 15 kg, the starter ration is replaced by grower ration which has only 18 percent protein. If weaned, the pigs are housed in small groups, less than 20 in number.
- Care should be taken to see that pigs housed together are more or less of the same weight. Pigs consume 50-60 kg of grower ration to weigh about 35 kg at the end of this period.
- It may be difficult to achieve these standards under feeding and management conditions available in tropics. The lower energy level is what often obtainable in a tapioca based feed in tropics.

*18% CP, housed in group of 20, consume 50-60 kg feed to reach weight of 35 kg.*

## GROWING AND FINISHING PIGS

- This is the stage during which the weaned pigs grow from 35 kg to 60 kg body weight.
- Rapid and economical gains are possible if the pigs have access to a good pasture and supplementary feeding is given.
- Vitamin $B_{12}$ supplementation reduces protein requirements of weaning pigs from 18 per cent to 13 per cent.
- With every 20 kg additional weight, a reduction of one per cent in protein is recommended.
- Pigs above 60 kg live weight and until marketing are known as finishing pigs.
- The only major difference in the nutrient requirement of this group from the previous one is in their protein requirement. They need rations containing only 13 per cent protein. Under hot climatic conditions it will be advantageous to market/slaughter pigs between 70-75 kg.

*13% CP, growth from 35 to 60 kg body weight, marketed at 70-75 kg*

## FEEDING ADULT MALE PIGS

- Boars should be fed to keep them in thrifty condition avoiding fattening. The boar may be given almost the same kind of ration fed to the gilts during the breeding period.

- It is advisable to give one-quarter to one-half of an acre of good pasture to every boar to give exercise as well as pasturage. They are usually given a supplementary ration by self-feeding method.
- If the boars get too fatty, the concentration of grains in the ration may be reduced and that of lucerne meal increased.

## FEEDING GILTS

- Gilts, like boars, should be fed limited amount of nutrients to keep them thrifty but not fat. If they are already fat, there will be no scope for flushing during the breeding season.
- Line gilts meant for breeding should be removed from the growing-fattening group when they are between 45-57 kg body weight.
- They should be subjected to limited feeding at a rate of about two-third of the requirement of growing-fattening group.
- It has been observed that limited feeding increases the litter size by one to two pigs over that when they are full-fed. It also reduces feeding costs.

*Two third of fattening group feeding.*

## FEEDING UNBRED SOWS

- Unbred sows may be fed similar to the gilts to keep them in medium condition. Usually their requirements are less than that of gilts, the latter needing nutrients for growth.
- The actual amount or composition of the ration will depend on the condition of the sow. If the sow is lean and run-down in condition due to previous pregnancy and lactation, it needs more of nutrients to recoup.

### Flushing

- Litter size is affected by the condition of the gilts or sows at the breeding time. This may be by influencing regularity of heat, the number of ova shed and the fertilization and subsequent implantation of the zygote.
- In order to ensure maximum results, sows and gilts are fed a more liberal ration from about two weeks before breeding until after they are bred. This should produce a gain, from 0.7 kg to 0.9 kg per day, and ensure good health. Such a procedure is known as flushing.
- The ration for flushing should be well balanced and fed in required quantities. It should have plenty of proteins, minerals, vitamins and green forages. While sows require less than 20 gm flushing ration for every kg body weight, gilts require 25 to 30 gm as they are growing also.

Last modified: Sunday, 3 June 2012, 03:57 PM

## FEEDING SOWS AT THE TIME OF PARTURITION AND AFTER PARTURITION

- As the time for farrowing gets near, the swine-farmer should exercise more and more vigilance and give particular care on their feeding.

- About four to five days before the farrowing, the sow's ration should be reduced to nearly half. They should be prevented from becoming constipated by including laxative feeds like wheat bran, linseed meal, etc. in the ration.
- The amount of high energy feeds like corn be reduced to be substituted by feeds like wheat bran, lucerne hay or oats. On the day of farrowing, it is better not to give any feed at all. But enough of clean fresh water should be available throughout the period.
- California Manual 17 suggests the following ration for the last ten days before farrowing:

| | |
|---|---|
| Barley, oats or other grams | 42 parts |
| Alfalfa (lucerne) meal | 25 parts |
| Wheat bran | 25 parts |
| Soyabean meal | 7 parts |
| Oyster shell flour | 0.5 parts |
| Salt | 0.5 parts |

- It is essential not to feed the brood sow heavily after farrowing. If fed too much, she may produce milk in excess of the needs of the piglets which will lead to scours in them.
- The sow may be fed the same bulky ration as fed before farrowing for three to four days after farrowing. It is best to feed 50 per cent of the ration on the first day and to increase the ration by 200 to 300 grams daily until she is full fed.
- Another recommendation (Delaware Bulletin, 40) is 400 – 500 grams of wheat bran and plenty of luke-warm water to the sow on the day after farrowing.
- It is also necessary to satisfy the appetite of the sows, otherwise, they may eat their own litter.
- Minnesota Bulletin suggests that the sow's appetite may be satisfied by feeding a slop made of water and a mixture of half bran and shorts.

*Reduce the sow ration by 50% four days before farrowing- substitute with bulk (bran)- continue the bulk ration 3 days after farrowing*

## FEEDING LACTATING SOW

- Sows receiving adequate ration produce 2.5 to 3.6 kg milk per day. When the litter size is small, this is adequate. But sows nursing more than ten pigs must produce to their maximum capacity satisfy the nutritional need of the pigs.
- The weight as well as thrift and vigour of the weaning pigs is dependent to a great extent on the care and feeding of the lactating sow. The gain made by pigs in the first few weeks is directly related to the milk-producing ability of the mother sow.
- A sow which produces about 180-185 kg milk during a lactation of 56 days, secretes in the milk about 12 kg protein, 450 g of calcium and 280 g of phosphorus.
- A bulky ration may be continued up to the second week of lactation. Sometime during the second week the sow should have started getting the full feed. By that time pigs require large amounts of milk and ration of the sow should be changed in such a way as to induce and sustain heavy lactation.
- The dry-lot lactation ration should contain 15 percent crude protein for both first litter gilts and sows. If one the other hand they are put on a legume pasture, 13 percent crude protein will be sufficient in the ration.

- Lactation rations should contain 0.7 percent calcium, 0.6 percent phosphorous and 0.5 percent common salt. They require vitamins in the following amounts under dry-lot feeding:
    - Vitamin A: 1500 I.U
    - Vit. D: 100 I.U
    - Riboflavin: 1.5 mg
    - Niacin: 8.0 mg
    - Pantothenic acid: 6.0 mg
    - Vitamin $B_{12:}$ 5.0 microgram
- Lactating sows required 14 to 23 litres of water per head per day.
- Sows in milk on full feed, consume four to seven kilograms per head per day. The exact quantity eaten will be determined by the weight of the pig, its condition, milking capacity and the litter size.
- Self-feeding has been proven to be a very satisfactory method for lactating sows. By the judicious use of lucerne meal, wheat bran and oats as 'diluents', it is entirely feasible to self-feed sows in the early part of lactation when they should be given limited feeding.
- The ration should then be progressively made more concentrated as the nutrient requirements of the pigs (through milk) increase.
- However, in India where labour charges are cheaper than grinding and mixing charges, there is very little to gain from self-feeding. Hand feeding may still remain a more economic proposition.

**Feeding thyroprotien to lactating sows**

- Iodinated casein included in the ration of the sows has increased the gain of pigs be 20-30 percent during the first week of lactation. Iodinated casein has one per cent thyroxine activity.
- It increases the metabolic rate and milk yield. The enhanced milk production results in heavier litter at the time of weaning.

*13% CP is sufficient, 4-7 kg daily feeding depending upon the milk production, required 14-23 litres of water daily*

## SWILL FEEDING

- The waste collected from hotels, restaurents, industrial conteens, students hostels can be used as feed resource.
- Care should be taken while feeding swill, contaminated food material may cause enteritis.
- The exact nutrient composition of the swill varies with the type of food material
- The swill must be boiled before feeding.

# MODULE-5: INTRODUCTION TO EQUINES

Learning objectives

In this module the learner will learn about,

- Zoological position of horse, importance of horse, donkey and mule
- Important breeds of horse in India and their population and distribution
- Difference between donkey, mule and their importance.
- Different type of mule available in India.

## INTRODUCTION TO EQUINES

- The horse was probably last of present – day farm animals to be domesticated by man.
- According to early records, after subduing the ox, the sheep and goat, man domesticated the ass and then the camel; and finally the horse become this servant.
- Horses appear to have been domesticated first in central Asia or Persia, more than 3000 years B.C.
- Species *Equus caballus* , the horse is distinguished from asses and zebras by the longer hair of the mane and tail, the presence of "chestnut" on the inner side of the hind leg and by other less constant characters such as larger size, larger hoofs, more arched neck and smaller head and short ears.

*Last of present day farm animal to be domesticated*

Wild horse

## GENERAL USE

- Men first use the horse as source of food, these animals being hunted by palectithic (Old Stone Age) man. This was prior to their domestication. Also, the use of horses for meat still persists in many part of the world, including France, Belgium and Switzerland.
- Horses, ponies, mules and donkeys are the most valuable pack animals for transportation of men and material in the plains of northern and north-western regions, in the hills and foothills as well as in the semi-arid regions and many other parts of India.
- Horses are widely used for races, polo, equestrian sports, hunting and various other purposes.
- Horses are also used by the army, paramilitary forces and the police for mobility, patrolling and riot control duties.

- The donkey is an important animal in the economy of landless labourers, small and marginal farmers and other poorer sections of the society, both in rural and urban areas.
- Mules have their use both in military establishments and civilian occupations.
- In the medical field horses are used as a factory for the manufacture of antitoxins that are used for rendering animals and people immune to certain diseases such as tetanus.

*used as food, pack, race, game animal. Donkey and mules used in army*

## ZOOLOGICAL CLASSIFICATION

| | Horse | Donkey | Mule |
|---|---|---|---|
| *Kingdom* | Animalia | Animalia | Animalia |
| *Phylum* | Chordate | Chordate | Chordate |
| *Class* | Mammalian | Mammalian | Mammalian |
| *Sub-class* | Eutheria | Eutheria | Eutheria |
| *Order* | Ungulate | Ungulate | Ungulate |
| *Sub-order* | Perissodactyla | Perissodactyla | Perissodactyla |
| *Family* | Equidae | Equidae | Equidae |
| *Genus* | Equus | Equus | Equus |
| *Species* | Caballus | Asinus | |
| *Zoological name* | *Equus caballus* | *Equus asinus* | *E. caballus + E. asinus* |

## TERMINOLOGY USED IN EQUINE PRODUCTION

- Species - Equine
- Group of Animals - Pack
- Adult male - Stallion
- Young male - Colt
- Young female - Filly
- New born - Foal
- Castrated male - Gelding
- Castrated female - Spayed
- Female with its offspring - Foal at foot
- Actof parturition - Foaling
- Actof mating - Covering
- Throughbred horse - Horses whose immediate ancestors are used with stallion and mares record. Mainly used for racing and crossbreeding programmes. They are registered with Jockey club.
- Pure bred Horse - Entered in stud book maintained by abreed society
- Halt – bred Horse - Race horse with no pedigree
- Light horses - Usedmainly for riding, driving, and racing. They measure 14.2 – 17 hands at withers,weigh about 408 – 635 kg.
- Ponies - Measures under 14.2 hands. Weighed 136 – 400 kg. Mainly used for riding anddriving.

- Donkey - Common name for the ass
- Ass - Smaller than horse, longer ears,gestation period is one month longer than that of horse,short and erect mane.
- Jack - Male ass is called jack. Jack is crossed with a mare and the resulting offspring is called mule. (Mules are usually sterile)
- Jennet - Female ass is called Jennet. When a stallion iscrossed with a jennet, a resulting offspring is called hinny. Hinnyis smaller in size than mule.
- Brood mare - Female horse used for breeding
- Broken horse - Well trained horse
- Cob - Short legged stocky horse
- Aged horse - Morethan 8 years
- Yearlings - 1– 2 years of age
- Whaler - Australians addle horse.
- Bishoping - The practice of artificially altering the teeth of older horses in an attempt to make them to sell as young horses.
- Blaze - A broad white marking covering almost all of the forehead
- but not including the eyes or nostrils
- Blemishes - Those abnormalities that do not affect the service ability of the horse, including shoe boils and capped hocks.
- Bloodhorse - A pedigree horse
- Bloodspavin - Varicose vein enlargement which appears on the inside of the hock.
- Bolting - Habit of horses of eating too fast
- Broodmare - Mare kept for breeding or reproductive purpose.
- Colic - Severe ingestion which causes abdominal discomfort and pain
- Colt - Young stallion under three years ofage.
- Dentalstar - Marking on the incisor teeth of horses, used in judging their
- age. It first appears on the lower central and intermediate incisors when the horse is about 8 years of age.
- Doping - The administering of a drug to a horse to increase or decrease his speedin a race. Race course officials runsaliva test, and urine test to detect whether any horses have been doped.Usually such test are conducted on the winners of every racehorse.
- Gymkhana - A program of games on horseback
- Laminitis / Founder - Inflammation of sensitive laminae under the horny wall of the hoot.
- Quarter crack - Avertical split in the horny wall of the inside hoof,which extends from the coronet.
- Quittor - Adeep seated running sore which occurs on the coronet
- bar or hoof head.
- Run / gallop - Fast, four beat gait of horse
- Stud - Male horse kept for breeding.
- Stud book - The permanent book for breeding records.
- Whinny - The horse's sound that denotes happiness

## EQUINE POPULATION OF INDIA

The population trends indicate continuous decline in equine population between 1951 to 2003 for horses, ponies and donkeys except mules which have shown a steady increase.

**Population trend in India (in 000.s)**

| Year | Horses and ponies | Donkeys | Mules |
|---|---|---|---|

| | | | |
|---|---|---|---|
| 1951 | 1514 | 1249 | 61 |
| 1956 | 1484 | 1057 | 39 |
| 1961 | 1327 | 1096 | 53 |
| 1966 | 1148 | 1054 | 75 |
| 1972 | 942 | 994 | 75 |
| 1977 | 916 | 917 | 89 |
| 1982 | 900 | 1024 | 131 |
| 1987 | 784 | 960 | 169 |
| 1992 | 800 | 1000 | 200 |
| 1997 | 800 | 900 | 200 |
| 2003 | 800 | 700 | 200 |

- The horses and donkeys are dwindling species both by decrease in number and also by the dilution of the breeds as a result of indiscriminate breeding due to non-availability of purebred stallions in want of organized breeding.
- Of the total equine population in India, donkey, horses/ponies and mules constitute 50.24%, 40.93% and 8.83% respectively.
- The population of horses and ponies is 24988 and donkeys is 25779. The world's horse population is 55.5 million, mule 12.8 million and donkeys 40.3 million.

## COLOURS OF HORSES

- **Black:** Body coloration through out the coat, limbs, mane and tail (web link....)

- **Bay Brown:** Brown coloration in the coat, black limb, mane and tail. (web link .....)

- **Bay:** Defined as shades of dull red to brown approaching chestnut, however black coloration on mane, tail, and limbs are permissible (web link…)

- **Chesnut:** Yellow coloration with different intensity is known as chestnut. There are two types of chestnuts
    - True and
    - Lighter.
- True chestnut means colour on mane and tail are lighter than body, whereas in the lighter chestnut colored horse yellow coloration is on mane and tail. (Web link ...)

- **Grey:** Body coat having black skin with white hairs, lighest black colour is expressed as Grey

- **White:** Born white, pink skin, the eye or pink or blue


- **Roan:** is identified as coloured body coats with white hairs (web link..)
    - *Bay roan*: Body colour is black, with white hairs on limbs, knees and hocks, whereas black coloured hairs predominates
    - *Blue Roan*: Body colour is black or brown with white colour hairs giving blue tinge
    - *Bay or Red Roan*: Reddish tinge to skin coat on limbs and black coloured hair Predominates
    - *Strawberry or chestnut Roan*: Where body colour is Chestnut with white hairs

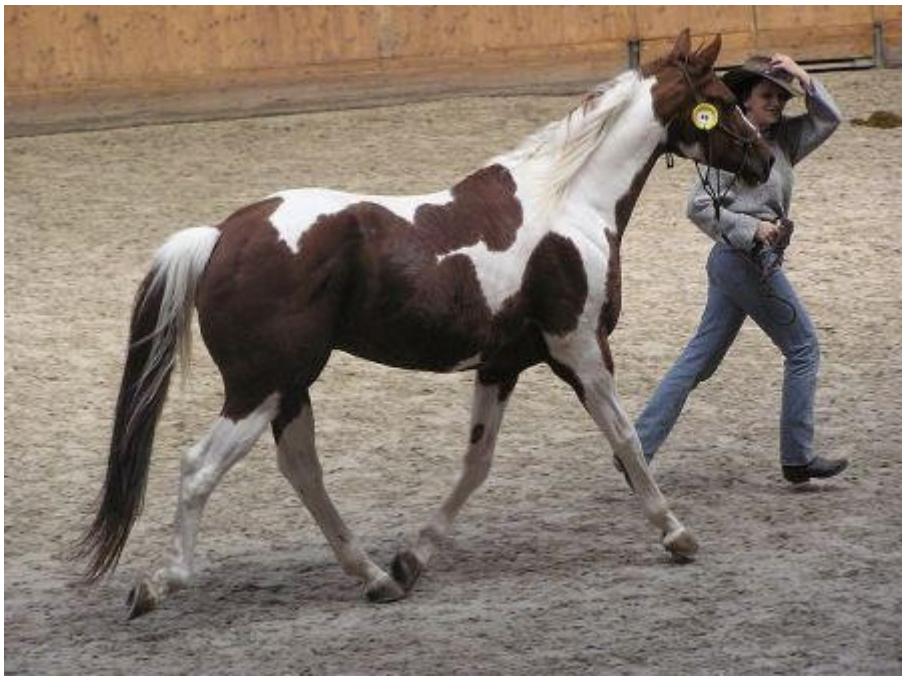
| | |
|---|---|
|  |  |
| **Bay roan** | **Blue roan** |
|  |  |
| **Red roan** | **chetnut roan** |

- **Dun:** (web link..) It varies from a mouse colour to golden yellow. Zebra markings are generally well marked on animals of these colours. It has two varieties
    - Blue dun: They are seen with dilute blue evenly distributed over the body giving a bluish colour appearance. It may have a dorsal band and stripes on the withers.
    - The skin,tail and mane are always black.
    - Yellow dun: The skin is black with diffused yellow pigmented hair with or without dorsal band, wither stripes or bars on the legs.

| | |
|---|---|
|  |  |
| **Red dun** | **Blue dun** |
|  |  |
| **Yellow dun** | |

- **Piebald:** Large irregular patches of white and the line of demarcation between two colours is well defined (web link ....)

- *Skewbald*: The coat consists of large irregular patches of white and any other colour except black (Web link ...)



- **Whole coloured:** where there are no hairs on the body, head and limbs

**Marking expression of horses** (Web link .....)

- *Star*: White mark on fore head,
- *Stripes*: Narrow white marking down the face and specification such as interrupted stripe, broad stripe, narrow strip and strip inclined to left/right be specified

- *Blaze*: White marking covering almost complete forehead
- *White face*: White coloured forehead and front of the face.
- *Snip*: An isolated white marking between nostrils
- *Lip marking*: Flesh mark partial/complete
- *White muzzle*: White colour extends between nostrils
- *Wall eye*: Partial/complete discolouration
- *Whorls*: Irregular settings of coat on head and neck.

## UNSOUNDNESS OR BLEMISHES IN HORSE (Web link ...)

- *Unsoundness* - Defect that affects the usefulness of the horse
- *Blemish* - Imperfection that does not affect the usefulness of the horse.
- Head
    - Poll evil - Inflammation and swelling of poll
    - Roman nose - Faultyconfirmation

    - Parrot mouth - Conditionwhere the upper saw overshoots the lower jaw

    - Monkey mouth- Condition in which the upper jaw is shorter than thelower jaw (Under shot jaw)
    - Floating teeth - Sharp edge ofmolars or premolars can injure the tongue and cheek.
- Neck - Ewe neck - Faulty confirmation of the neck.
- Shoulder - Sweeny - Decrease in size of group of muscles, usually in the area of shoulder.
- Fornt legs
    - Shoe boil / capped elbow - Swelling on the point of elbow
    - Splints - Deposits of bone that occur on theupper, inside part of the cannon bone
    - Wind puff - Puffyswelling that occurs on either side of the (Wind gall or Road gall) tendons above the fetlock or knees.
    - Bowed Tendons - Swellingsof the tendons on the back of the leg
- Feet
    - Ring bone - Growth of bone on either or both of the bones of the pastern
    - Quittor - Decays of lateral cartilage resultingis an open sore
    - Quarter crack - Vertical split inthe wall of the hoof
    - (Sand crack)
    - Founder - Inflammation of sensitive laminae offoot
    - Thrush - Disease of the frog of the footcaused by filth
    - Corns - Reddish spot on the horny sole causedby improper shoeing.
    - Scratches - Inflammationof the back surfaces of the fetlocks. Scabs form on the (Grease heel) area.
- Hind legs
    - Stringhalt - Condition inwhich there is a sudden involuntary flexion of one or both hocks
    - Throughpin - Puffy swellingjust above the hock

- Bog spavin - Large, softswelling on the inside and front of the hocks
- Curb - Hard swelling on the back surface ofthe rear cannon
- Cocked ankle - Condition in whichtendons become inflamed & shortened
- Blood spavin - Swollen vein overthe front and inside the hock, it doesnot cause lameness.

## BREEDS OF HORSE (EQUUS CABALUS)

- In India, there are 6 well known distinct breeds of horses. These include Marwari, Kathiawari, Spiti, Zanskari, Manipuri and Bhutia.
- Besides these, the FAO has also recognized 3 more breeds, namely Chummarti, Deccani and Sikang.
- These breeds have distinct breeding tracts in various parts of the country including northern, north-west and North-East India.

## INDIAN HORSE BREEDS AND CLASSIFICATION OF HORSES

- Indian horse breeds

| Breed | Location | Purpose |
|---|---|---|
| Kathiawari | Gujarat | Pace & Speed |
| Marwari | Rajasthan | Pace & Speed |
| Bhutia | Himalayan Ranges | Hill purpose |
| Manipuri | Manipur | Speed, polo and sports |
| Spiti | Himachal Pradesh | Pace |
| Zanskari | Jammu & Kashmir | Hill purpose |

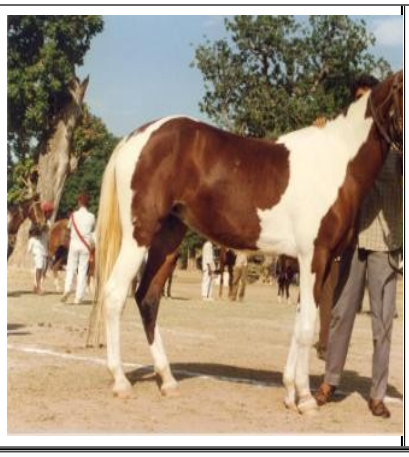
- Classification of horses

| Character | Light horse | Draught horse | Ponies |
|---|---|---|---|
| Height (M) | 1.47 to 1.52 | 1.47 to 1.52 | >1.47 |
| Weight (Kg) | 400 to 600 | 600 and above | 200 to 400 |
| Uses | Riding and pack | Riding & Heavy work | Pack |

## MARWARI HORSE

- The Marwari horse has its origin in the Marwar and Mewar region of Rajasthan State in Western India, which is the natural habitat of this breed.
- These horses are mainly reared for riding, sports and safari.
- The Marwari horse measures in height from 142-169 cm.

- In appearance the face is finally chiselled, slightly longish, pointed with round nostrils and large expressive eyes.
- The ears are longer measuring up to 16 cm in length and 6-10 cm width. Ears are at 90° axis and can rotate at 180° angle. Ear tips are pointed and curved inward like a sickle. The ears meet or overlap each other when the animal rotates them.
- The animal have fine coat. The predominate body colours are chestnut, liver chestnut, black, brown, piebald and skewbald.
- Marwari horses are docile, beautiful and known for endurance, speed and adaptability under adverse climatic conditions and scanty feed and fodder. Long distance endurance and docile nature makes Marwari horses best suited for safari.
- The Marwari horse described as “as fine a the horse as any other in the world” by General Tweedie, a British Cavalry Officer. The breed is under threat of extinction as only few hundred animals true to breed are left.



*As fine as the horse, Reared for riding, sports and safari, Ear tips are pointed and curved inward like a sickle, ears overlap while rotating*

## KATHIAWARI HORSE

- The breeding tract of Kathiawari horses is erstwhile Saurashtra province of Gujarat.
- The breed is believed to have evolved from the wild horses of Kathiawar of Gujarat State and Arabian horses which happened to land on seashore after the crash of a ship in Arabian sea.
- Common body colours observed are chestnut, bay, grey and dun.
- The ears are upright on 90° axis and can rotate at 180°. As compared to Marwari breed, the ears are smaller in length and less in width.
- The forehead and poll gives a triangular appearance. Other features are long neck like a cock, short legs and squared quarters. The height is 130-150 cm.

*Triangluar forehead and poll, smaller ear compared to marwari, Chestnut, bay, dun are common colours*

## SPITI HORSE

- Spiti ponies have their origin in Tibet and are found in Pin valley of Spiti Division of Himachal Pradesh.
- These strong and hardy ponies are adapted to cold desert regions and capable of thriving under adverse condition of nutrition, food scarcity, low temperatures and longer journey at high altitude.
- These are mainly used as back animal and for riding. The average height is 120-122 cm. Predominant body colour includes gray, black, brown and dun.
- The neck is short with a long and thick mane.

## ZANSKARI HORSE

- Zanskari breed of horses is available in Laddakh area of Jammu and Kashmir.
- Common body colour are gray, black and copper.
- These horses are known for their hardiness and ability to work at high altitude. The animals are alert, well build, medium in size.
- The height ranges between 132-147 cm. The tail is long and heavy, almost touching the ground. These horses are used for draught, transport, riding and polo.

## MANIPURI HORSE

- Manipuri ponies are found in Manipur and Assam.
- These alert ponies are known for beauty, fastness and are famous for polo and riding purpose.
- The animals are of medium built standing 112-132 cm at withers. The common body colours include bay, brown, gray or chestnut. The ears are alert and *almond shaped*.

## BHUTIA HORSE

- These horses are distributed in Sikkim and Darjeeling.
- Predominant body colour are gray and bay.
- Height at withers is from 130-132 cm.
- These are mainly used as pack and riding animals in hilly terrains.
- Strong legs and long hairs on neck and tail are characteristic features of this breed.

## CHUMMARTI HORSE

- This breed is found in the Chummarti valley of Tibet.
- In India, these horses are available in Himachal Pradesh.
- This breed is very similar to Spiti. Height at withers is 127-129 cm.

## EXOTIC BREEDS

### Thoroughbred horses

- Thoroughbred horses have been developed by crossing warm-blooded Arabian horses with cold blood heavy breed European horses.
- These are maintained by the private breeders. Registration of individual thoroughbred stallion and brood mares is governed by Stud book authority of India which is a part of Royal Western India Turf Club Limited, Pune, Ministry of Agriculture undertake registration of studs. Presently, more than 130 organized stud farms are there.
- These horses are used for competitiveness at various racecourses. Indian Army and Paramilitary forces and police use thoroughbred horses for their requirements.
- Most of the stallion are yet imported for breeding activity by Indian army and thoroughbred industry.
- Distinctive feature Long fore arm and lesser thigh, long distance from hip to hock, long smooth muscling. The rear quarters are highly powerful.

*Arabian and European cross, stud book registration required,*

**Arabian horse**

- The head is relatively small, dished, and triangular with small muzzle, wide set eyes.
- The neck is distinctive, it is long arched and set high on the shoulder.
- The tail is often arched above the croup level while the horse is walking or trotting.

**Pony breeds**

**Welsh or welsh mountain pony**: is ideal for young children as play and pet animal

**Connemara**: largest of pony breed

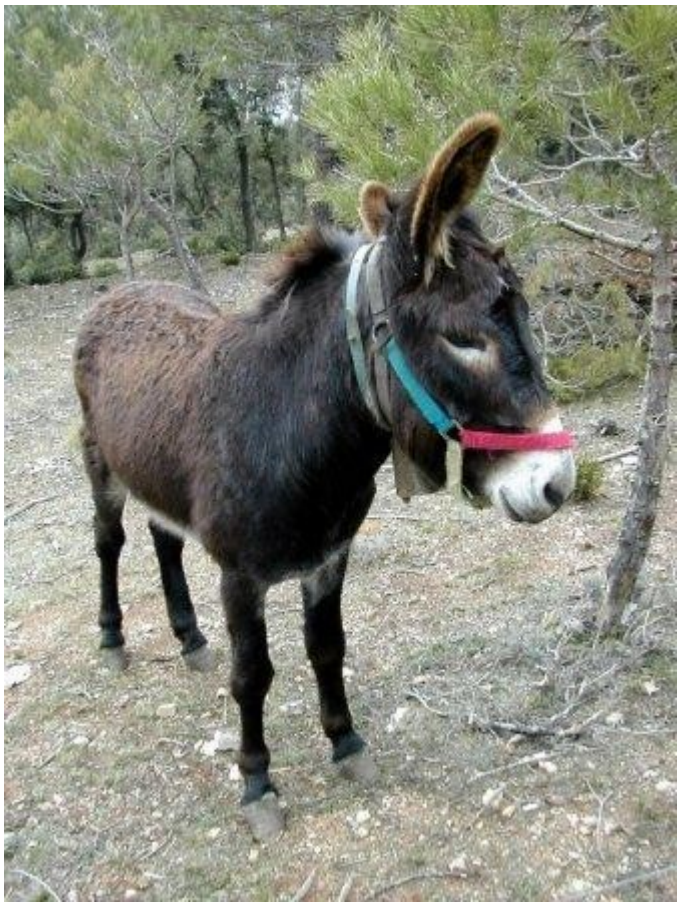
**Miniature horse**: the maximum high for registration by the international miniature horse registry is 32 inches only. Eg. Tom Thumb (23”), Cactus (26”), Flabella (15”)

**DONKEY** (.. to know more)

- It is considered that asss are of purely African origin. The ass was first domesticated in the valley of the Nile. Three wild races of asses were observed:
  - North-East African race (Nubia).
  - North-East African race (Sudan) and
  - Somalian race (Somali-land).
- The greatest contribution to animal husbandry that ass has made is the production of mules. Mules fit well in different agricultural operations. The asses have several features that differ from horses; one of the most noticeable characteristics is longer and much larger ears of asses.
- The hair on mane and tail are very scanty and there is a brush like switch at the end of the tail. Jacks and their mule offspring have well-muscled, broader loins, long and well sprung ribs. Consequently, they can take more abuse and

punishment than the horse.

- Jacks lack apparent muscling, have larger bone and joints but smaller rounder feet than the horses. Jacks also have a characteristic bray, which is a decidedly in contrast to the whinney of the horse.
- The modern domesticated asses have mainly descended from the Nubian race. Though grey colour predominates but black, white and even piebald asses can be seen. The ass is indisputably one of the most useful animals and is available everywhere.
- FAO has reported three distinct types of Indian asses viz. Indian, Indian wild and Kiang. Indian wild asses are available in Rann of Kutch while Kiang are available in Sikkim and Laddakh. They are dark red brown with white underparts and patch behind the shoulder.
- Among Indian, two major types of donkeys i.e. those of larger size and smaller size are common.
    - The larger size donkeys are light grey to almost white in colour.
    - The smaller size ones are dark grey in colour.



- Good quality donkey stallions of exotic breed obtained from France and other European countries are maintained by NRCE, State Animal husbandry Deptt. of Haryana and Uttar Pradesh, and at Equine Breeding Farms of the Army.

## ASS OR DONKEY

- The asses are believed to be of African and Asian origin. They differ from horses my many ways.
- The most noticeable characteristic is large and much longer ear.
- The hairs on mane ad tail are very scanty and there is a brush like switch at the end of the tail.
- The FAO has reported three distinct types of Indian assess namely, Indian donkeys, Indian wild ass and Kiang.
- There are three types of donkeys available in India.
    - Small size dark grey
    - Large sized light grey to white
    - Large size dark brown colour with long hair.
- In India there is an organized exotic donkey breeding farm at National Research Centre on Equines, Hisar and Bikaner, which is able to proved donkey semen for mule production as well as for upgrading of indigenous donkeys.
- During the recent past, China has utilized the potential of donkeys with special breeding programme.

- Presently, china has raised about 10 million high bred donkeys for carting. Donkey carts in China carry about 400 kg loads.
- (Indian wild ass is found in Little Rann of Kutch (Gujarat) and Kiang in Ladakh, Kiang is largest and heaviest of all the Asiatic wild Ass.)

*Large ear, short mane and tail, NRC on Equine, Hisar doing breeding and research*

## MULE

- These are hybrid born out of donkey stallion and the horse mare. The production of mules involves three steps including breeding of jack stock for use as stallion, breeding of the horse mares and crossing of jack with mare.
- One of the difficulties in mule production is to locate a fertile jack that can serve the horse mare. The mules are usually produced for draught purposes.
- The mules are most useful as draught, pack and transport animals particularly in difficult terrains including hills.
- The mule combines some of the superior qualities of both the species. It has size, speed, strength and spirit of the horse and surefooted-ness, lack of excitability, endurance and ability to thrive on poor food of donkey. The draught mules stand from 155-172 cm in height and weigh from 450-650 kg.
- There are two distinct types of mules, namely,
    - Mountain Artillery (MA) and
    - General Service (GS) kept by Indian Army.
        - Mountain Artillery mules are used for carrying heavy load and artillery in mountain region and general services mules are used for general transportation.

## CHARACTERISTICS OF MULE

- With its short thick head, long ears, thin limbs, small narrow hooves, and short mane, the mule shares characteristics of a donkey
- In height and body, shape of neck and croup, uniformity of coat, and teeth, it appears horse-like
- The mule comes in all sizes, shapes and conformities. There are mules that resemble quarter horses, huge draft mules, fine-boned racing mules, shaggy pony mules and many more types.

- A mule does not sound exactly like a donkey or a horse. Instead, a mule makes a sound that is similar to a donkey's but also has the whinnying characteristics of a horse (often starts with a whinny, ends in a hee-haw).
- Sometimes, mules whimper. The coats of mules come in the same varieties as those of horses.
- Common colors are bay, black, and grey. Less common are white, roans (both blue and red), dun
- The mule possesses the sobriety, patience, endurance and sure-footedness of the donkey, and the vigour, strength and courage of the horse.
- Operators of working animals generally find mules preferable to horses: mules show less impatience under the pressure of heavy weights, and their skin, harder and less sensitive than that of horses, renders them more capable of resisting sun and rain. Their hooves are harder than horses', and they show a natural resistance to disease and insects.
- Mules exhibit a higher cognitive intelligence than their parent species - horses and donkeys. This is believed to be the result of hybrid vigor, similar to how mules acquire greater height and endurance than either parent.
- Mules are highly intelligent. They tend to be curious by nature. A mule generally will not let the rider put it in harm's way. However, the stereotype of the mule as being stubborn is somewhat unfair and inaccurate.

*Shares the characters of donkey(patience, endurance) and horse(vigour, strngth and courage), common colours bay, black and grey.*

## EQUINES IN INDIA

- According to the National Commission on Agriculture (1976), horses in India can be placed broadly in two classes viz. the slow moving pack ponies and the fast running saddle horses used for riding or for drawing carriages.
- The indigenous breeds of horses/ponies include Marwari, Kathiawari, Manipuri, Spiti, Bhutia and Zanskari. Among these, Marwari and Kathiawari are considered as 2 distinct breeds or types although they have several characteristics in common. Kathiawar (Gujarat) and Rajasthan are the homes of Kathiawari and Marwari breeds, respectively.
- These breeds have been selected both for utility and beauty. Bhutia, Spiti and Zanskari ponies, mainly found in the hilly areas of Himalayan ranges are slow moving horses.
- The Manipuri horses having qualities of both hill and plain breeds of horses have been bred over centuries in the Manipur area of the northeast. Manipuri horses reputed for their intelligence are used for polo and racing. Three other breeds of India namely Deccani, Chummarti and Sikang are considered to be on the verge of extinction.
- The exotic breeds of horses introduced in India include English thoroughbred, Water, Arab, Polish, Connemera and Halflinger.
- The Arab, the first to be introduced,is believed to have contributed substantially for the evolution of Kathiawari, Marwari, Sindhi, Malani and Manipuri horses.
- It is believed that all the indigenous breeds of the horses are rapidly deteriorating in quality as a result of lack of organized systematic breeding and availability of good specimen animals. Unless huge financial commitment is made, there is a possibility of the breeds losing their identity even in their home tract.

*Two type of horses slow moving pack ponies and fast running saddle horse*

## MODULE-6: DENTITION AND AGEING OF HORSES

Learning objectives

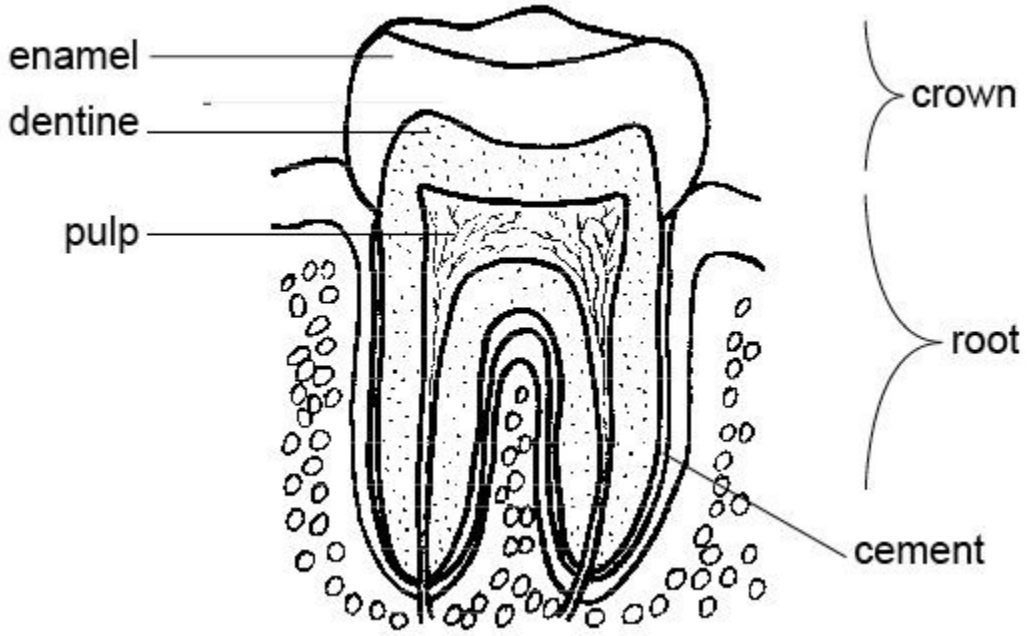
This module discuss about,

- Structur of teeth, dental formula of horse and how to determine the age of the horse with shape, structure and eruption of teeth

## INTRODUCTION TO DENTITION AND AGEING OF HORSES

- The age of the horse determined by the appearance of Incisor teeth. The use of the examination of teeth to determine age is of value in non-pedigree animals. Further it is impossible for the following reasons.
    - To issue soundness certificates
    - For valuation of livestock
    - For selection and purchase
- The surface which bites the food or its fellow on the opposite jaw is the TABLE OR WEARING SURFACE of the tooth. The mark of infundibulum is the blackened depression seen on the table. It is lined by distinct narrow pearly white ring of enamel.
- The crown of the tooth is that part which is above the gum and the point where the gum and tooth meets is the neck. The fang is that part within the jaw, hollowing its cavity contains the blood vessels and nerves which nourishes and sensitize the tooth.

## DEFINITIONS OF TEETH




- *Alveolus*: The bony cavity in which the fang of the tooth is embedded.
- *Buccal Surface*: The outer surface of tooth that is next to the cheek.
- *Central Incisors*: The 2 incisors immediately on each side of middle line
- *Cheek Teeth*: Premolars and molars are often spoken off collectively as cheek teeth

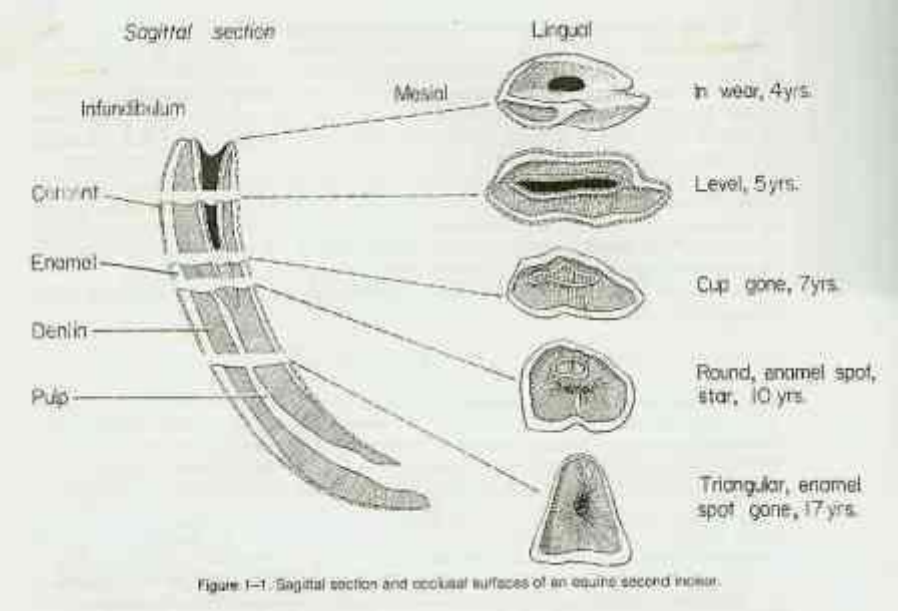


Figure 1–1. Sagittal section and occlusal surfaces of an equine second incisor.

- *Corner Incisor*: The outer or most lateral pair
- *Crown*: The part of the tooth which appears above the gum
- *Deciduous or milk teeth or temporary teeth:* These are temporary teeth which are pushed out by the growth of corresponding permanent teeth

- *Erupting or cuttin:* Teeth has cut through the mucous membrane of the gum
- *Fang hole or Dental star:* The upper extremity of pulp cavity
- *Fang or Root:* Part of tooth under the gum
- *Galvayne's Groove:* The part of the groove running down the labial surface of the ground of the upper corner incisors of the horse. It normally appears near the gum at 10 years, is half way down at 15 years, extends down the whole length of tooth at 20 years, has grown half way out at 25 years, and has disappeared at 30 the age of years. Simultaneously appearance of star and disappearance of mark takes place.


- *Infundibulum:* Dark depression on the table in the incisor it is called as mark.
- *Inwear:* Hole of the table of tooth is in contact with opposite teeth of other jaw.
- *Labial surface:* The surface next to the lips of the incisors.
- *Lateral Incisors:* The second pair in between central and corners.
- *Lingual surface:* The inner surface of tooth next to the tongue.

- *Mandible:* The lower jaw
- *Mandibular cheek teeth:* Lower premolars and molars.
- Maxilla and premaxilla: Constitute the upper jaw.
- *Maxillary sinus:* Cavity in the skull situated in horse above the last 3 or 4 cheek teeth into which their roots project.
- *Molars:* The last 3 cheek teeth. These are permanent teeth.
- *Neck:* Joins the crown to the fang.
- *Pulp Cavity:* A hollow part of tooth containing nerves and blood vessels.
- *Shelly:* The newly cut incisor teeth either temporary or permanent.
- *Table or wearing surface:* The part of tooth which grinds the food and comes in contact with tooth of other jaw.
- *Tush:* The canine tooth of the horse present in stallion or gelding but absent or rudimentary in mark It is situated near the incisors in the lower jaw than in the upper jaw.
- *Full Mouth:* All permanent teeth (both molars and incisors) have fully erupted. Full mouth is seen in the case of horses at $4^{1}/2$ to 5 years. A horse is said to be aged, when it is over 15 years.

## STRUCTURE OF TOOTH

- The pulp is the soft gelatinous tissue occupying the pulp cavity in the centre of the tooth. The pulp is well supplied with blood vessels and nerves.
    - *Dentine:* Covers the pulp and is hard and yellowish white in colour.
    - *Enamel:* Hardest tissue in the body and covers the dentine of the crown. It is clear and bluish white in colour.
    - *Cement:* Covers the dentine of the roof. The embedded portion of tooth is firmly attached to the alveolus, periosteum by layers of connective tissue.
- There are 2 complete sets of incisors,
    - Temporary, milk or Foal teeth and permanent or horse teeth. The difference between temporary and permanent teeth are as follows.
    - The temporary teeth is small and white , has a distinct neck, and a short fang which practically disappears as the tooth gets older. The permanent teeth are longer, stronger and brown in colour and has no marked neck or distinct neck and has a stout long fang.

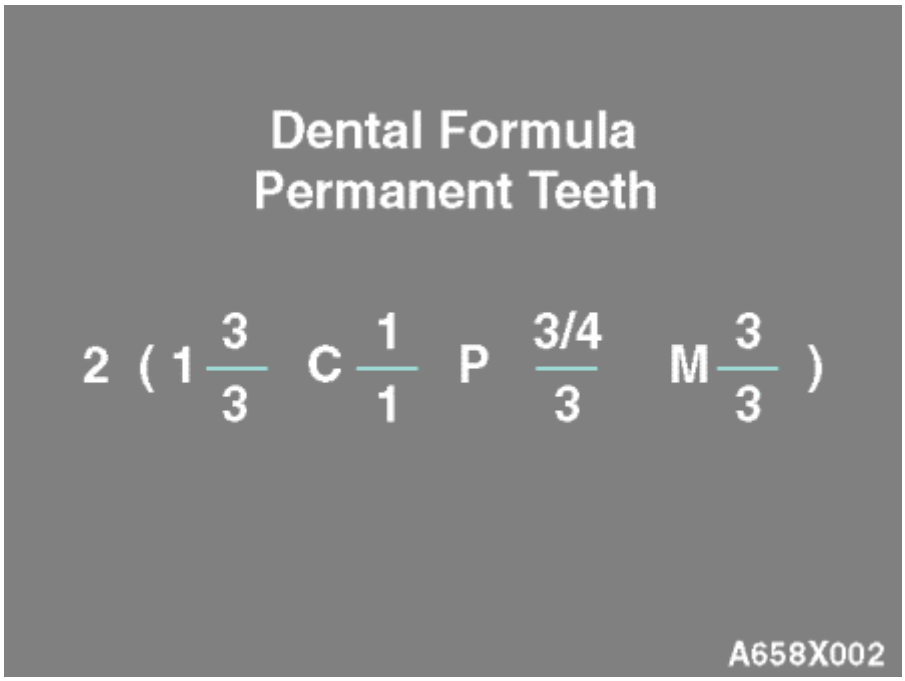
## DENTAL FORMULA AND ERUPTION OF TEETH

### TEMPORARY DENTAL FORMULA (Horse)

3 0 3 0

3 0 3 0

### PERMANENT DENTAL FORMULA




The variation in the number of premolar depends upon whether wolf teeth are present or not.

**ERUPTION OF TEETH IN HORSE**

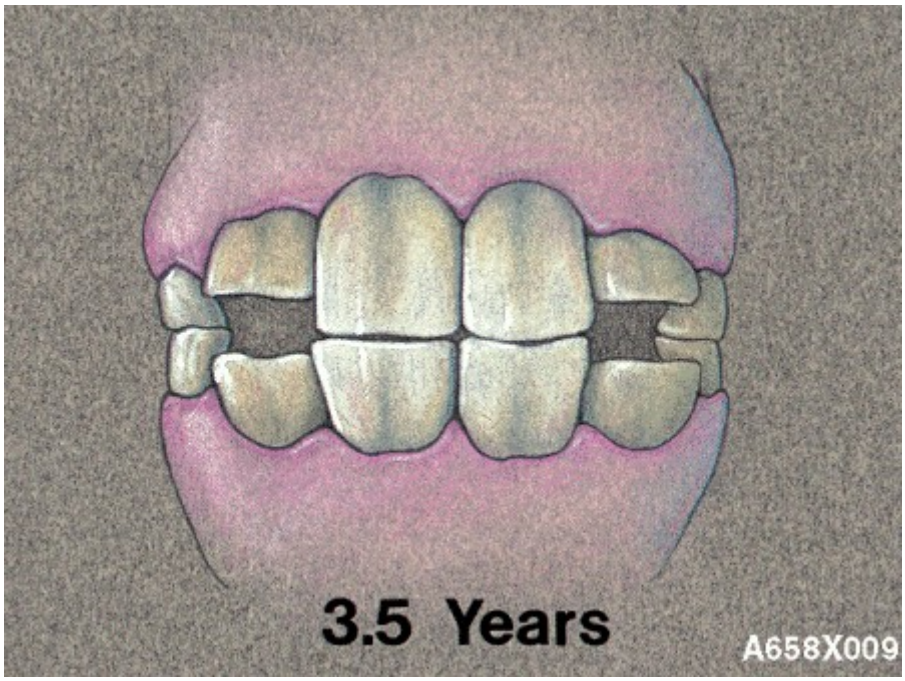
- 9 days - Central incisors (temporary)
- 9 weeks - Lateral incisors (temporary)
- 9 months - Corner incisors (temporary)

**WEARING OF TEMPORARY TEETH**

- 1 Year - Central incisor
- 1 ½ Year - Lateral incisor
- 2 Years - Corner incisor

**ERUPTION OF PERMANENT TEETH**

- 2 1/2 Years - Central incisors
- 3 ½ Years - Lateral incisors




- 4 1/2 years - Corner incisors

**DISAPPEARANCE OF DENTAL MARK**

- 6th Year - Central incisors
- 7th Year - Lateral incisor takes in lower jaw
- 8th Year - Corner incisors
- 9th Year - Central incisors
- 10th Year - Lateral incisors takes in upper jaw
- 11th Year - Corner incisors

When the dental mark disappears, the dental star reappears.

## ERUPTION OF TEMPORARY INCISORS

Temporary dentition: 3/3, 0/0, 3/3, 0/0

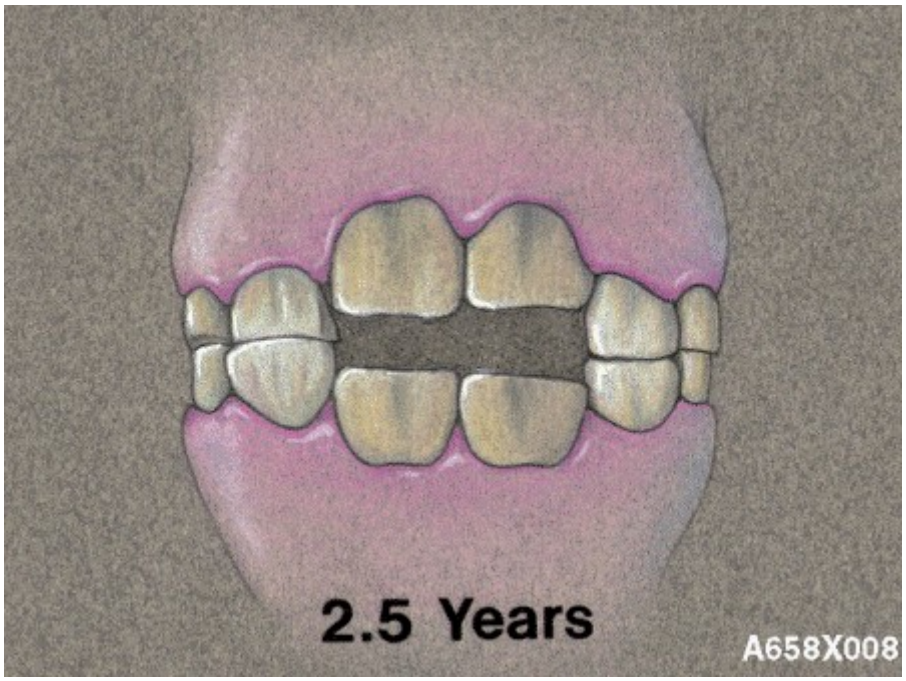
Permanent dentition: 3/3, 1/1, 3 or 4/3 or 4, 3/3

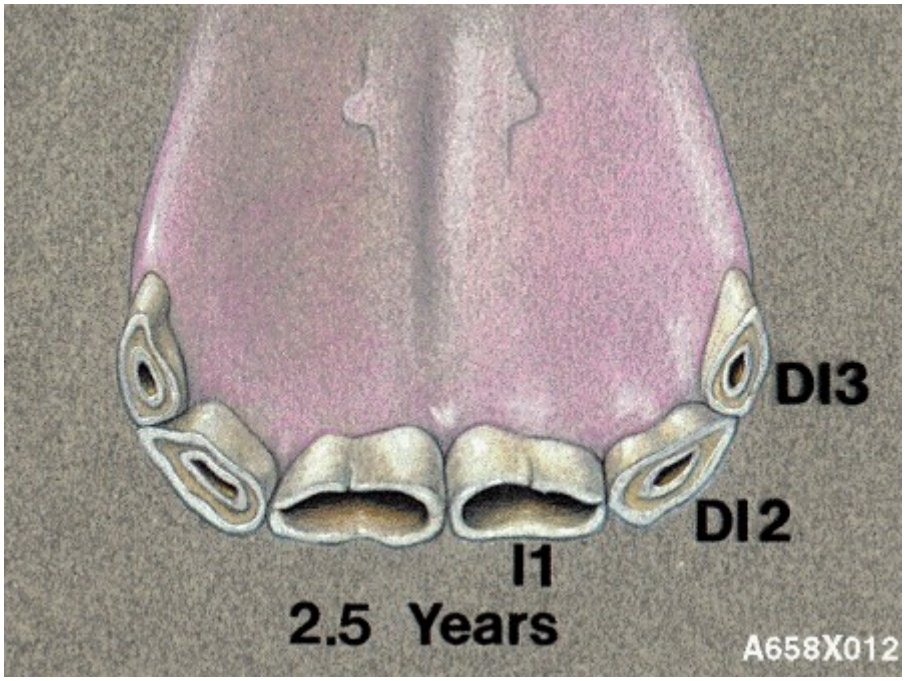
- **At birth:** The foal usually has two temporary central incisors in each jaw through the gums, or just appearing.
- **At 1 month:** The two temporary lateral incisors erupt. At about this age the first three temporary molars cut through the gums.
- **At 6 months:** The foal's mouth has a neat and compact appearance. The central and lateral incisors being well developed and are in wear upon their anterior edges.
- **At 9 months:** The foal has two temporary corner incisors cut through the gums, but these are only touching along their anterior edges.
- **At 1 year:** The temporary central and lateral incisors start wearing due to the friction with lower teeth. The temporary corner incisors are still shell like and only touching along their anterior edges.

- **At 1 year 6 months:** The temporary corner incisor starts wearing all along their edges, and the centrals and laterals have become large and well formed. At about this age the 5th molars erupts.
- **At 2 years:** The temporary corner incisors are well in wear, and all the incisor teeth have well formed tables.
- **At 2 years 3 months:** The temporary central incisors are often loose, and the gums are receding from their necks and may appear to be inflamed. The teeth are only held in position by a short portion of fang or root.

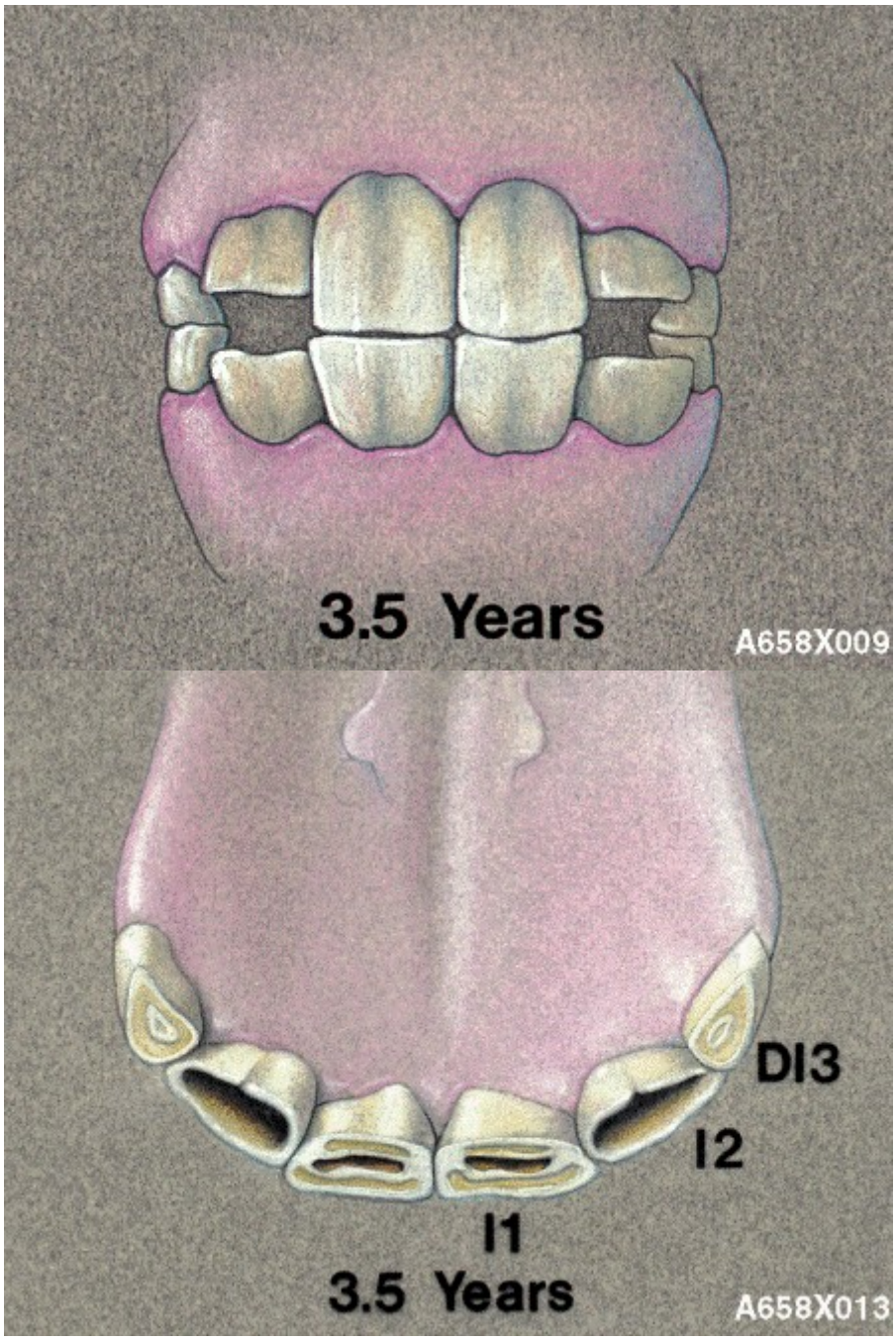
## ERUPTION OF PERMANENT TEETH

- **At 2 years 6 months:** The two temporary central incisors fall out and are replaced by permanent central incisors. At the same time the first 2 temporary molars in each jaw are shed, and the corresponding permanent molars get erupted.

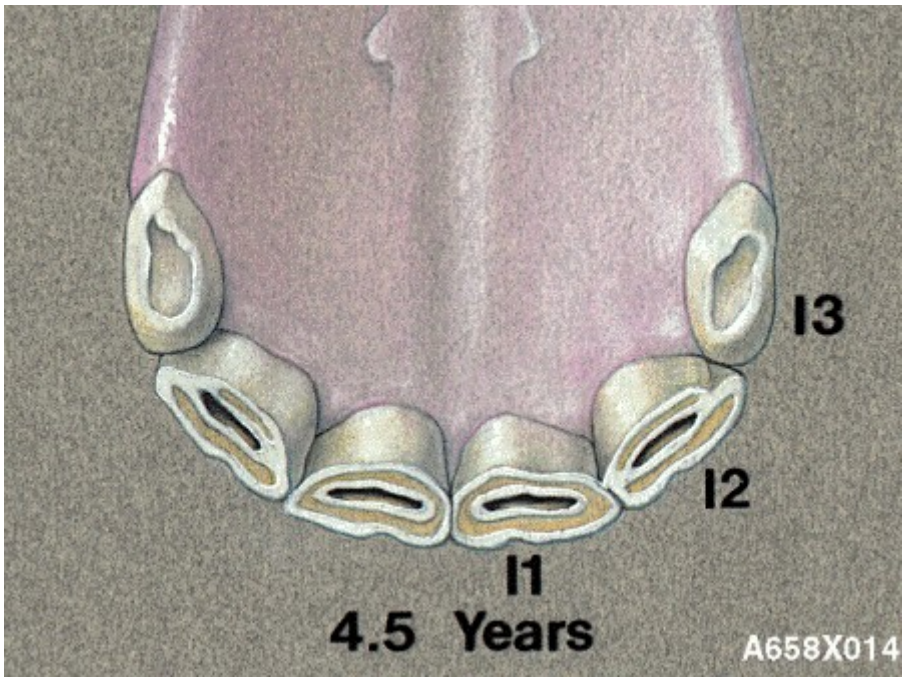



- **At 3 years:** The two permanent central incisors have met the corresponding incisors in the lower jaw, but only a slight amount of wear is showing on their tables.
- **At 3 years 6 months:** The four permanent lateral incisors have erupted, pushing out the corre sponding temporary lateral incisors in the process.




- **At 4 years 6 months:** The temporary corner incisors fall out and the permanent corner incisors cut through the gums.

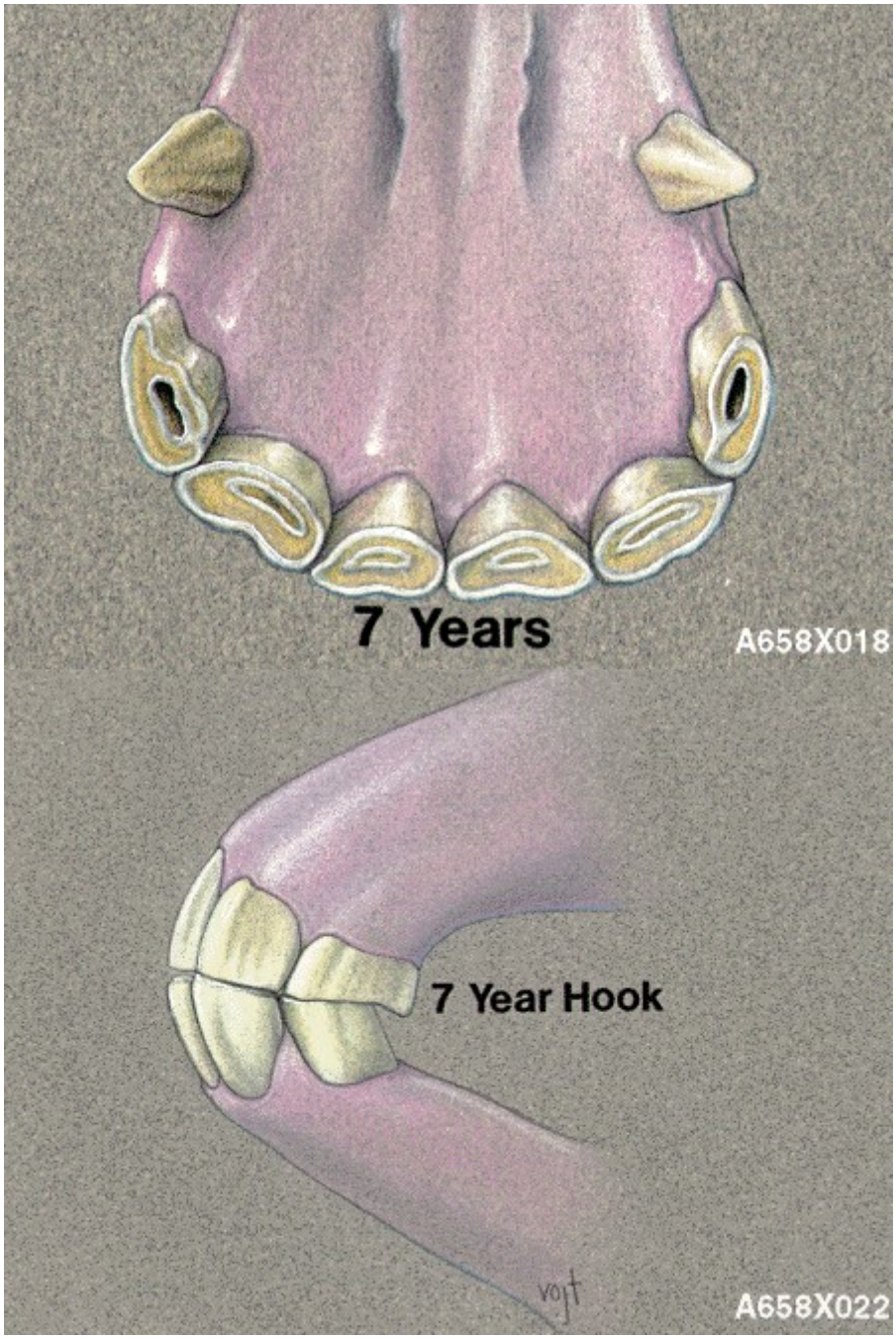



- **At 5 years:** The permanent corner incisors meet their corresponding corner incisors in the lower jaw along their anterior edges, but their posterior corners are still rounded off and unworn.
- **At 6 years:** The permanent corner incisors have lost their shell like appearance and are in wear along both sides of their central cavity.


## 7th TO 15th YEAR OF AGE

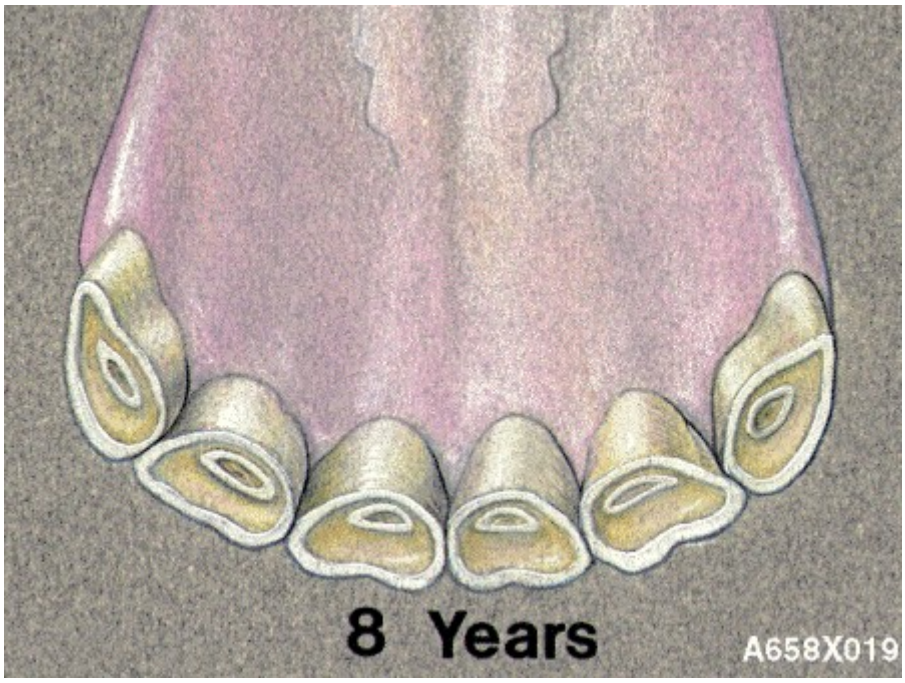
**At 7 years**

- The tables of the lower corner incisor teeth are well formed and the infundibulum in each is shallow.
- The upper corner incisor will develop a hook known as ‘dental hook’ or ‘7 year hook’.
- It is due to the fact that the lower corner incisor is placed somewhat further forward in the jaw than the corresponding upper tooth.




**At 8 years**

- In the tables of the central incisor teeth a brownish or yellowish brown, liner streak will be seen running transversely across the tooth between the inner and outer rings of enamel and situated just behind the anterior edge of the tooth. This is called the 'dental star'.
- It is usually confined to the centrals. The 7 year hook will slowly disappear by the 8th year.




**At 9 years**

- The central and lateral incisor teeth are more triangular in outline with posterior angle rounded.
- The table is much more broader and the angle between the teeth is more acute.

**At 10 years**

- Infundibulum is worn out, dental star is distinct and the galvayne's groove appears on the labial surface of the upper corner incisors.

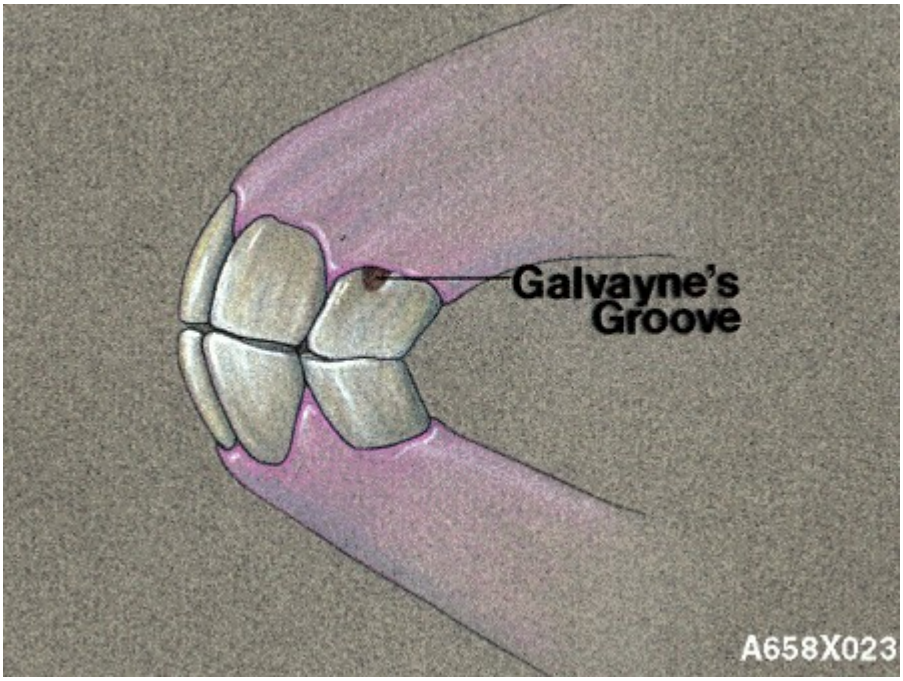
**At 11-13 years**

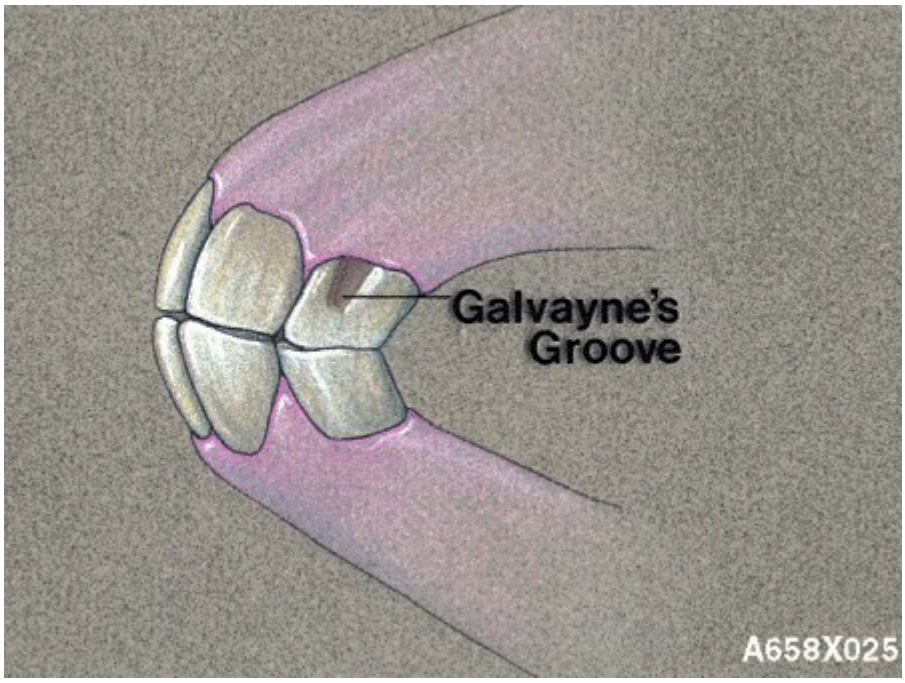
- All the teeth appear longer on account of the receding gums.
- The tables of each of them gradually become distinctly triangular with rounded angles.
- Dental star becomes distinct, dental hook appears on the corner incisors and the angle of the teeth is more acute.

## 15th TO 30th YEAR OF AGE

**At 15-16 years**

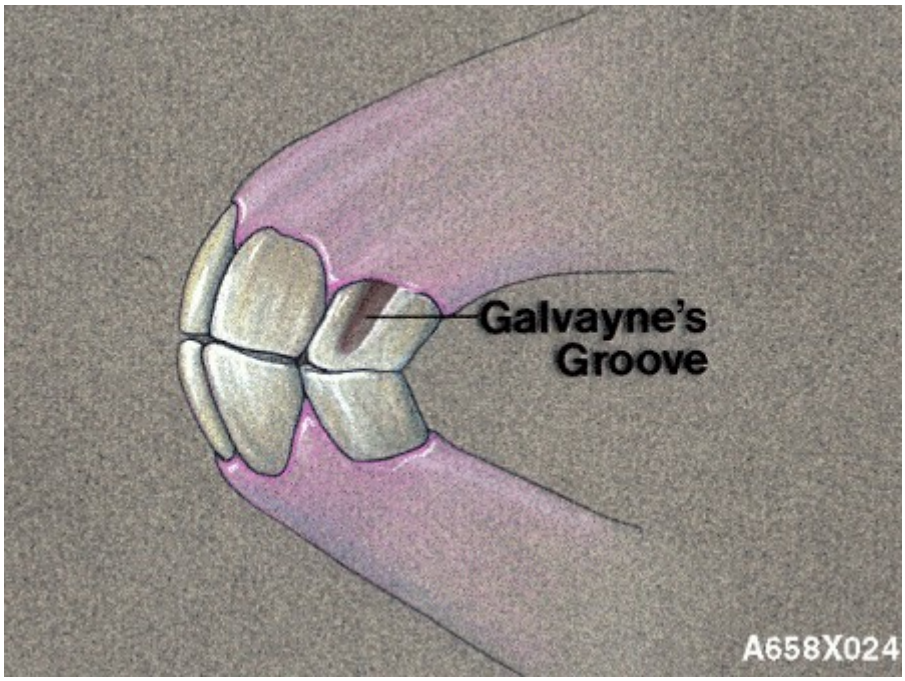
- The tables of the teeth are becoming broader and in the centre of the dental star a cleft or depression usually appears.
- Galvayne's groove has grown about half way down to the free edge in the upper corner teeth.




**At 18-20 years**

- The angle formed between the teeth of the two jaws is almost a right angle, and the tables of teeth are getting much smaller.
- A distinct depression appears in the centre of the dental star. Galvayne's groove has almost reached the free border.




**From 20-30 years**

- The teeth gradually appear older and more worn and the teeth are huddled together with no space between them.
- Galvayne's groove is practically the only definite guide, and even it may be indistinct or absent.

## BISHOPING

- It is attempting to make an old mouth to look younger. The teeth are rasped and levelled.
- A false mark is gouged out of the centre of the table and blackened with caustic (usually with silver nitrate crystals).
- This can be found out by observing,
    - The angle of teeth,
    - The absence of enamel rim and
    - Occasionally the traces of rasp being used to shorten the teeth.

## MODULE-7: GENERAL MANAGEMENT OF HORSES

Learning objectives

This module will discuss about,

- How to approch, handle, restraining a horse?
- Important managemental practices like grooming, bandageing etc also discussed
- Sadle and importance of different type of saddle and sadle application is discussed here.

## PURPOSE

- To record the rectal temperature, pulse rate, respiration rate
- To collect blood and give injection
- For performing surgical operation
- For easy transportation of animals
- To examine the skin surface and treat the simple wounds
- For shoeing and trimming the over grown feet
- During mating time to prevent injury to stallion

## APPROACHING AND HANDLING

- When approaching a horse, always talk to the animal before touching it. Always approach it on the near side.

- It is not advisable to carry a stick and to wear bright coloured clothing.
- Do not let the animal suspect that you are afraid of it. Hold the halter and handle the head first before touching other parts of the body. In a loose box, when approaching the horse from the near side talk to the animal, hold the forelock, ear or nose, or mane until the halter has been put on.

- When approaching the hind leg area one of the fore leg should be lifted.
- The animation given blow explain safe and risk area for approaching a horse.

*Approach from near side, talk to the animal, do not wear bright colou cloth, use halter.*

## LEADING THE HORSE

- To lead a horse, a halter, a bridle or head collar, with shank is necessary.
- When a horse is to be led for any distance, in public a bridle should always be put on.
- The person leading the horse should walks on the horses left, opposite to its head placing himself about an arm's length from the head.
- The right hand should the reins close to the horses mouth. The left hand should hold the loose ends of the coiled reins.

*Arm lenth from the head, lead from left side, hold the rope close to horse mouth.*

## BACKING THE HORSE

- *To back the horse, entire rope is folded to sufficient length and placed over the noseband of the head stall.*
- *Holding the ends of the folded rope with the cheek pieces of the head stall the*

*horse is gently pushed backwards.*

- *Care should be taken that the head of the animal is kept as low as possible.*
- *Backing is done while putting the horse into the stable.*
- *It is also carried out to find out any defects in the loin.*

*Head should be kept low, hold the cheek pieces and push the horse back*

## TURNING A HORSE

- It is always done away from a person holding it and never towards him.
- The horse should be turned to the right side with its hind legs as anchor.

## TROTTING A HORSE [Web link ...]

- The horse is trotted for exercise and also to detect any defects in the limbs.
- The man should walk on the near side of the animal and should hold the rope or reins about 18 inches from the horse's mouth and keeping this length quite slack he should also look to his front and not towards the horse.
- He should run at a slow pace, only along the side of the animal . If the horse refuses to trot, he must be driven from behind and not pulled by the man at its head.
- After trotting, the horse should be stopped and always turn round to the off side.

## RESTRAINING METHODS

**By halter**

- Horse are usually handled with a halter. Halters can be temporarily constructed of rope.

- Permanent halters are constructed of nylon rope and leather (Triple stitched leather ).
- The horse will stand more quietly for haltering if a rope is places around it's neck first.

Click here for animation

## Chain shank

- This chain shank is frequently used for further restraining . The chain may be placed through the mouth and arched to the cheek ring on the opposite side, serving as a bridle.
- The chain may also be placed over the bridge of the nose. By gently tugging the shank one can divert animals attention. The pressure exerted tensed to pull the nose down.

Click here for animation

## Twitch

- The twitch is the most important manual tool used in equine restraint . The principle is based on the reaction to pressure applied to sensitive lip . Endorphins are released that cause lowering of the heart rate and an increased performed elsewhere on the limbs (or ) on the other side of the body.
- The most satisfactory twitch consisting of a short length of chain attached to a hard wood handled approximately two feet long . A rope may also be used . A piece handled with two holes drilled at the sides to admit the rope to pass through is a satisfactory base.
- To use a twitch ,grasp the twitch and the cheek piece of the halter with the right hand. Place the finger's of the left hand partially through the loop of the twitch. Don't insert whole hand to the loop, as this complicate placement of the twitch . Bring the left hand over the bridge of the nose and gently move to the upper lip . Once the operator is prepares to grasp the lip, it should be done firmly to prevent the horse from pulling away . Once the fingers have firm grasp of the nose, the rope (or) chain is brought over the lip and right hand begins to twist the loop. Twist firmly to maintain grip, but not so tightly that produce pain.
- Don't use the twitch as a leaver, the pressure on the lip should be twist not a pull. When twitching pull the head to the front legs, if the horse should strike. The handler should stand close to the shoulder on the rear side, never stand in front of the horse.
- It is more desirable to carryout a rocking motion with the handle . So the twist is released and tensed periodically.

- To see animation click here  To seed video click here

## By hand

- The hand can be used as a mild twitch. The horses attention may be diverted by pressing on the eyelid (or ) grasping a fold of skin at the shoulder.
- Some horses will refuse and fight a twitch but can be restrained by applying pressure to one (or) both ears . To do this , stand in front of the shoulder along the neck. Grasp the left ear with the right hand, the left hand grasp the halter (or) is placed over the bridge of horse nose.
- Pull the horses head towards our side to keep the animal slightly imbalance. As soon as the animals feels pressure on the ear , it will pull away towards the right. The tension on the ear can be increased (or) decreased by simple opening and closing the hand.

## Muzzle

- They are used by man to prevent the horses from chewing upon wounds and bandages and to starve the animal before medical administration. Two types of muzzle

- Leather box muzzle – expensive but durable
- Wire muzzle - Cheap but less durable and comfortable
- To see animation click here 

**Bib**

- It is a leather sheet which can be buckled on to the cheek and back stay on the head stall . It is completely convenient in the lower lip. It is used to prevent the horses from tearing its own clothing.
- To see animaion click here 

**Neck cradles**

- It is used to prevent the lateral movement of the head. Ten to twelve pieces of 18 inches length and whose front ends are pointed.
- They are strung 2 pieces of wood bored longitudinally comes between each, which is bored transversely top and bottom. This applied at the neck and tied along the crest.
- It prevent the horses from turning its head to other parts of the body

**Side rod (or)Stick**

- The purpose is to prevent the horse from reaching a wound, bandages on the rear half of the body.
- The side stick is wooden piece of different length to suit different horses running from the halter leading to a side ring on a surcingle.

- It has the advantage of being less restrictive than the neck cradle, but can not be used in case of front leg injuries because, it would be possible for the horse to reach them.
- To see animation click here 

### Stirrup leather

- It is a long belt of leather about 5 feet long and a buckle is provided at one end.
- It is used to secure the fore limb of horse.

### Blinkers

- They restrict the field of vision of horses and prevent it from seeing traffic coming up along its sides.
- The blinkers are attached to the bridle.

## Cross tying

- It is useful to prevent a horse from moving the forequarters from side to side.
- The ropes high enough to prevent the horse from entangling the feet in the rope.
- The rope should be wither height are even higher and tied for short time. The rope should be of short length.
- To see animation click here 
- 

## Blind folds

- If a horse is afraid to enter a new environment (or) new box stall , a blind fold may help.
- The blind folded horses usually more calms down and then depends on you quite it.
- Towels may also be used and special blinders are also available in market.

## MANIPULATION OF FEET OF THE HORSE

- Lifting the forelimb of horse
- Lifting the hind limb of horse

### Lifting the fore limb of horse

- To lift the near (left) forelimb, approach the horse on the near side. Talk to the animal and tap it. Then turn the face put the left hand on the shoulder region and pass the hand down the withers and elbow midway between the knee and fetlock.
- Hold the middle of the fore cannon and ask the animal to lift up the forelimb. Then pass right hand under the pastern region and change the left hand from the middle of the cannon to the hoof region.
- When the foot is raised, hold the toe with the back of the hands towards the horse's tail and fingers pointing to the front. Stand upright and keep the horse's knee well flexed. If the off (right) forelimb is to be lifted, first go the near side (left side) and talk to the animal then go to the off side (right side) and repeat the above said procedure.

### Lifting the hind limb

- Approach the animal taking necessary precaution, stand near the forelimb of the animal facing the tail.
- Talk to the animal and take two steps forward and passing the left hand from shoulder region to the hind quarter and bring the left hand to the middle of the hind cannon and ask the animal to lift up by grasping the tendo achilles with left hand by drawing the leg up and forward.
- Hold the hoof region with both the hands and restrict in between your knees and keep it firmly.

## SECURING THE FORE LIMB OF HORSE

Stirrup leather (or) Rope method

- The forelimb may be secured with a stirrup leather or tied with a rope. It is fixed to the pastern and the foot is lifted.
- A thick pad of straw is placed on the hollow of the knee to prevent the strap or rope from slipping off and then buckled or tied around the forelimb.

## SECURING THE HIND LIMB OF HORSE

- Army side line method
- Single side line method
- Gatacre's method
- Service hobbles method
- Simple untwisted method
- Simple twisted method

## SERVICE HOBBLES METHOD

### Simple untwisted service hobble

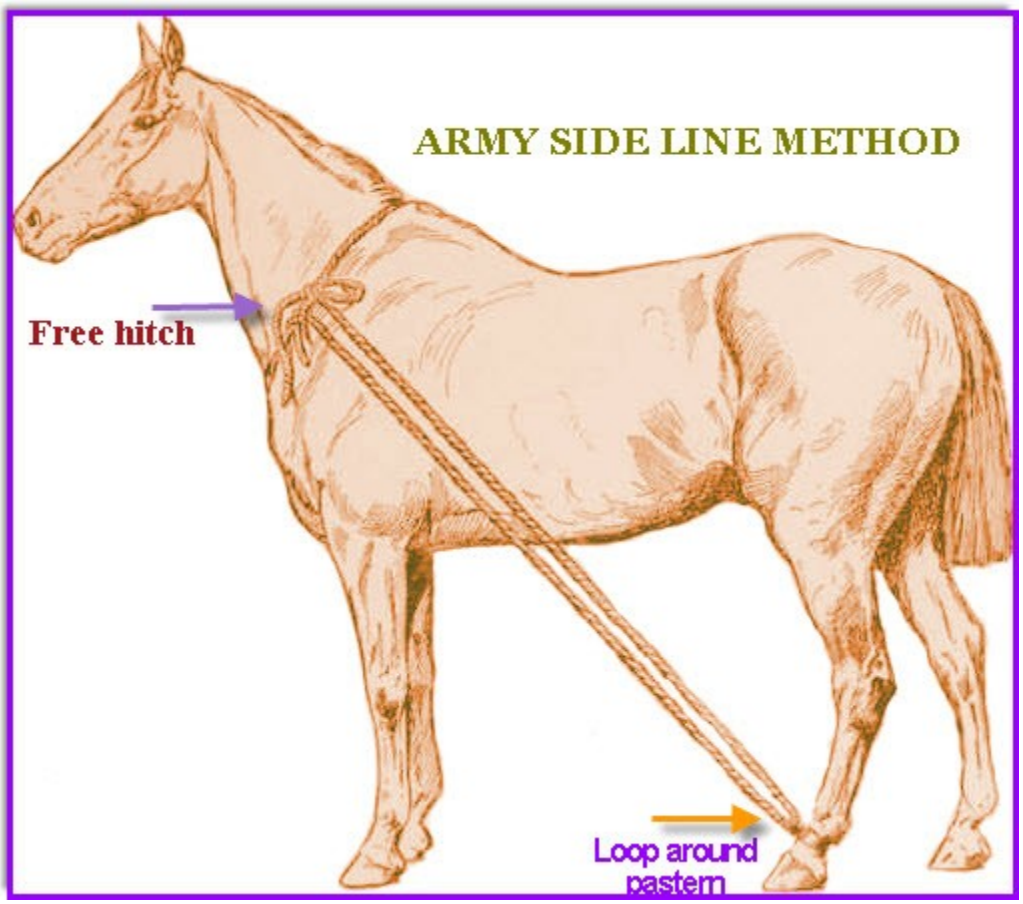
- Both the hind limbs should be secured for operations such as docking or to prevent injury to the stallion when serving a mare.
- The following methods are used for securing both the hind limbs.
    - Simple untwisted service or covering hobbles method (over pastern)
        - Attach two shackles round the pasterns. Attach two ropes to the

two rings of shackles.
    - Bring the ropes between fore legs, and take each one round the fore arm below the elbow, bring up and tie over the back with quick-releasing knot.
- Twisted service or covering hobbles method (over fetlock)
    - In this method shackles are applied above the hind fetlocks.
    - Ropes are attached, twisted round each other tightly, brought between forelegs and put an '8' knot near the brisket and the free ends are tied round the neck in front of and to the side of withers with a quick-releasing knot.
    - This method is better than the previous one since the lateral movements of the legs are minimised by twisting the ropes.

Last modified: Sunday, 3 June 2012, 04:23 PM

## ARMY SIDE LINE METHOD

- Take a long rope of about 15 feet in length, a loop is put around the hind pastern brought forward, turned around the neck in free hitch and head by an assistant.
- This is simple and easy method of securing hind limb and commonly used now-a-days.




## SINGLE SIDE LINE METHOD

- Shackle is applied to hind limb.
- A large loop is made at the end of the long rope and slipped over the horse's head.
- The face band is passed through the ring on the shackle and the rope is twisted about 2 or 3 times round the first part and the hind leg is pulled up and forward while standing by the horse's head.

## HIPPO LASSO OR STRAIGHT JACKET METHOD

- It consists of a breast band and broad ring connected by traces and supported by straps passing over the back.

## GATACRE'S METHOD

- By this method the hind limb can be lifted for prolonged examination. Take a 20 feet long 1 / 2 inch thick rope.
- Double it and tie the double end to the tail. Apply a shackle on the pattern.
- Pass the two free ends off the rope through the ring of the shackle, one to the near side and the other to the off side and have them held by two assistants standing well behind and to each side of the horse. Lift the leg by pulling the ropes.
- The rope can be tied to the tail by the following three methods.
    - *Double sheet bend knot method.*
    - *Tail hitch method.*
    - *Docked tail or double rope half hitch method:*
        - If the horse's tail is too short this method is advocated. Pass a loop made in the middle of the doubled rope over the root of the tail and further secure by two half hitches.

## STOCKS OR CRUSH OR TREVIS

- 


## GROOMING OF HORSES (Web link ...)

- The objects of grooming are cleanliness, prevention of diseases and improvement of the animal's condition and appearance and the results may be sufficiently attained for the horse by good brushing and wisping once a day.
- The necessity for the amount of grooming required varies with the condition under which animals are placed, the better they are fed and the faster the pace expected of them when at work, the greater should be the amount of care towards getting the skin into perfect condition.
- Grooming may therefore be limited to the amount necessary for cleanliness and health, or it may be prolonged and amplified with the object of maintaining the skin in best possible condition even while work is at high pressure, and this is derived by hand rubbing and wisping.
- The importance of grooming as a prevention of diseases while it is quite true that mange and many other diseases are not produced by dirt.

- The regular brushing and cleansing of the coat is an undoubted preventive measure against various skin diseases.
- The relation of regular exercise to the amount of grooming required is another matter which should be kept in mind.
- It is a well-known fact that an idle horse is always more difficult to clean than the one which is at work; indeed, it is almost impossible to keep some skins free from scurf and grease when the horse is idle.It is also believed that the tendency to accumulate skin dirt is found to be greater with corn-fed horses than those at grass.
- The idle horse therefore requires even more attention and thoroughness as regards grooming than his fellow at work. Accordingly, regular exercise is considered, in addition to its other benefits, a labour-saving procedure.

*To improve animal condition, cleanliness, prevent disease*

## GROOMING EQUIPMENT

- The grooming tools consist of body brushes, curry comb, dandy brush, mane or tail comb, sweat scrapers, sponge, rubber and wisp.

**Body brushes***:* (To see image click here)

- Made of stout bristles or vegetable fibre and have a broad hand-loop of webbing across the back to prevent the brush slipping from the grasp.
- The use of the body brush is to remove scurf and dirt from the coat, and for this purpose, the bristle brushes are superior to those made of fibre.
- Fibre, however stiff at first, ultimately flattens down from the continued pressure on the brush. Bristles, on the other hand, though more expensive, do not bend, but simply wear shorter, and retain their upright position till worn down to the back.
- It is well to remember that as bristles get shorter, they become less pliant and stiffer, so that a half-worn brush is a very prickly article and should be used with consideration.

**Curry combs** ( See image)

- The curry comb consists of several straight, blunt toothed blades in a metal back, with a broad loop of webbing for the purpose of securing it on the back of the hand.
- It is essential that the teeth should be smooth and blunt, though may be rounded at the top and bottom. This prevents the bristles being unduly worn away when the comb is used to clean the body brush, and also guards against injury to the skin when used for the removal of dirt.
- Other patterns have wooden handles, and some have a series of curved springy blades, instead of the straight rigid ones usually met with.
- At the sides, small projections of the blades are seen on many patterns for the purpose of knocking on the ground when dislodging dirt from the back.
- Use of the curry comb
    - The use of curry comb on the skin should generally be restricted as its utility is confined to cleansing the body brush of scurf.
    - To effect this, only an occasional rub on the brush is necessary, but its use is much abused by animal attendants who make a great show of cleaning the brush and do little work with it on the skin, the result being that the brush is quickly worn out.

- The dirt should be dislodged by knocking the side of the comb on the floor behind the horse, where it can be seen and swept up, and is evidence of the man's diligence.
- Blowing the scurf out of the comb should not be practised as it results in the dust being inhaled by the horses or settling again on the coat from which it has just be removed.In light horses, use of curry comb is limited to the removal of caked dirt and mud. However, in some commercial stables, generally the animals are groomed all over with it, and subsequently brushed with a dandy brush.
- The method has a good deal to recommend it where time is an object; it is quick, effective, does not in any way injure the skin, and seeing that this is the case, some discretion may be allowed in its use.

**TOP**

**Water brushes**

- These are made of longer, finer, and softer bristles than body brushes.
- They are intended for damping the mane and tail, and washing the feet and legs.
- They are also often used dry for grooming fine coated, ticklish horses, and are certainly very useful for grooming the head and face.
- When employed for washing feet, their use should be confined to the hoof only, wetting of the legs should be avoided as a routine.

**TOP**

**Dandy brushes** (see image)

- These are made of stiff whisk fibre. They are in general use as a grooming brush, and as a matter of fact, are most useful in any stable.
- On light horses, their use is limited to the removal of hard caked dirt, the rest of the grooming being performed with the body brush.
- However, in commercial stables, these are often used, in conjunction with a free use of the curry comb. Their use saves time and labour and they are most efficient instruments of grooming.

**TOP**

**Mane or tail combs** (see image)

- These are made of horn or metal, with deep, broad teeth; though convenient, they are not actually necessary and, if not very carefully used, they tear out and break the hair considerably.

**TOP**

**Sweat scrapers** (see image)

- These are long flexible blades of smooth metal with a handle at each end by means of which the lather of a sweating horse may be conveniently and quickly removed.
- Another variety has a central handle with a rigid curved blade, but the pattern is not so good as the flexible one, since the rigid blade does not adapt itself to the curves of the body so well.

**TOP**

**Sponges** (Click here for image)

- These are commonly used during grooming for cleaning the eyes, lips, nostrils, and dock.
- Though the convenience of sponges for this purpose is undoubted, they should invariably be prohibited on the occurrence of any contagious disease, as they are one of the commonest means by vhich infection is spread.

TOP

### Rubbers

- These are generally used to give the coat a final polish after the rest of grooming is completed, and a damp rubber may, with the advantage, take the place of a sponge whenever possible, since it can be easily disinfected and cleaned by boiling, a process which ruins sponges.

TOP

### Wisp

- It is a pad of hay or straw, made by twisting the material into a rope and doubling it into a convenient-sized pad as described below.
- Its proper use, which is really a form of massage, is a most valuable method for improving the condition of the skin and coat. To make a wisp, soft hay or straw should be twisted into a convenient-sized rope about 2.5 to 3.0 m long; two loops are then formed at one end, one being very slightly longer than the other.
- Each of these loops in turn is then twisted beneath the remainder of the rope until the end is reached, when it is passed through the extremity of each loop and tucked under one of the twists. A really good wisp should be no wider than can be conveniently grasped by the hand.

## TIME AND METHOD OF GROOMING

### Time for grooming

- As a matter of appearance and cleanliness, horses should be "quartered" (lightly groomed) before going to exercise, but the "strapping," i.e. thorough grooming is best carried out on return from work, unless it has been of a very exhausting nature, when horses are better left alone until recovered from fatigue.
- As a practice, it is advisable to pick out and inspect the feet before commencing to groom the horse, in order that the feet are not overlooked.

### Method of grooming to be adopted

- The horse must be cool and dry. Commencing at one side of the neck immediately behind the ear, the coat should be thoroughly brushed out, the brush moving the way the hair lies as a rule, though in order to get rid of hard dirt or scurf, it is sometimes necessary to brush in a circular direction.
- To use the brush with the best effect, the man should stand well away, keep his arm stiff, and lean the weight of his body on the brush, which should be placed gently on the skin and not brought down with a bang, especially on a thin-skinned, ticklish horse. If the man stands close, with a bent elbow, and brushes with his arm only, he does not force the bristles or fibres through the coat so well, or remove the scurf so effectively.
- He should use the brush in the left hand for most part in grooming the left side, and for hind leg. He should grasp the hamstring with his free hand.
- The horse is now turned round in the stall, the head and mane brushed and eyes, nostrils, and the dock cleaned.

- Finally, he is put about again, the tail is brushed out and the whole coat wised and given a final polish with a rubber.
- In grooming the head, it is well to use a soft brush if one is available, and for this purpose, a dry water brush is frequently requisitioned; it is further to be noted that a good groom is careful not to knock the skin with the wooden edge of the brush when going over the bony projection of the head and legs.

Click here for animation "Grooming a horse - Training the mane"

Click here for animation "Grooming a horse - Training the tail"

Click here for animation "Grooming a horse - Brushing the tail"

Click here for animation "Grooming a horse - Sponging the eyes muzzle and dock"

click here for animation "Grooming a horse - Using a grooming cloth"

click here for animation "Grooming a horse - Using the body brush"

### Wisping

- As previously stated, it is a form of massage. It stimulates the skin, increased blood supply into it, great effect on the oil glands of the hair, increasing their output, and thereby giving a marked gloss to the coat.
- The wisp should be brought down with a bang on the skin, in the direction of the hair, and the process repeated all over the body, care being taken to avoid delicate parts.

### Hand-rubbing

- Is another excellent form of massage, and is specially useful for removing the loose hair of the coat as well as stimulating the skin.
- The hands are slapped on the body one after the other, and the weight of the groom's body leant upon them and the forearms, whilst both are moved over the skin with firm pressure.
- In the case of the legs, brisk but gentle rubbing with the fingers and palms in the direction of hair is an excellent stimulant to the circulation of the limbs.
- For the removal of loose hair by rubbing, the hands and arms should be kept slightly damp.
- Length of time occupied is no criterion of the quality of work done and quick, hard grooming should be encouraged in every way.

## GROOMING STALLION

- Regular and proper grooming is essential for health of stallions. The grooming ensures cleanliness, promotes blood circulation, keeps the coat short and shining and beautifies the appearance of stallions.
- Grooming must be done systematically as a routine After grooming is over, all stallions should be checked.
- Slackness and faults in grooming should be pointed out on the spot and-grooms warned to do their work properly.
- It is only the regular grooming which can bring shine to the coat. How hard one may groom in one or two days, his work is not likely to show up, if the grooming has not been carried out regularly.
- After the grooming and the covering is over, the bedding is laid thick and spread evenly all the standing. The sentries should be posted during mid-day break.

- They should ensure that the bedding is kept even and bare patches are covered with bedding.
- The dung should be removed from the stallion box immediately it has been voided. Sentries should also ensure that the 'jhools' (Rugs) are properly retained on the body of the stallions and noticeable sickness is reported at once.
- Winter 'jhools' should be properly fitted, surcingle and breast piece should not be very tight. The 'jhools' should be kept clean and free from dirty cakes.
- Summer 'jhools are often used to protect the stallion from flies and to beautify its appearance. The stallions' sheath should be cleaned once a week with very weak disinfectant if they have not been used for breeding for more than a period of one week.

## WASHING OF HORSES

- The washing of horses as a general practice is to be strongly condemned. In cold and changeable temperate climates, it may very easily lead to sickness, and even in warm and equable temperatures, its practice is not always without adverse effects.
- The only purposes for which the use of water or soap and water is necessary on the body of the healthy horse is for the removal of dirt stains which will not groom off, and for the occasional cleansing of the mane, tail, and hooves.
- The dangers which washing may give rise to are not, however, due to the wetting of the skin, but to want of attention to the subsequent drying; and in all cases where it is found necessary to wash, too much care cannot be bestowed on making sure that the ' animal is thoroughly dried and the warmth of the skin kept up, or a chill results.

- The use of soap removes a great proportion of the usual greasiness of the coat and consequently some of nature's protection and until this is restored, an unusual liability to chills is present, which can only be guarded against by thorough drying and protection from draughts. From the same cause, i.e. removal of the natural grease, the coat of washed horse is dull and lacks the glossiness which it would otherwise carry.
- Washing of the body, then, should be avoided as a rule, except for the special purposes mentioned, and should it be necessary at any time to break the rule, greatest care should be taken to dry the skin thoroughly, clothe the animal warmly for the time and keep it out of draughts.

- Washing the legs and belly on return from work in order to get rid of mud is frequently followed by stiffness and cracking of the surface.This is more likely to happen if warm water is used or when the weather is cold, and especially when there is a *keen* wind; it is most common in the heels, legs and bellies of horses which are washed on return from work.
- When confined to the hollow of the heel, the condition is called "cracked" or "greasy heel", the latter term *originating* from the fatty nature of the discharge from the oil glands of the skin which collects round the injury.
- On the legs and belly, it is commonly attributed to the irritation of mud, and is frequently called "mudfever". The *condition* is a serious one and may incapacitate horses for long periods, but it may be practically banished from the stable by prohibiting the routine washing of legs and feet. Mud should be left till dry, and then brushed off.
- It has been stated that animals with white legs are more frequent sufferers from cracked heels than others and this is no doubt the case; but it is not on account of weakness or peculiarity of the white skin, but owing to the fact that it is more frequently washed.

## CLIPPING OF HORSES [Web link....]

- Under natural conditions, the horse's thick winter coat provides him with an extra warm covering during the time that the weather is cold.
- The extra warmth of the long, thick hair, added to the increased greasiness always found under a heavy ungroomed coat, keeps the body warm and so helps considerably to maintain the weight and condition. If, however horses are required to work hard, the coat becomes a positive drawback, adding considerably to the exhaustive nature of the labour, keeping the animal in a constant sweat and preventing rapid drying of the skin after exertion as a result it is found that a loss of condition is inevitable.

- On the other hand, a clipped horse not only works with less distress and it is, moreover, dried and cleaned with much less labour and risk of chills.
- An argument which is sometimes advanced for not removing the hair from the back of the fetlock is that it acts as a natural drain for water when the animal sweats or is wet.
- Altogether, apart from its beneficial effect on the horse's condition and working power, clipping enables the groom to dry and clean wet and dirty animals better, more quickly, and with less labour; and in considering the question as a whole, this point should not be lost sight of.
- The attempt to dry and groom a muddy, soaking, heavy coated horses is a heart breaking end to a day's work, and should be avoided, if possible.
- The operation of clipping - Whether the hand or power clipper is used, some little skill is necessary to produce the best results, and as the tooth blades of all cutters are hard tempered and very accurately adjusted, they are easily broken and frequently found out of order unless carefully handled.
- In using the hand clipper, the pressure exerted on the skin should be quite even throughout or the result will be "ridgy", and the right hand, which operates the blades, should do so without any pressure whatsoever.
- Care must be taken not to cut any of the mane and tail hair, and when the legs are left unclipped, the appearance is enhanced by slanting the boundary line from the back of the elbow upwards to the front of the forearm, where there is a natural dip in the limb, similarly in the hind limbs, the line should slope downwards and backwards from the point of the stifle.
- If the power clipper is used, the driving machine should be worked at an even pace and should be placed in such a position that it cannot be knocked over by any unexpected movement of the animal, or a barrier should be erected to protect it.
- With either variety, the blades must be kept free from accumulating scurf and dirt, occasional brushing and wiping with a little paraffin oil being all that is required.

## PERIOD FOR CLIPPING

- Horses may be clipped with advantage from the time their coat thickens in the autumn until summer coat shows signs of coining in the spring.
- The frequency of the operation will probably depend on the time and labour available. If there is no limit to these, the machine should be run over the coat every time it shows at all long, and frequent clipping certainly keeps animals smart in appearance, as well as giving the other advantages already enumerated. Where, however, labour and machines are limited, it will be found most advantageous to clip at the beginning of winter. This period will vary with the severity of the season, and the individual animal. Some animals are, in fact, clipped all the year round and carry quite good coats.
- Following points with regard to clipping of animals must be considered
    - The nature of the work
    - Environment
    - Supply of food
    - Supply of clothing
    - Clipping as a means of cleanliness to control parasitic diseases.
- The benefit which animals voyaging from a cold to a hot climate at a time when their coats are thick, derive from clipping en route is evident. It is true that the long coat falls off naturally under these circumstances, and the hair rapidly adapts itself to changes of climate, but its removal by the machine at once relieves the animal of an unnecessary blanket and should be carried out when possible.
- The use of clothing during the winter months for working horses which have been clipped is practically universal, and where horses are called on to work up to their rations, it is beneficial to the animal's condition, and economical to the owner.

## CLOTHING OF HORSES [Web link]

- The term "clothing" as applied to horses comprises a hood, pad, roller, reast piece, and quarter sheet.
- With the exception of the hood, all these articles are combined in a shaped rug which fastens across the chest and has surcingle stitched on.
- Some rugs fasten centrally on the breast, whilst thers have a flap which buckles on the side, the latter being the better plan, is it prevents the front being blown up.
- For a similar reason, a well fitting fillet string" should be fastened round the quarters to prevent the wind blowing the rug over the back; or the rug may be fastened to the flap of the ug.
- The fit at the neck is another point which should be looked into. Very often the opening is much too large and as a consequence, the rug gradually works back over the shoulders till the top is drawn tightly across the withers and may cause a sore from pressure.
- When surcingles are stitched on, a space of four inches (10 cm) should be left free where the web passes over the backbone or shrinkages from wet may cause injury by tight pressure.
- A well fitting rug should embrace the neck like a collar, but in rather looser fashion, cover the body down to the level of the elbows and extend as far back as the dock; the fillet string should be capable of adjustment and the buckle of the surcingle sufficiently high up to prevent the horse lying on it when down.
- Rugs are made of thick woollen blanketing or of jute sacking, lined with stout woollen cloth, and both are quite lasting, though the latter perhaps shows dirt least.
- If the roller is not stitched to the rug, it should have a pad on each side of the spine, sufficiently thick to prevent the webbing coming down on the centre of the back when it is drawn tight.
- These pads are frequently so badly designed and stuffed that they do not prevent pressure on the backbone and a sore is the result.
- They should be thickest near the spine and thin off to nothing at their lower edges, pieces of felt laid on each other, then skived off, and covered with leather or serge, make a very serviceable pad.

## BANDAGES OF HORSES [Web link ....]

- Bandages are generally used on the legs of horses either to keep the legs warm and the circulation active or to protect them from injury whilst at the work.
- To keep the legs warm, a bandage should not be any tighter than to prevent it slipping down. It should cover as large a surface as possible and be applied without wrinkles and with even pressure throughout.
- Stable bandages are usually about 2.15 or 2.45 m long and should be put on as follows - starting just below the knee or hock, enough should be unrolled to make one turn round the leg, at a slight downward slope; keeping the bandage close to the leg, allow it to unroll itself round and down the limb in the same direction it was started, until it reaches the coronet.

Click here for animation

- Now it will naturally take an upward direction and its unrolling should be continued till the point from which it started is reached, where the tapes are to be tied in a bow on the outside of the leg, and the end should be tucked in neatly.
- In this position, they will' be out of the way and not likely to be rubbed or undone. As an additional security, the corner of the loose end first applied may be turned down so that the next turn of the bandage will pass over and fix it.
- The nice adjustment of a bandage can only be acquired by practice, but., the above directions will enable a correct method to be adopted.
- The usual errors are starting to unwind at too great a slope and then endeavouring to correct this by pulling the material in the required direction; and failing to get the bandage over the fetlock without altering its direction.
- Warm bandages put on too tightly defeat their object by stopping the circulation, and wrinkles are very likely to cause injury to the skin from the pressure of the folds which lie over them: for the same reason, knots, or bows should not be tied either on the back of the tendons or on the front

and readjusted. All precautions should be taken to prevent any injury from pressure. The legs should be hand-rubbed after removing bandages.

- Bandages put on for work should reach from below the knee to above the fetlock and should not in any way interfere with either joint. They should be fastened with a double strap and buckle stitched on the material, or if tapes are used, by a knot and should be removed as soon as the work is done. These bandages should not be put on tob tight to prevent injury from pressure.

Click here for animation

- Material of bandages should be pure woollen for warmth, and some are now made with a fleecy side for this purpose. Bandages which are put on to protect the legs from injury while at work should be made of stockinette, an elastic material which permits of some pressure being applied when they are put on.
- To roll a bandage, fold it by the end of which the tapes are attached i.e. the side on which they are stitched facing you. Double the tapes into a small bundle about the width of the bandage and lay them across the place they are stitched to, then roll the tapes inside. When the bandage is applied the tapes will then be outside in the most suitable position for fastening.
- Knee caps to protect the knee in case of a fall at exercise, are generally used in sports horses. They are made of stout woollen cloth with thick leather bosses on the front, which are shaped to prevent them interfering with the bending of the joint.
- The top strap, which must be soft and padded on its inner face, should be tight enough to keep the knee cap in position, whilst the lower one should be quite slack, so that the lip may be freely bent when trotting. If these precautions are not observed, knee caps may lead to the very accident, they are designed to prevent.

Click here for animation

### Tail bandage

- Tail bandage is done normally at the time of covering, to prevent injury to stallion's penis

Click here for animation

## EXERCISE OF STALLION

- Exercise is by far the most important factor in keeping the stallions in tip-top breeding condition.
- The combination of over-feeding and idleness quickly leads to disaster. More vigorous exercise is required to be given during winter months and in summer, early exercise should be given to avoid profuse sweating.
- There are various ways of giving exercise to the stallions. Whatever method is employed, proper exercise during covering season is very essential.
- Ridden exercise is the best if it can be safely given to the stallions. For riding stallions, men trained in equitation should be employed. The stallions require l'/2 hours exercise daily.
- It should be divided for an hour in the morning and 1/2 hour in the evening. The exercise should be alternatively changed into walk and trot at intervals.

- In winter, more time should be consumed in trot while in summer more time should be taken in walk.
- The stallions should be grouped together for exercise according to the temperament of the individual stallion. The stallions which resent the company of the other stallions should be given individual exercise.
- The area of exercise should be away from the brood mares stables and no brood mare should be visible while the stallions are being exercised.
- Enclosed exercising school with a wall all round is also used for exercising and grazing of the stallions.
- Exercising track is made all round and central area of the school is sown with Lucerne for grazing.
- The track for exercise should be even, soft and at raised level from the ground. There should be no stone or hole on the exercising track.
- Dried dung or tan should be used on the track to keep it soft. Before the stallions are taken out for exercise, the exercising track should be inspected daily for its suitability.
- The stallions should be exercised under the supervision of a competent hand.

## FEEDING AND EXERCISE

- Brood mares in liberty get enough exercise and no special attention is necessary for their exercise.
- The mares confined to loose box should be turned out every day in grazing paddocks.
- Exercise, in whatever form it may be, is essential for brood mares for promoting health and preventing ailments

## STABLE ROUTINE

- Daily work of the stallion should be carried out according to set routine and daily stable routine be supervised by the Incharge.
- The work of the stallions must start early in the morning so that they have enough time for exercise, covering and grooming which should be completed during cool hours of the day.

- The first thing when an attendant enters the stable is to clean the water and feeding troughs, then a morning light feed is given to the stallions.
- While the stallions are busy in feeding, the bedding of the loose box is removed, the portions soiled with dung and urine are separated and the remainder is laid outside systematically for aeration and drying, then the floors must be thoroughly cleaned by scrubbing. By this time, the stallion finishes his grain feed and he should be prepared for exercise.
- His feet are picked up and body lightly cleaned before saddling and taking him out for exercise.
- After return from exercise, stallion's girth is slackened, the stallion is allowed to cool himself for about- 20 minutes before the saddle is taken off.
- The stallions are lightly groomed if the covering is done before grooming parade, otherwise thorough grooming is taken in hand straightaway.

## HOOF CARE

### Hoof care

- Foot care is one of the most neglected of all horse management practices. Most lameness that impairs the usefulness of a horse can be prevented by proper foot care. Foot care should b as routine as feeding and watering. It should include
    - Routine cleaning
    - Periodic trimming
    - Corrections of minor imperfections
    - Treatment of foot disease and injuries.
- Ideally, a horse's foot should be inspected and cleaned every day. A hoof pick or or fine-bristled wire brush can be used for cleaning the sole, frog and hoof wall. This will improve the likelihood of detecting prooblems early.
- The hoof wall grows an average of ¼ inch per month. Most horse' hooves are trimmed and shod every 6 to 8 weeks. This depends on rate of growth and wearing of hoof wall.

### Tools required

- Hoof pick – used to clean any dirt or rocks from the hoof crevices
- Nippers used to remove extra hoof wall
- Clinch cutter or pincher or puller – used to remove shoes that have been worn and are ready to be taken off
- Hammer – two kinds can be used one for driving the nail in and the other for shaping or rounding the horseshoe on the anvil
- Rasp need for leveling the foot
- Hoof leveler used to determine the angle of the hoof wall and check that the hoof is level to the ground

| | | | |
|---|---|---|---|
|  |  |  |  |
| **Hoof pick** | **Nipper** | **Clinch cutter** | **Rasp** |
|  |  |  |  |
| **Hoof leveler** | **Hammer alter shoe** | **Hammer to drive nail** | **Hoof care kit** |

## FOOT CLEANING

- The foot should be cleaned from the heel towards the toe with a hoof pick.
- Special care should be taken to clean the commissures on each side of the frog and the cleft of the frog itself, but the heal should not be opened excessively. This weakens the area and interferes with proper contraction and expansion of the heal.
- After the hose has been ridden, its sole must be cleaned and checked for gravel or other foreign objects that could be lodged in the natural depression of the foot.
- A nail, gravel, stick, other other object can work into the foot and cause lameness for a long time.

## PERIODIC CLEANING

- Trimming of the feet is important, although it is not

needed as frequently as cleaning. Trimming should be done at about 4 weeks intervals on horse kept in stall or paddocks or about 6 weeks interval for horse used heavily or running in pastures.

- The main goal in trimming is to retain the proper shape and length of the foot. The bottom of the foot should be kept level, and the inside and outside walls should be maintained at equal lengths. The toe of no4rmal feet and pastern should be 3 inch long; the quarter, 2 inches and the heal 1 inch.
- The hoof wall should be trimmed with nippers to remove excess length, then a rasp is used to smooth and level the bottom of the foot. Each stroke of the rasp needs to run from the heel through the toe to prevent uneven area in the hoof wall.
- Trimming the sole, referred to as lowering the sole, is done to keep the pressure on the hoof wall rather than on the sensitive inner part of the foot. The dead, flaky tissue should be trimmed from the sole. Live tissue, elastic when stretched between the fingers, should not be trimmed away.
- The frog should not be trimmed excessively because it should contact the ground with each step. It is trimmed only enough to remove dead tissue and to provide uniform and adequate fissure along the junction of the sole and the frog.
- After the bearing surface has been rasped to the level surface of proper length, the edge of the wall should be rounded if the horse will not be shod. This prevents chipping and peeling as the foot contact rocks, logs or other obstructions.
- The heel should be trimmed enough to promote expansion and prevent contraction of the heels. The main concern is to trim often enough to prevent cracking and uneven wear, which could eventually contribute to improper set of the feet and legs.

## Maintaining hoof-wall angle

- The proper hoof wall angle in relation to ground and the angle of the pastern is very important. The angle of the hoof wall should approximate the angle formed by the shoulder and the pastern usually 45 to 55 degrees.

## CORRECTION OF MINOR IMPERFECTIONS

- The most common deviation from the normal set of feet and legs are when either front or rear feet toe in or toe out.
- Other problems commonly corrected by trimming are cocked ankles, buck knees, calf knees, sickle hocks, and slight rotation of the cannon bone.
- Also, some common faults in the movement of feet in a stride – forging, scalping, interfering and brushing are corrected by careful trimming.

## TREATMENT OF HOOF INJURIES AND FOOT DISEASES

- Moisture in the horse's feet helps to maintain flexibility and prevent cracking. Most of the moisture needed in a healthy and well protected foot can come from within. One way to maintain proper moisture in the foot is to regularly apply a good hoof dressing containing some animal fat such as lanolin.
- When a shoe is lost, it is important to promptly cut the hoof wall level with the sole to preen it from breaking about the point while awaiting the farrier. Removing the opposite shoe and lowering the hoof wall to equal the length of the other hoof will balance the gait of the horse.
- Much lameness results from nail pricks. Horse should not be ridden in areas littered with trash and board containing nails. Injury caused by nails can ruin the horse. As soon as the nail prick is identified, prompt medical attention and packing is needed to prevent infection by ground borne disease organisms.

## SADDLE (to know more)

- Saddle Various types of saddle are used for riding and carriage of load. These may differ in various details but their construction is based on the same principles.
- Hence they have similar frame work known as saddle tree consist of a front arch and a rear arch secured by two side bars placed parallel to each other.
- The purpose of using two arches is to ensure that spine of the horse is not pressed.
- Similarly, the side bars not only distribute the weight equally on the back but also keep the arches in the place.

## PARTS OF SADDLE

### Saddle tree

- It consists of a front and rear arch made of steel. Both the arches are secured by two side bars, placed parallel to each other. The front arch forms the 'pommel', the rear arch the 'cantle'.
- The side bars rest on the back of the animal and distribute the weight of the redder along the animal's back.
- The side bars are made of wood and are slightly twisted to enable them to conform to the shape of animal's back. The ends of the side bars are slightly curved upward and outwards.
- That part of the side bar which projects in front of the saddle is called the 'burr' whereas the one projecting behind the saddle is called the 'fan'.
- Just behind the front arch, the side bars are fitted with a steel bar and a roller through which the stirrup leather passes.

### Numnah/felt panels

- Side bars are fitted with detachable numnah/felt panels. The leather pockets at both ends of the numnah panel fit in the fan and burr.
- The front leather pockets are provided with straps and buckets for securing them on to the side bar.
- The object of numnah panel is, firstly to provide extra padding without filling up the channel of the saddle and secondly to prove a surface which grips the blanket and prevent slipping of the saddle. They also afford protection to the side bars.

**'V' girth attachment**

- It consist of front and rear straps which connect the sweat flap to the side bar, meeting in a v shape on the sweat flap to which they are riveted.
- The front straps has two parts, the upper part secured to the side bar has a buckle and the lower part secured to sweat flap is punctured with three holes for adjustment to suit the conformation of different animal.
- The rear strap whose upper part is screwed to the side bar and the lower part riveted to the sweat flap does not require any adjustment.
- The sweat flap consist of an oblong piece of leather to which the straps of 'V' attachment are secured and on this are also sewn the girth straps.

**The seat**

- It is made of leather and cover the frame of the saddle between the front and rear arches which are connected by a sling of webbing.
- The webbing takes off the strain from the leather.

**The flap**

- It is a leather covering on the side of the saddle. The shape of the flaps suit the bend of the rider's legs which his feet are in the stirrups.

**The stirrup leather**

- It is to hold the stirrup iron, it has a buckle at one end and is punched with holes and the other end for adjustment.

**The stirrup iron**

- These are made of steel. The top part is of semi oval shape with a slot at the top through which the stirrup leather passes. The tread is the flat portion on which the rider's root rests.

**The surcingle**

- It is a plain leather strap, five cm in width, tapering to 2.5 cm width towards the buckle. At the end, is attached a strap 2.5cm wide, punctured with holes for buckling.

**Girth**

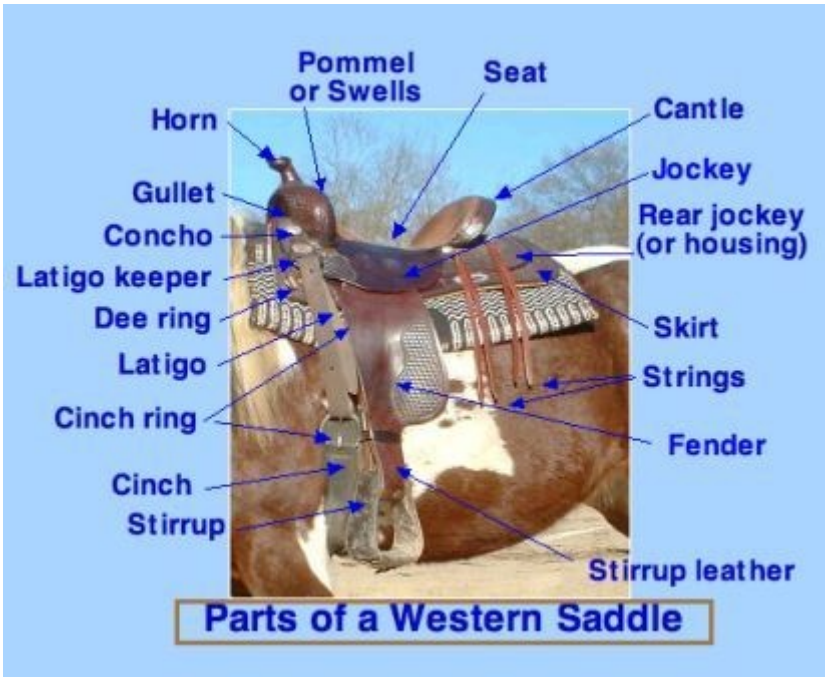
- It is made of leather or cord with split opening and varies from 0.75 to 1 meter in length. There are two buckles at one end to hold the girth straps.
- At 7.5 cm form each end, is sewn a leather loop, through which the surcingle is passed before being fastened.

# TYPES OF SADDLES

- The style of riding determines the type of saddle.
- The basic types are western saddle and English saddle

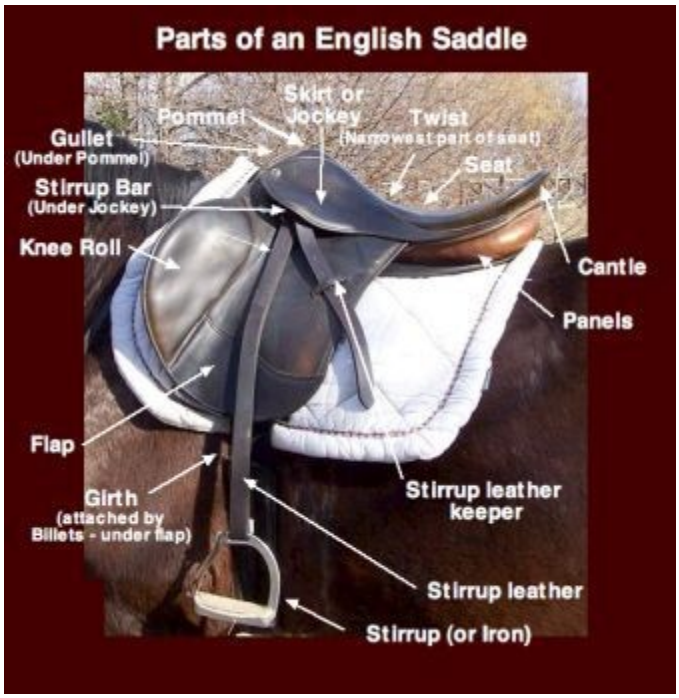
**Western saddle** (web link....)

- Western or stock saddles tend to be large and heavy. They are nearly impossible for youngsters to handle. However, they offer a great deal of security for the beginner.
- Western saddles are saddles originally designed to be used on horses on working cattle ranches in the United States. Used today in a wide variety of western riding activities, they are the "cowboy saddles" familiar to movie viewers, rodeo fans, and those who have gone on tourist trail rides.
- The Western saddle has no padding of its own, and must be used with a saddle blanket or pad in order to provide a comfortable fit for the horse. It also has sturdier stirrups and uses a cinch rather than a girth.
- Its most distinctive feature is the horn on the front of the saddle, originally used to dally a lariat when roping cattle




**English saddle** (web link....)

- They are usually rather light and easily handle. This type of saddle allows the rider to sit closer to the horse, to feel the horse, and to communicate more readily with seat and legs.
- The major distinguishing feature of an English saddle is its flatter appearance, the lack of a horn, and the self-padding design of the *panels*: a pair of pads attached to the underside of the seat and filled with wool, foam, or air.
- However, the length and angle of the flaps, the depth of the seat and height of the cantle all play a role in the use for which a particular saddle is intended

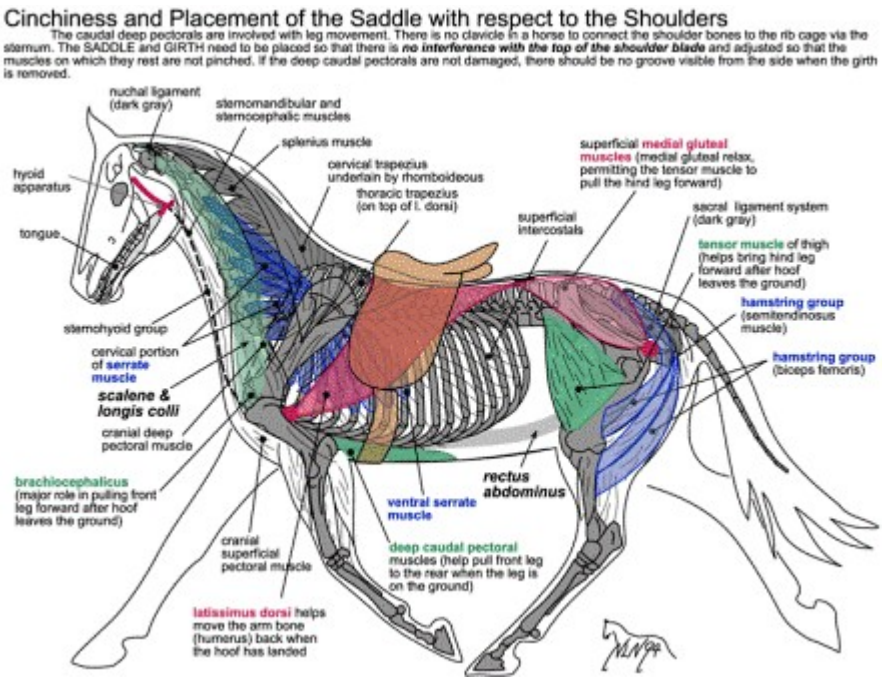



## PRINCIPLES OF SADDLE FITTING

- The withers must not be pressed or pinched upon.
- The spine must have no pressure imposed upon it
- The shoulder blades must have free and unimpeded movements
- The weight must not be placed on loins
- The weight must be evenly disturbed over the weight bearing surface which extend from the play of the should to the last rib
- The weight must be imposed on the ribs through the medium of muscles covering on them.

## SADDLING

- The horse should be groomed thoroughly to ensure that there are not sores on its back or in the cinch area. If there are saddle sores, extra padding or a girth pad should be considered and sufficient time should be given to the score to heal.
- The blanket or saddle pad should have no wrinkles and offer adequate padding fo the horse. Some horse requires more padding them others, and some may require extra padding at their withers to prevent binding the shoulder. The saddle cinch (western) or girth (English) must be clean because dirty cinches or girths can cause saddle sores.
- The saddle should be raised as high as possible and set it down gently on the horse's back. This helps to prevent back soreness and helps assure the horse that the saddle experience is nothing to fear. Throwing the saddle onto the horse's back can cause bruising and may aggravate any existing back problem.
- The saddle should be placed properly. It should not be placed too far front, which may restrict the shoulder movement and may cause discomfort or too far back, which can cause kidney damage and sore backs.




For a western saddle, let the cinch and stirrup down, making sure they do not slam down on the horse's side. For English saddles, hook the girth on one side. Never release the cinch and stirrup by pushing them ouver the saddle from the left side. This could hurt or startle the horse.

- In western riding, with the left hand under the buckle to prevent pinching, tighten the cinch slowly, 1 or 2 inches at a time. In English slowly buckle the girth but not too tight. Tightening it too quickly can cause your horse to be 'cinchy' or irritable, during saddling. Some horse may even begin biting or rearing when you tighten the cinch if they anticipate discomfort. Tighten the cinch until it is snug enough to hold the saddle on the horse. It tightened more before ridding.
- For unsaddling, the process should be reversed

## BEHAVIOUR OF HORSE

- The horse is a herd animal and needs to be able to communicate with other members of the herd.
- Of course, horses do not have philosophical discussions, but they do need to convey basic emotions, such as fear, and to establish a hierarchy of dominance without resorting to violence.
- Domestic horses treat us as members of their herd, so they use the same body language with us.

### Signs of happiness

- A contented horse is not worried about any other horses that may be around. It shows off its best features by carrying its head high and holding its tail up, and tends to make its movements more extravagant than usual.
- In the field, horses like company, they are usually pleased when they see a human being whom they recognize and trust. They will approach you without fear, rather than running away from you.
- In the stable If a horse wants to be left alone to enjoy a rest, it will turn away from other horses. A stabled horse may turn its back to the door to show you that it does not want to talk.

ANNOYANCE : View animation

FRIGHT OR FURY? : View animation

IMPATIENCE : View animation

UNHAPPINESS : View animation

# MODULE-8: STABLE AND ITS MANAGEMENT

Learning objectives

This module discuss about,

- Stable management
- Arrangement of different buildigs in a stud farm
- Space, facilities and fittings required in a stable
- Daily stable management

## INTRODUCTION TO STABLE ROUTINE

- Daily work of the stallion should be carried out according to daily stable routine be supervised by the incharge.
- The work of the stallions must start early in the morning so that they have enough time for exercise, covering and grooming, which should be completed during cool hours of the day.
- The first  when an attendant task enters the stable is to clean the water and feeding troughs, then a morning light feed is given to the mare/stallions.
- While the stallions are busy in feeding, the bedding of the loose box is removed, the portions soiled with dung and urine are seperated and the remainder is laid outside systematically for aeration and drying, then the floors must be thoroughly cleaned by scrubbing.
- By this time, the stallion finishes his grain feed and he should be prepared for exercise. His feet are picked up and body  cleaned before saddling and taking him out for exercise.
- After return from exercise,  the stallion is allowed to cool himself for about 20 minutes before the saddle is taken off.

## GENERAL STABLE MANAGEMENT

The following stable management practices are recommended:

- Remove the top layer of clay floors yearly; replace with fresh clay, and level. Also, keep the stable floor higher than the surrounding area.
- Keep stalls well lighted.
- Use properly constructed hayracks to lessen waste and contamination of hay, with the possible exception of maternity stalls.
- Scrub concentrate containers for frequent intervals as necessary, and after feeding a wet mash.
- Work over bedding daily, removing excrement and wet, stained or soiled material, and provide fresh bedding.
- Practice rigid stable sanitation to prevent fecal contamination of feed and water.
- Lead foals when taking them from the stall to the paddock and back, as a way in which to further their training.
- Restrict the ration when horses are idle, and provide either a wet bran mash the evening before an idle day or turn idle horses to pasture.
- Provide proper ventilation at all times-by means of open doors, windows that open inwardly from the top, or stall partitions slatted at the top.

## DAILY ROUTINES IN STABLE

Bedding

- Horse should not be forced to spend for the long periods on a bare brick or concrete floor. So horse will need bedding in the box through out day and night.
- Straw bedding
- Peat moss
- Saw dust
- Wood shavings
- Shredded paper
- The above bedding materials are absorbent and act as a deodorant at the time of defecation and urination.

### Mucking out

- Whatever the bedding material is used, it is essential to remove droppings as often as possible to maintain the health environment.

### Grooming

- *Essential grooming kit*
  - Dandy brush - Used for removing surface mud and dirt
  - Body brush - Used for removing grease and dirt
  - Hoof pick - Used for removing dirt and stones
  - Hoof oil - Improve the appearance of feet
  - Sweat scraper - Used to remove excess sweat
  - Stable rubber - Used to give the coat a final polish.

### Quartering

- One of the first task in the morning is to remove stable stains.

### Full growing

- The best time for full grooming is after exercise. During this time the horse is warm and the pores are opened.

### Clipping

- Clipping is carried out in winter to prevent the horse from sweating.

### Rugging

- Stable horses normally need rugs to keep them warm in winter and this becomes essential after clipping.

## DAILY TIME SCHEDULE IN STABLE

- *7.30 AM* - Check over the horse for any symptoms of sickness, give the fresh water, first feed, small hay net, muck out the stable and lay day bed.
- *8.30 AM* - Remove any droppings, throw up rugs and quarter, pickout feet, saddle up and exercise. On return from exercise, feed/water horses, groom thoroughly, put on day rugs.
- *12.30 PM* - Provide fresh water and give second feed.
- *2.00 PM* - Turnout horse into paddock.

- *4.30 PM* - Remove droppings, pickout feet, provide fresh water, small hay net, put on night rugs, lay night bed, give 3rd feed.
- *7.30 PM* - Check the horse for any symptoms / sign of discomfort, remove droppings, provide fresh water, give 4th feed.

## STALL ARRANGEMENT

- Stalls in the stable shall be arranged in a single or double row depending upon the number of animals.
- The width of the passage shall be 1.5 to 2 m in single row system and 2.5 to 3 m in double row system.
- In double row system the stalls shall be so constructed that the horse do not face each other.
- The height from the floor to the roof shall be at least 4 m in the case of flat roof and 3 m from the floor level to the tie beam in gabled roof.

## DIMENSIONS OF STALLS

| size of animal | lenght (m) | width(m) | height(m) |
|---|---|---|---|
| Small horse | 3.0 | 2.5 | 1.9 |
| Light/average/ meidum | 3.5 | 3.0 | 1.9 |

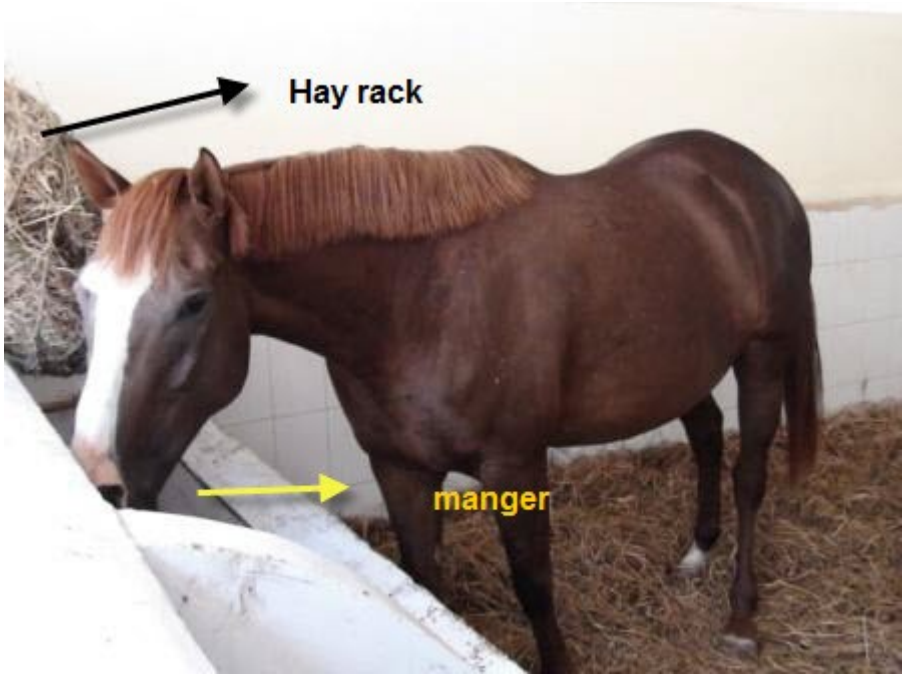
| | | | |
|---|---|---|---|
| Large | 4.0 | 3.5 | 1.9 |

## STALL DIVISION

- Shall be of hard wood of sufficient strength or of reinforced concrete or of brick work. In case of wooden partition, a gap of at least 15 cm, between the bottom of the partition and the floor level, shall be provided.

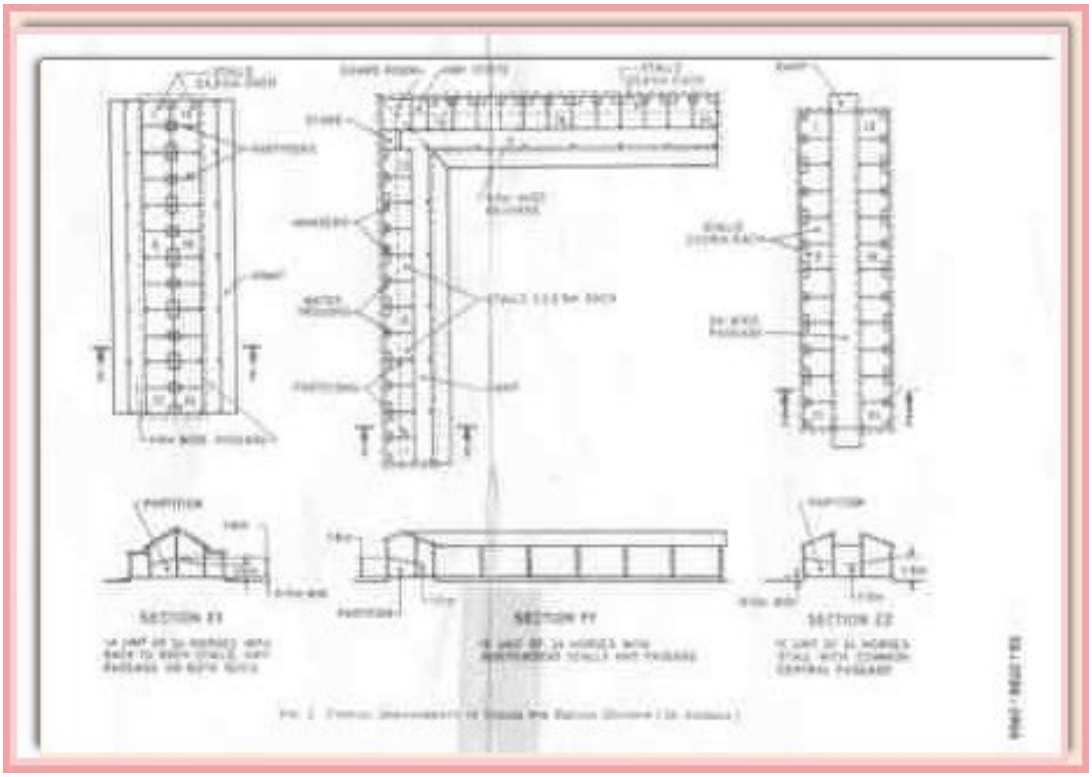
## MANGER

- Manger may be in 3 parts for providing grains, hay and water. The manger shall have a wide thick top of chinrest made of reinforced concrete to avoid crib-biting.
- The hay rack may be of either mild steel bars or wooden poles and placed lower than the animal's head and not above.
- Dimesions of the manger shall be 45 cm wide at the top, 22 cm wide at the bottom, 75 cm long and 30 cm deep.
- The bottom of the manger shall be 75 cm from the floor level. The manger may be portable or built-in type. All the corners shall be well rounded.




## STUD DESIGN

The ideal stud has been carefully designed and built from scratch and subsequently soundly managed as a business so that mares, stallions and young stock can be safely and efficiently cared for. The following chapter outlines the basic requirements for a two stallion stud.



## FUNCTIONAL UNITS OF STABLE

- Stallion stable box
- Mare's stable box
- Foaling boxes
- Young stock yard
- Teasing and covering yard
- Examination stocks
- Paddocks
- Fencing
- Isolation boxes

## STALLION BOXES

- Horses require roomy, well-ventilated boxes and the stallion requires a box at least 14 feet by 14 feet (4.27 m x 4.27 m), and preferably bigger to prevent boredom.
- Traditionally, stallions have been kept in separate yards, well away from the mares' yard but it may be desirable for stallions not to be completely isolated from the yard activities.
- If stallions are being frequently visited on a public stud it is wise to have strong grids on the doors to prevent the curious onlooker from constantly harassing the stallion.
- The stallion's name should be prominently displayed and the box should always look clean and tidy when prospective clients arrive.

## ACCOMODATION OF STALLION

- The stallion boxes should be roomy, airy and should have plenty of light. 4.25 x 5.00 m is ideal size for the stallion box.
- Earthern floors are usually preferable but these require frequent replacement and thorough ram ming to keep them level. With a view to maintain proper hygiene and sanitation, the floor of the stallion boxes should be made with cement concrete, impervious and non-slippery by making grooves.
- The floors should have very gentle slope towards the rear so that urine can flow and drained away easily.
- Each stallion box should be provided with an independent feeding and water trough with rounded corners to facilitate easy cleaning.
- There should be arrangements for proper cross ventilation and stallion boxes should have 3 m wide verandah (corridor) in front.
- Each box should be provided with electric ceiling fan, all windows and doors should be fly proofed and there should be arrangements for coolers/khas khas. tatties to deal with the heat effect in summer months.
- The stallion must be protected during winter from cold wind, by suitable wind protector.
- There should be open loose boxes made of pipe railings and posts, 7.25 x 7.25 m in size, well separated from each other, for keeping the stallions at night during hot summer months.

## MARE BOXES

- There should be at least 30 boxes for visiting mares; mares with a foal at foot require boxes of at least 12 x 14 feet (3.66 m x 4.27 m), and preferably 14 x 14 feet (4.27 m x 4.27 m).
- A barn system is economical in terms of space and labour and can usefully take advantage of existing buildings.

## ACCOMMODATION

- Stables for brood mares must be airy, roomy and protected from draughts. Brood mares as a rule are kept in liberty and should be provided with covered as well as open dry paddock.
- Covered accommodation is provided at the scale of 4.25 X 2.50 m per mare and the brood mares should be stabled in small batches if individual boxes are not possible.
- Ideal stable for a batch of 15 brood mares or 10 brood mares with foal at foot is 4.25 x 35.00 m covered standing and 35.00 x 75.00 m dry paddock.
- The feeding troughs should be provided in the covered standing and as well as in the open dry paddocks. The mares should be allowed to roam about at their will under cover or in the open.
- There should be a water trough, with running clean and fresh water provided outside in the dry paddock. Fencing for dry paddock should consist of upright angle iron posts with four strands of wire.
- Each dry paddock should have some trees to provide shade for the brood mares. The ground should be level, sandy, free from stones and holes and must have facilities for quick draining during monsoons.
- Each group of brood mares in the paddock should have an independent grazing paddock, easily approachable.
- The foaling boxes should be roomy and spacious in order to provide enough room for the mare and the foal.
- An ideal size for foaling box is 4.25 x 5.50 m. It should have independent watering and feeding troughs inside, should have electric ceiling fan and be provided with fly proof windows for cross ventilation, so that it does not become stuffy during hot weather.
- The floor of the foaling boxes should be made of cement with gentle slope of 5 cm in 3 m for the drainage of urine and water.
- It should have few shallow grooves to prevent the mares from slipping, to take the liquid away and keep the bedding dry.

## FOALING BOXES

- There should be one or two spacious foaling boxes; these should be at least 14 x 16 feet (4.27 m x 4.88 m) and have a minimum of stable fittings on which the foal might injure itself.
- Ideally, there should be heat lamps and closed circuit television so that foalings can be carefully monitored.
- The boxes should be in a quiet situation with a sitting-up room containing the television monitor nearby.

## YOUNG STOCK YARD

- It may be advantageous to over-winter young horses in a yard rather than stable them individually.
- They can be put in their own stables at night and released into a covered yard by day to exercise and play.
- This provides them with a more healthy and natural environment.
- The yard must be free from dangerous projections and of an adequate size for the number of youngsters.

## TEASING AND COVERING YARD

- The teasing yard should be an enclosed, and preferably covered, area convenient to the stallion boxes containing a teasing board.
- The board should be not less than four feet (1.2 m) high and ten feet (3m) long and made of a narrow pyramid of heavy wood supported by wooden or metal posts set in concrete.
- The board should be heavily padded with rubber to prevent injury to both mare and stallion and it is sometimes fitted with a roller bar along the top to help the stallion should he accidentally get a leg caught over the top of the board.
- The teasing covering yard surface should be non-slip so that the stallion can get good footing when he covers a mare, it should also be dust-free.

## EXAMINATION STOCK AND OTHER BUILDINGS


## Examination stocks

- Stocks can be used to prepare mares for covering, pregnancy testing, artificial insemination and embryo transfer.
- They are designed along lines similar to cattle crushes, being sturdy cubicles used to restrain mares. Ideally, solid partitions should enclose the mare on two sides with two doors allowing access and exit.

### Other buildings

- Other buildings should include a tack room, feed room, office, wash box (hot and cold water and heat lamp), staff accommodation, garages for machinery, a loading ramp and hay barns.

## PADDOCKS

- Provided for horses, gelding, yearling, stallion, colt, filly in order to provide them fresh air and natural environment.
- Facilities for feeding and watering must be provided. A night shed is necessary to provide safety for horses during rain and during extremes of climate.
- About 75 acres (30 hectares) will be required for this stud with two stallions covering approximately 100 mares.
- Stock should be divided into appropriate groups, e.g. mares and foals, barren mares, foaling mares, stallions and young stock.
- There should be one paddock resting for each group so that fresh grazing is available at all times.



## FENCING

- Double post and rail fencing about 4’6” (1.37 m) high is ideal between paddocks although existing hedges, providing they are sturdy, are useful as they also provide shelter.
- Corners should be rounded so that horses cannot be trapped.


## ISOLATION BOXES

- One or two isolation boxes, situated well away from the yard, are essential to stop the spread of infectious disease.
- They can be used to house mares on arrival at the stud if it is suspected that they have been in contact with disease.

## EQUIPMENT USED IN STABLE

- *Manger* - Need to be positioned at about the height of the horse chest. Removable manger is the best one for horses. Mangers at ground level get dirty easily as bedding and droppings fall into the manger.
- *Haynet* - Most satisfactory and economical method of feeding hay. A ring for the hay-net should be positioned about 5 ft. from the ground.
- *Feeding buckets* - Should be positioned in the corner of the stable or held by hinged rings on the walls.

# MODULE-9: FEEDS AND FEEDING OF HORSES

Learning objectives

This module discuss about,

- Nutritional requirement of horse at different stage of growth and production.
- Particularly importance of feeding foal and yearling for their life time growth is discussed
- Feeding of mare, foal at foot mare, importance of calcium and phosphorous in the equine nutrition is also discussed extensively

## INTRODUCTION TO FEEDS AND FEEDING OF HORSES

- Optimum feeding of brood mare is one of the most important aspect of management of any breeding stud, to achieve higher conception rate, growth of foetus through in utero *nutrient,* birth weight of foal and its further development of bones, body growth and protection through passive immunity gained through colostrum.
- The level of feeding can be gauged from the condition of horse and its response to it.
- It is advisable to avoid any extreme condition of fatness or thinness

## PRINCIPLES FOR FEEDING HORSES

- The individual variation of feed requirement and body condition must be given due consideration for planning the feeding regimen of the horses. Some horses perform best while being trim or empty stomach whereas others exhibit their best when their body condition is optimum.

- The growth, development and expectations from the horse regarding its performance will determine the extent of feeding especially in early days.
- Both over-feeding and under-feeding are harmful for horses, therefore, the diet has to vary as per the requirement of the horse and its physiological status.
- All feed ingredients of horses should be free from extraneous substances such as weeds, dust, mould etc. The hygiene of feed box should also be maintained.
- The time of feeding the horses should be strictly adhered to. Also no abrupt changes in the diet should be permitted.
- Well being of horses depends a lot on the exercise. It helps to keep them in shape for riding racing work and performance
- A clear, wholesome and fresh water source should always be available to the horses.
- A source of salt or complete mineral mixture should always be available for horses at all times which give them an opportunity to take extra minerals depending upon their requirements.
- The feed of the horses must contain roughages, otherwise the heavy feed concentrates are likely to pack the stomach. However, feeds too high in fiber (should not exceed 30%) may also cause discomfort or digestive disturbances.
- Oral hygiene and dental care should receive due attention as teeth problems limit the horse's ability to chew.
- Weighing of horses to find out gain or loss in the condition is a valuable parameter to decide the response of feed and effect changes
- Horses should be fed in groups according to their age, growth or development stage to prevent over-feeding or under-feeding which may occur if horses of varying sizes and age are fed together.
- Foals should be allowed access to creep feed so that they achieve the maximum for their growth and bone development as the mare's milk.
- Regular deworming and health inspections are important to keep horses healthy. The stables should be kept cleaned and manure removed to reduce parasitic infestation as they decrease feed intake feed efficiency and body weight.
- The digestive tract of horses is limited in size and feeding large quantities of grain or concentrate feeds at one time results in higher frequency of colic and grain founder. Therefore, high performance horses, which require large amount of energy from grain or concentrate sources, should be fed three to four times daily instead of two times.
- More frequent feeding with less portions in each one will reduce founder, colic and other digestive problems. Recommended feeding schedule is as follows:

| Type of feed/fodder | Morning | Noon | Night |
|---|---|---|---|
| Hay | 25% | 25% | 50% |
| Grain/concentrate | 33% | 33% | 33% |

- The grain portion of the diet of high performance horses should be reduced if they are not being exercised. The roughage portion can be suitably increased. This is essential to prevent azoturia or Monday Morning Sickness, which causes muscle spasms or tetany.
- The diet of horses must contain roughage to provide fibre or bulk. This will reduce the incidence of vices such as wood chewing, tail and mane biting. It will also decrease the incidence of digestive disorders.
- The horses should not be exercised after feeding as the stomach contents are likely to cause pressure on the diaphragm leading to laboured breathing due to restriction in the lung expansion. Secondly, the absorption of nutrients is also affected as the blood circulation is diverted from splanchnic bed of blood vessels around the intestines to vital organs, reducing the absorptive process.
- There is little microbial action in the stomach of horse. As result the horse does not break more than bout 30 per cent cellulose of feed, whereas the ruminant breakdown 60-70 per cent.

- Antibiotic supplementation in the feed increases the growth rate and feed efficiency and reduces the non-specific infections.

### Role of water

- Water is an ideal dispensing medium because of its solvent and ionizing powers which facilitates cell reaction and because of its high specific heat, it is able to absorb the heat of these reactions with a minimum rise in temperature. The latent heat of vaporization also plays an important role in regulating body temperature.
- It aids in digestion, in the transport of metabolic products and excretion of waste products.
- It is a constituent of cells and body fluids. Surplus water is excreted via urine, faeces, perspiration and vapors from the lungs via breathing.
- Water as a constituent of synovial fluid lubricates the joints and as cerebrospinal fluid, it acts as a water cushion for the nervous system.
- In the ear, it transports sounds and in eye, it is concerned with sight.
- It provides cushion to the body organs and system.

## CEREAL GRAINS

- **Oats:** Oats have traditionally formed a very important component of horse diet. It is known for low density and high fibre content which helps to avoid over feeding and at the same time its grain size is more appropriate for chewing. There are very less chances to produce grain founder or other digestive disturbances as a result of feeding excess quantity of oats as compared to the other cereals.
- **Barley:** It is another grain which is enveloped in a hull and constitutes 10 14 percent of the total grain weight. It is relatively smaller and more tightly apposed to a grain which is larger as compared with oat hull. Therefore, barley grain should be crippled or tightly rolled to rupture the hull before feeding. Because of higher starch content and weight of the barley, it may cause digestive disturbances when fed alone, hence mixing barley with more bulky feeds such as 15 percent or more wheat bran or 25 percent oats may minimize the occurrence of colic. It is normally fed in combination with oats.
- **Corn:** It is widely used in feeding of horses and ranks second to oats. As the grains are very hard, they should be cracked before feeding. Corns contain twice the energy per unit volume of oats and therefore, it is fed at higher level in cool weather and its level is decreased during warm weather. It contains about 65 percent starch and the crude protein levels range from 8 to 10 percent.
- **Sorghum:** The kernel of sorghum is naked like that of maize and wheat. It is more spherical in shape and smaller in size than that of wheat. When compared to corn, it contains more crude protein but less oil. The sorghum protein is deficient in lysine as such it should normally be fed in combination with heavy feeds. The size and shape of sorghum warrants that it should always be rolled, cracked, coarsely ground or steam flamed before feeding to horses. Since it is a high energy cereal, it should form only a portion of the cereal intake to avoid digestive disturbances.
- **Wheat:** It is not commonly used in feeding of horses, as it contains gluten, which is a sticky substance. When wheat is ground, it is rather doughy and tends to ball up moisture and poses palatability problems. If it is to be fed, it should be mixed with other bulky feeds. It should be cracked; coarsely ground or steam flaked before use. Wheat protein is deficient in h sine. Its level in feed should not increase above 10 20 percent of the concentrate diet.

## FEEDING OF MARE

- The most important period of feeding of a pregnant mare is the last 90 days of gestation. 60-65 percent of weight of foetus gets deposited during these last 90 days as growth rate of embryo is the greatest during this ' period.
- During lactation, the mares are estimated to produce milk equivalent to 3 and 2 2 percent of body weight daily during early lactation (1:12 weeks) and late lactation (13-24 weeks) respectively. Therefore, a lot of body energy of mare is utilised for synthesis of milk energy and this process of conversion of digestible energy of feed into milk energy is about 60 percent efficient.
- The dietary requirements of the breeding mare can be arbitrarily divided into three stages
    - Requirement upto 8 months of gestation,
    - Requirement during last 3 months of gestation, (c) Lactation and 0-4 months post parturition.
- The first 8 months of gestation have no practical impact on the nutrient needs i.e. they do not raise requirements above maintenance level nor do they increase the already high requirement of the lactating mare. Thus, mare's energy requirement during this stage are approximately those of maintenance.
- The DE requirements for the ninth, tenth and eleventh months of gestation are formulated by multiplying the maintenance requirements by 1.11, 1.13 and 1.20 respectively.
- The protein requirements also increase during period and with a protein utilization efficiency of 60 percent, a 500 kg gestating mare requires 127, 130, 178 gm of DP/day for foetal deposition above maintenance, for a total of 427, 430 and 478 gm of DP during the ninth, tenth and eleventh months respectively. Presuming digestibility of protein to be 55 percent, a 500 kg mare would need 776, 782 and 869 gm of CP daily during ninth, tenth and eleventh months respectively.

*First 8 month of gestation no additional feeding*

- The requirements of calcium would be 11,  25 and 11 gm/day for ninth, tenth and eleventh month of gestation assuming the efficiency of calcium absorption to be 50 percent, whereas phosphorus requirements have been estimated to be 7,12 and 6,7 mg/kg of body wt/day during ninth, tenth and eleventh month of gestation respectively.
- The requirement of other macro and micro minerals are also enhanced during this period.
- The requirement of fat soluble and water soluble vitamins too increases considerably.
- The requirements of energy, protein, minerals and vitamins are the maximum for a mare during the first phase of lactation i.e. from 1 to 12 weeks post parturition.
- The energy requirement of lactating mares depends upon the composition and amount of milk produced. The requirement of energy are 792 K Cal of DE/kg of milk produced above the maintenance level. The protein content of milk is highest immediately after parturition and it decreases gradually as lactation progresses.

- Crude protein requirements are calculated presuming that mare's milk contains 2.1 and 1.8 per-cent protein in early and late lactation respectively. Utilisation of digestible protein for milk protein formation is 65 percent and digestibility of protein in the digestive system is 55 percent.
- The requirement of calcium for lactation, ranges from 1.2 gm/kg of milk during the first post partum week to 0.8 gm/kg of milk during 15 to 17 week postpartum, above maintenance re-quirement, whereas requirement of phosphorus ranges from 0.75 gm/kg of milk in early lactation to 0.50 gm/kg of milk in late lactation.
- In the last quarter of pregnancy, foetus occupies an increasing proportion of mare's s abdominal cavity. Accordingly, her capacity for bulky feeds declines during the period in which nutrient requirement increases.
- The quality of hay and concentrate. should improve during the last 3 months of gestation. The diet in this period should contain concentrate mixture with 16percent protein upto 25 to 35 percent of the diet which can increase or decrease depending upon the condition of the mare, its response to feed and quality of the hay and pasture used.
- It is recommended that the total diet fed during gestation contains at least 12 percent protein which means that hay or pasture should contain 11 to 12 percent protein.
- The higher level of protein should provide a safety factor for hay and pasture which may have protein of low digestibility depending upon kind of pasture used and its stage of maturity when consumed .

*Last three months of gestaion the CP should be 16%*

## CONCENTRATE DIET

| Feed** | Percentage in Diet |
|---|---|
| Oats | 30 |
| Corn | 10 |
| Barley | 13 |
| Wheat Bran | 10 |
| Soyabean Meal | 11.5 |
| Linseed Meal | 04 |
| Alfalfa Meal | 10 |
| Black Strap Molasses | 07 |
| Dicalcium Phosphate | 02 |
| Limestone | 00.5 |
| Salt trace Mineralised | 01.0 |
| Vitamin Supplement | 01.0 |

** The concentrate diet should contain 16 percent protein, 1 percent calcium and 0.9 percent phosphorus.

- A study on pony mares has revealed that protein percentage in diet does not affect general .reproduction parameters (oestrus or ovulation) but did affect progesterone concentration which in turn may be responsible for the differences in conception rate which is low with low level of protein and high with optimum protein levels.
- Needless to mention that pregnant and lactating mares require high quality of protein for proper foetal development and milk production.

## FEEDING OF MARE DURING LACTATION

- The mare suffers from maximum stress after parturition as it has to recover from parturition stress, produce enough milk and even rebreed during the next season.
- Inadequacy in energy, protein, vitamin and mineral content of feed will lead to decreased milk production and also her ability to breed back while suckling the foal.
- Inadequate feed intake will lead to poor rebreeding performance, delayed post-partum intervals, low conception rates and increased embryo mortality.
- During the 1st phase of lactation i.e. first 3 months of lactation, feed intake increases by 37 percent over feed intake during the last quarter of the pregnancy.
- The feed intake also rises from 1.5 to 2.0 percent of body weight. In this phase, concentrate diet should be 45 to 55 percent of total feed intake of the mare.
- However; the amount of concentrate intake can vary depending upon the quality of hay and pasture used, milk production level of the mare, her condition and other factors.
- During the first 3 months of lactation, the total diet of mare should contain at least 12.5 percent protein but it can be up to 14 percent.

*First three months of lacation 45-55% of total feed should be concentrate, 12.5-14% CP*

- The higher protein percentage level will be safer to use with higher milk producing mares and also it will provide a safety factor to compensate for hay and pasture with lower digest-ibility because of stage of maturity at which they are consumed or harvested.
- The hay/pasture should contain at least 10 percent protein in feed. Minerals should be self fed to mares especially if they need more than that is supplied in the concentrate mixture, especially if milk production is more, concentrate level in diet is less and quality and digestibility of hay/pasture is poor.
- Inclusion of soyabean meal has been shown to improve the protein content of early lactation mare's milk and it is considered to be accompanied by faster growth of the foal.

## SUGGESTED CONCENTRATE DIET FOR LACTATION

| Feed** | Percentage in Diet |
|---|---|
| Oats | 15 |
| Com | 30 |
| Barley. | 10 |
| Wheat Bran | *07* |
| Soyabean Meal | 15 |
| Linseed Meal | 05 |
| Alfalfa Meal | *07* |
| Black Strap *Molasses* | *07.0* |
| Dicalcium Phosphate | *01.25* |
| Limestone | *00.75* |
| Salt | 01.00 |
| Vitamin Supplement | 01.00 |

**The level in the concentrate diet should be adjusted to 16 percent protein, 0.8 percent calcium and *0.7* percent phosphorus.

- In the second phase of lactation that is from 13 weeks to 24 weeks, the milk production decreases to about two third the level of milk produced during the first three months after foaling. As a result, there is decrease in level of feed intake.
- During this period, the foal also starts supplementing its nutrient requirement from creep feed and hay/pasture feeding.
- The mare's intake of concentrate also decreases to 30 to .40 percent of the total feed intake. The average protein requirement during this stage should be 11 percent but 12 to 12.5 percent is preferable with high milk yielders.

- The concentrate level can be about one third of the total diet during this stage of lactation.

## FEEDING THE FOAL

- Neonatal feeding of the foal depends upon how well the mare has been fed during the gestation.
- A well balanced diet supplies all nutrients needed for development of foal and also enables the mare to produce optimum milk after foaling.
- Also the foal should receive adequate nutrients post-natal, and pre-weaning, to have a good start in bone development and growth, especially if the foal is to become a high level performance horse.

## COLOSTRUM FEEDING

- The mare has to pass adequate passive protection to foal which is provided through colostrum feeding. Besides, colostrum has laxative substance that promotes bowel movement and elimination.
- Mare has to, there fore, be in foaling area preferably a month before foaling so that she confers immunity to microbial strains peculiar to her environment, especially those causing scours, joint ill and septicemia etc.
- Immunoglobulins do mot pass through dam's placenta and are absorbed only through first part of intestine during first few hours of life. The immunoglobulins get concentrated by the mare in her udder within last two weeks of gestation.
- The mare's colostrum contains protein upto 19 percent immediately after parturition which falls to 3.8 percent after 12 hrs and to a fairly constant level of 2.2 percent, after 8 days.
- The foal absorbs gamaglobulin as intact undegraded molecules throughout first 12 hours of life which gets reduced to a great extent in next 24 hours.
- Amounts of these specific antibodies so acquired by foal, start to decline from 24 hours of age, by 3 weeks the values are halved and by 4 months, the titre of specific immunity provided by the mother is barely detectable.

*Protein % drops from 19% to 3.8% after 12 hours of foaling*

- The foal's own system of building active immunity in the form of autogenous gamaglobulins first provides detectable products at 2 weeks of age in the blood of colostrum deprived foals and at ,4 weeks in those reared normally.
- By 3-4 months of age, the gamaglobulins attain adult plasma concentration, Upto this stage, therefore, the foal is more susceptible to infection than is an adult in the same environment, particularly when it has received inadequate quantity of colostrum.
- The foal may at times be deprived of colostrum because of premature birth of foal, small intestine malabsorption, delayed suckling, premature leakage of milk through teats or death of the mare. In case of colostrum deprivation due to leakage of colostrum through teats of mare or due to some other reason except malabsorption, it is necessary to give foal colostrum from another mare preferably one accustomed to the same environment or failing this, cow's colostrum rather than milk.
- The foal should receive about 500 ml of colostrum by nipple or stomach tube every hour for three or four feeds before 12 hrs of age.
- After 18 hrs, the colostrum has little systemic immune value, although it does have some beneficial local effects within the intestinal tract.
- If the plasma concentration of immunoglobulins falls below ,400 mg per 100 ml blood then foal may be given blood plasma from another horse at the rate of 22 ml/kg body weight over a period of 1-2 hours which is approximately 1 litre per foal.

## FEEDING OF MARE'S MILK

- Milk meets the needs during 2 to -3. weeks of life of a foal, and how adequately it meets these needs depends upon how good a milk producer the mare is, and also the growth and development one expects of the foal.
- The foal needs supplementation of other feeds after 2-3 weeks of life. Vigorous foals nurse within 30-45 minutes.
- Mare's milk is not a perfect food to foal. It is deficient in energy, protein, vitamins and minerals and, therefore, it alone is insufficient for foal to sustain it. Mare's milk is also deficient in calcium, phosphorus, iron and copper.
- Milk production on an average ranges at about 3.1 percent of the mare's body weight at 11 days post-partum, 2.9 percent at 25 days and 3.4 percent at 39 days which supplies about 3.1, 2.1 and 2 percent DM of the foal's body weight.

- The Mare's milk contains on an average 2.1 MJ of gross energy per kg. The milk yield is markedly influenced by the mare's innate ability, by feed consumption during the later stages of pregnancy and more importantly, by water availability and intake of energy and nutrients during lactation.

*Foal need supplementation after 3rd week of age, mare's milk is not a perfect food*

Last modified: Monday, 23 December 2013, 04:27 PM

## CREEP FEED

- At about 7-15 days of age, the foal starts to nibble on the feed given to the mother. To meet the inadequacy of nutrients in mare's milk and avoidance of imbalance diet to the foal, horse owners prefer to feed well balanced creep feed to the foals.
- It is usually recommended that creep feeding be started after 1-2 weeks of foaling. The creep should be located where the mare goes periodically during the day for water or shade.
- The use of creep feed helps to ensure that inherited potential of growth and development is realized.
- The creep feed also helps to avoid set backs that can occur when the foal is weaned from its mother.
- Creep feeding also accelerates anatomical and physiological maturation of the gastro-intestinal tract.
- At 5-6 weeks of age, a foal should be consuming at least 0-1 kg of creep feed daily per 50 kg of body weight. By weaning time, the foal should be consuming at least 2-3 kg of creep feed per day which depends upon milking ability of the mother and development desired in the foal, kind of creep feed used and economics involved.
- Creep feeds also help in conditioning to the change of dependence on mother's milk to a man made diet. If the mare and foal are doing well during the first 6-12 weeks of age, creep feeding may be deferred until then when the mare's level of milk production starts to decrease and foals requirements are increasing.

*Creep should be introduced by 2nd week, 1 kg creep per 50 kg body weight*

**Suggested Creep Feed for Nursing Foals**

| Feed | Percent in Diet |
|---|---|
| Oats | 35 |
| Corn/Barley or combination | 35.4 |
| Soyabean Meal | 15 |
| Dried Skim Milk | 5 |
| Black Strap Molasses | 5 |
| Dicalcium Phosphate | 2 |
| Limestone | 0.8 |
| Salt trace mineralised | 1 |

| | |
|---|---|
| Vitamin Supplement | 0.8 |

## NUTRIENT REQUIREMENT FOR GROWTH

- The digestible energy requirement increases with age of the foal. However, high energy intake is associated with developmental orthopaedic disease.
- Starch feeding causes significant changes in serum insulin, thyroxine and triidothyronine which retards cartilage maturation.
- The protein requirement for growth have been found to be 50 and 45 gm/MCal of DE/day for weanling and yearling respectively.
- Lysine is the first limiting amino acid in the diet of growing foals which is 2.1 and 1.9 gm/MCal DE per day for weanling and yearling ,respectively.
- The growing foals deposit approximately 16 gm calcium per kg of gain whereas phosphorus requirement is 8 gm/kg of gain.
- The requirement of vit A to support normal growth has been estimated to be 20 IU/kg of body weight or 1760 IU/kg of feed, whereas requirements of vit D has been calculated to be 275 IU/kg of feed.
- Alternatively, 6.6 IU of vit. D per kg body weight is sufficient for most circumstances.

## FEEDING OF THE WEANLING HORSE

- Weaning of foals may be before or after six months but preferably at six months. Weaning before six months is practiced where the owner can supplement the feed of the foal with creep feed, starter diets which are excellent substitutes for or supplement mare's milk.
- Delayed weaning is preferred by some in order to take advantage of the nutritional value of the mare's milk especially when feed supply available for the weaned foal is limited in quality and quantity.
- Early weaning, however, requires excellent diet fortified with minerals, vitamins, amino acids, protein, besides superior managerial ability.
- Weanlings grow rapidly and develop considerable bone and muscle s and, therefore, their diet has to be well balanced in terms of energy, protein, minerals and vitamins.
- It is important to note that fastest gains are made during the first year, and horses with. heavier mature weights, gain faster than horses of lighter mature weight.
- Thoroughbred foals have been seen to attain, 46, 67 and 90 percent of their mature weight at 6, 12, and 18 months of age respectively. However, ponies attain 55, 75 and 84 percent of their mature weight at 6, 12 and 18 months of age which indicates that lighter breeds attain mature weight at an early age.
- Thoroughbred foals attain 83, 90 and 95 percent of their expected mature height at 6, 12 and 18 months of age which indicates that during the first few months after birth, the fastest growth and most elongation of bones occurs.

*Maximum growth, height, weight occurs with in 18 months period*

- It, therefore, warrants a balanced feeding for mare to produce plenty of milk for the foal and a well balanced creep feed to supplement the mare's milk if they are being developed for high level performance at an early age.
- The creep feeding to foal before weaning is given at an approximate rate of 0.5 to 0.75 percent of the body weight which after weaning should be increased to 1 to 1.5 percent of

body weight. In addition, the foal should be given forage at least at the rate of 1 kg per 100 kg body weight.

- The individuality of horse, its likes and dislikes, eating habits, quality of concentrate feed, quality of the hay/pasture provided are some of the factors which determine the roughage to concentrate ratio of the weanling's feed.
- However, whether the weanling is being developed for sale or for performance, is also an important factor.

## Suggested Concentrate Mixture for Weanlings

### Feed Percentage in Diet

| Feed | Percentage |
|---|---|
| Oats | *25* |
| *Corn* | *31* |
| Milo | *7* |
| Soyabean meal | *23* |
| Dehydrated alfalfa meal | *5* |
| Black Strap Molasses | *5* |
| Vitamin Supplement | *0.75* |
| Dicalcium Phosphate | *2* |
| Limestone | *0.25* |
| Salt trace mineralized | 1.00 |

- Table gives the suggested concentrate mixture which can be fed to weanling foals being developed for high level performance.
- Oats and corn are the energy sources whereas soyabean meal is plant protein source which is rich inlysine, the indispensable amino acid required for growth.
- The molasses is [a]dded for palatability and to help control dust. The vitamin supplement is used to reinforce the diet and make sure it is adequate in all the vitamins needed whereas salt trace mineralised makes sure that essential mineral elements required by the horse are supplied.
- The concentrate diet should be about 70 percent of total dry matter intake Whereas remainder should be a high quality hay *or* pasture which should contain at least 12 percent crude protein whereas concentrate ration should have 18 percent resulting into an average of 16 percent protein in the total diet.
- The feeding of weanling should be individually carried out so that aggressive ones do not dominate the timid weanlings. The concentrates should be fed at leasttwice daily whereas pasture or good quality hay should be provided on a *free* choice basis.
- Regulated exercise is a must for weanling to help develop *sound* bone and fitness. However, forced and excessive exercise may lead to development of joint inflammation, soreness, lameness, pulling up on their pasterns, bending over on the knees etc.

- These external disorders represent a variety of internal skeletal problems and are inaccurately put together under epiphisitis. There are three factors which are known to cause skeletal disorders in horses
    - Genetic predisposition associated with large size at maturity,
    - Nutrient imbalance or deficiencies in the total diet,
    - Confinement coupled with forced exercise.

## FEEDING RACEHORSES

- The racehorses must not be allowed to become fat. They need to be kept in trim and thrifty condition for which it is important that they receive
- protein, energy, vitamins and minerals in adequate amount to develop their body and perform to the maximum of their inherited potential.
- The concentrate diet should be upto percent of the total diet, however, it will vary depending upon condition of the horse, how it responds to the diet and amount and quality of the hay and/or pasture used. The concen
- trate feeding can increase or decrease depending upon whether the horse is under light training or heavy performance. The condition of the horse can serve as a guide as to whether too much or too little concentrates are being fed in relation to forage intake.

### Suggested Concentrate Diet for Racehorse

| Feed | Percentage in Diet |
|---|---|
| Oats | 30 |
| Corn | 10.75 |
| Barley | 9.50 |
| Wheat Bran | 7.0 |
| Alfalfa Meal (dehydrated) | 8.0 |
| Soyabean Meal | *23.0* |
| Black Strap Molasses | 7.0 |
| Dicalcium phosphate | 2.0 |
| Limestone | 0.75 |
| Salt trace mineralized | 1.0 |
| Vitamin Supplement | 1.0 |

- The racehorses should be fed high quality hay/pasture and should always have access to mineral lick and fresh clean water should always be available.
- The energy level in the concentrate diet could be increased by replacing some of the oats with corn and decreasing wheat bran and alfalfa meal. Excess high energy grain is to be avoided since it may cause digestive disturbances because of carbohydrate overloading.
- Many horse trainers prefer to add 5-10 percent fat to the concentrate diet for high level performance, however, its additional benefit to the performance of horse is not definitely

known. Fat increases the energy density of the diet and may allow reduction in total feed intake required to meet energy requirements which is important as it is difficult to take enough total feed during intense work.

- Moreover, it minimizes the possibility of colic, founder and other digestive disturbances occurring from too heavy concentrate consumption during intense activity.
- Addition of fat also increases the muscle glycogen of exercising horses. If fat is used, it needs to be a high 'quality product and it has to be protected against rancidity by a proper antioxidant, which can cause digestive disturbances and decrease in the palatability of the diet.
- Increased fat level in the diet also calls upon to increase the protein and calcium phosphorus level in the concentrate diet. The concentrate diet of high performance horses should supply about 18 percent protein which will allow the use of hay and/or pasture with a protein percentage of 7 to 10.
- So overall, a protein percentage of 12 to 14 percent would be supplied. It is always better to supply protein on higher side rather than run the risk of a lack of protein.

## FEEDING DURING NON BREEDING SEASONS

- When the stallion is not being used for breeding purpose, a high quality pasture will supply a large part of the nutrients needed.
- Stallion should have access to adequate minerals, vitamins and fresh clean water during this period.
- Green and leafy hay can also be fed. if pasture is not sufficient.
- Concentrate feeds should be fed in small amounts to supplement the forage used and to keep the stallion in a trim and thrifty condition.

## FEEDING DURING THE BREEDING SEASON

- Breeding season imposes increased activity on the stallion and will, therefore, need more energy, protein, minerals and vitamins which can be accomplished by feeding a higher level of concentrate in the diet.
- During this period, the concentrate and roughage can be in equal proportion, however, level of concentrates can increase or decrease depending upon the quality of forage, condition of stallion and number of services required weekly.

# MODULE-10: BREEDING OF HORSES

Learning objectives

This module discuss about,

- Horse breeding guidelines, season of breeding, physiology of male and female reproductive system.
- Preparation of mare for covering, trying a mare, estrus detection and covering of a horse.
- What is foal heat, requirment of foal heat, when foal heat covering should not be done
- Signs of nearing foaling, foaling management care and management of newborn foal

## BREEDING GUIDELINES

| | | |
|---|---|---|
| 1 | Sex ratio | 1 : 30-40 |

| | | |
|---|---|---|
| 2 | Age at puberty | 12-15 months |
| 3 | Optimum age and weight at first mating | Male : 3-4 years<br>Female : 2 ½ - 3 years<br>Weight 300-350 kg |
| 4 | Productive life period | 14-16 years of age or 10 foals |
| 5 | Length of estrus cycle | 21-23 days |
| 6 | Duration of estrus | 4-6 days |
| 7 | Diestrus | 17-19 days |
| 8 | Ovulation | 3-4$^{th}$ day of cycle |
| 9 | Optimum time for breeding | 2-3 days after appearance of heat |
| 10 | Estrus per mare per year | 1.71 |
| 11 | Services per mare yearly | 2.75 |
| 12 | Foaling heat | 9-11 days |
| 13 | Gestation period | 335-345 days |
| 14 | Weaning | 4-6 months |

*Sex ratio 1:30, Ovulation on 3-4th day,gestation period 335-345 days, weaning at 6 months*

## SELECTION OF STALLION

**Stallion**

**Stallion in the teasing yard**

- A breeding soundness evaluation should be completed on stallion before they are bought or before the breeding season starts.
- Thee stallion's past breeding records should be examined to determine his ability to impregnate mares.(These records should indicate the number of mares bred, number that conceived, average number of breeding per cycle, average number of estrous cycles mares were bred per conception, and average number of breeding per conception).

- Fertile stallions breed each mare 1.5 to 2 times per estrous cycle, and they are bred 1 to 2 estrous cycle per conception. The conception percentage for a properly managed and fertile stallion should be greater than 90 per cent.
- The stallion should be in excellent physical health, as shown by a physical examination and by his personal appearance. Injury to hind leg or back may impair or prevent the stallion from mounting mares.
- Overweight stallions tend to lose libido during the later part of the breeding season. The stallion should be checked for history of colic.
- Stallion should be free from cryptorchids, inguinal hernias.
- The temperament of the stallion is important. He should be easy to handle during teasing and breeding procedures and he should not have any stable vices.
- The stallion's libido should be evaluated by determining his reaction time. Normal reaction times (from the time of seeing a mare until and attempted mount) should be about 1 to 5 minutes during breeding season. During winter it may be long as 15 minutes.
- The average number of mounts per ejaculate should be about 1.5. The time of copulation normally lasts from about 30 second to 2 or 3 minutes. The stallion usually makes 5 to 10 intravaginal thrusts period to ejaculation, and each thrust last about 11 seconds. The ejaculatory reflex lasts about 15 seconds. About 5 to 12 (8 to 10 is average) ejaculation pulses can be felt side of the base of the penis. Ejaculation can usually determined by ***"tail flagging"*** – the stallion raises and lowers his tail several times.
- Olfaction is one of the fundamental stimuli of reproductive responses of the stallion. When the stallion smells the external genitallia of the mare or smells voided urine, he displays the olfactory or "flehmen reflexes" in which he extend his neck upward and curls his lip. During the reflex, he inhales and exhales air in the upper respiratory passages.

*Breeding soundness evaluation should be done, normal reaction time 1to 5 minutes during season*

## MALE REPRODUCTIVE TRACT

- The testes lie horizontally in the scrotum so that it is not as pendulous as the ram's or bull's.
- One testicle is frequently larger (left one) than other and one testicle is placed slightly farther back than the other, so that the scrotum is asymmetrical. They weigh about 225 to 300 gm.
- The penis of an average size stallion is about 50 cm long in the relaxed stage.
- The prepuce, commonly called the sheath, is a double fold of skin that covers the free portion of the penis, the internal layers of skin contain large sebaceous glands and coil glands or perpetual glands whose secretions, together with desquamated epithelial cells, form the fatty smegma. The fatty smegma and foreign substance such as dirt or wood shavings accumulate in the fossa glandis to form a round "bean". Hence regular washing of prepuce is essential

*Testicle lie horizontally, double fold sheath require washing regularly*

## SEMEN PRODUCTION CHARACTERISTICS

- Puberty for stallion varies between 11 and 15 months of age (it is the age when an ejaculate contains 1 x $10^8$ sperm with 10 per cent progressive motility.
- Stallion semen is grayish white in appearance and consists of seminal fluid and spermatozoa. The whole semen is ejaculated in a series of 8 to 10 jets. The first 3 jets are milky in colour and consistency. Approximately 80 per cent of the total number of spermatozoa is ejaculated in these jets
- The volume of a stallion's semen varies very widely ranging from 50-150 ml in one ejaculation, concentration of sperms also varies widely from 50-200 millions per ml of semen. Daily breeding

reduces the volume. If the volume of semen is less than 25 ml a stallion's fertility may be questioned.

- The concentration of sperm ranges between 30 and 800 million per ml of gel-*free ejaculate. The concentration varies between first and second ejaculation by 60 per cent. Similarly during non-breeding season and after prolonged rest the concentration will be 50 per cent less. Stallions ejaculating with a concentration of 8 million or less spermatozoa per ml have questionable fertility*

*80% spermatozoa ejaculated in first 3 jets, semen volume 50-150 ml, concentration of less than 8 million spermatozao- infertile stallion*

## USE OF STALLION

- Stud colt is capable of breeding a mare by the time of 1 year of age but stallions are not used at stud until they are 4 to 5 years of age.
- Normally stallions are put to stud work after they have retired from turf, animal which prematurely break down at 3 years can also be used for stud.

| Age of stallion | No of service per week | Number of mare per breeding season |
|---|---|---|
| 2 years | 2 | 6 or 7 |
| 3 years | 6 | 10 to 12 |
| Matured stallion | Daily once (should get 1 day of rest every 7 or 8 days)<br>If needed twice a day for 3 or 4 days in a week | 30 to 40 |

## TRAINING YOUNG STALLION

- Training the young, shy stallion takes patience and time.
- Training is usually started by teasing a mare or mares for a few minutes. As soon as the stallion loses interest, or after 5 or 10 minutes teasing should be stopped.
- As soon as stallion teases a mare vigorously, he should be allowed to mount a gentle mare that is in heat.
- He should be guided into the proper position prior to mounting. A stallion frequently mounts on the mare's side or shoulder until he learns proper position.
- When the stallion mounts correctly from behind, direct his penis into the vagina. The handler must be careful because the stallion frequently falls backward or off the side the first few times he ejaculates.
- After having bred two to six times, the stallion usually understands the process. Then training him to mount the mare by approaching her at the hip.
- The stallion must be trained to accept washing procedures before breeding. For the first few times, stand the stallion next to a wall after he drops his penis while being teased. He is washed in this position so that his movement can be controlled.

*Teasing training, trained to accept washing penis*

## SELECTION OF BROOD MARE

**Brood mare in the covering yard**

**Brood mare in the paddock**

- The brood mares must be wide and roomy, well ribbed up, broad and muscular over the loins and quarters in or order to provide enough room for the foal to develop.
- Horse breeding mares should have good conformation.
- Mule breeding mares are generally heavy draught type and coarsely bred, should have a big bone and big round belly and hips.
- The brood mares must be genitally sound and free from hereditary defects and should preferably have dropped foal.

## FEMALE REPRODUCTIVE TRACT

- Mares have traditionally had a reputation for low reproductive efficiency, when compared to other domestic farm animals.
- The low reproductive efficiency has been related to breeding mares with reproductive problems. The mare has a long estrous period, during which it is difficult to determine the appropriate time to breed.
- The ovary resembles a bean or kidney in that it has an area, the ovulation fossa , that is folded inward this is where ovulation occurs.
- The uterine horns are 25 cm long and coiled like ram's horn, the body of the uterus approximately 18-20 cm long and 10 cm diameter. The cervix is about 7.5 cm long.

*Poor reproductive efficiency than other domestic animal, long estrous period is a problem*

## REPRODUCTIVE PHYSIOLOGY

- The filly attain puberty at the age of 12 to 15 months, she starts to come into estrus periodically.
- The average length of estrous cycle is 21 to 23 days. Estrus lasts for about 4 to 6 days and diestrus lasts for 17 to 19 days.
- Ovulation usually occurs during the third to fifth days of cycle. About 50 per cent of all mares are out of estrus 24 hours after ovulation; 80 per cent are out after 48 hours.
- A mare is capable of considerable adjustments but in the extremes, excesses or deficiencies of energy will reduce her reproductive efficiency.
- There will be poor expression of oestrus and ovulation and even death of embryo in energy deficient mares.
- On an average, there are 1.71 oestrus periods per mare per year and 2.75 services per mare yearly.
- The maximum conception has been recorded in mares from 9 to 15 years of age which slowly declines with age.
- Twinning is rare in mares with incidence just as high as 2.5 percent with foal crop, average ranging from 50 to 65 percent, which means that mares breed one year and skip next year.
- Generally twinning is discouraged in stud farm (due to low birth weight of foal)
- Abortion during early 90 days of gestation is more in energy deficient mares.
- Conception rate is low at foal heat and pregnancy losses, which occur between fertilization and 150 days post ovulation, are reported to be between 11 to 13 percent.

## BREEDING OF STALLION

- The stallions are usually put to Stud work at the age of four years, after they have retired from turf.
- However, animals which prematurely break down at 3 years are retired to the Stud and such stallions have to be initiated into service. These young stallions will be let down which means that his body conformation changes, the hard and tight abdominal muscles relax and normal belly coulour is developed.
- The well developed hard muscles of galloping and propulsion become softer and more elastic. As such, the time taken for the process of letting a horse down is not less than 3 months.
- Many stallions are awkward in their first attempt at service and all possible help, guidance and encouragement must be provided at this time.
- For its first 'service, the stallion should be kept well under control and a mare in proper heat should be selected for service. Maiden mares and mares for DHAMAN (Foal heat) covering should not be put to such stallions.

*Optimum age of stallion for breeding 4 years, new stallion should not be used for foal heat covering*

- Some stallions have bad breeding habits and such habits usually develop during their first use in the Stud.
- Some are slow in mounting and often have to mount several times before actual ejaculation. The others bite badly during service.
- Normally 30-40 mares are allotted to a stallion and the stallion has to cover 2 to 2 ½ times per mare in order to get them in foal. The total covering quota of the stallion should be fixed and number of mares allotted according to the age of the `stallion.
- The new stallions in their first year of service in the Stud should not cover more than 15 mares and their covering quota should not exceed the whole year.
- The second year, the number of mares as well as covering quota should be gradually increased which should be limited to 50 coverings during the whole year.
- It is during the 3rd year of the Stud service that a stallion is. fully utilized and the covering quota should not increase 80-100 in a year. Similarly, when the stallion gets older than 15 years, the `covering quota' should be accordingly reduced.
- Normally one covering should be allowed in 48 hours as replacement of semen takes place in this period.
- During busy covering season, there is no harm in using a stallion daily but this should not be continued for a long time as excessive use has adverse effect on concentration of the semen and motility of the sperms. If daily covering has to be given for few days, it should be ensured that 48 hours rest is given after 2-3 days. Total covering in a month for a stallion should not exceed 20.

*Mare quota should be increased year by year, 48 hours rest is essential, total covering in a month should not exceed 20*

## SIGNS OF HEAT

- During diestrus, the mare shows complete resentment of the stallion. She will kick, bite and chase him.
- One or two days before estrus, she becomes more passive to the stallion. She may or may not object to his presence.
- During estrus, mare is receptive to the stallion.
- She flexes her pelvic(immage), raises her tail.
- Frequently urinates, spreads her hind legs apart, contracts and relaxes the lips of the vulva with winking of the clitoris, and allows the stallion to bite and chew on her neck and flanks.

*Frequent urination, winking of clitoris, raising of tail, flexing of pelvis*

## BREEDING SEASON IN MARES

- *The mares are polyoestrous and heat varies according to the climate and the season.*
- *The breeding season is mainly confined twice a year. The spring breeding*

*season commences from Feb till the end of June and Autumn breeding season is confined to Sep-Oct and Nov.*

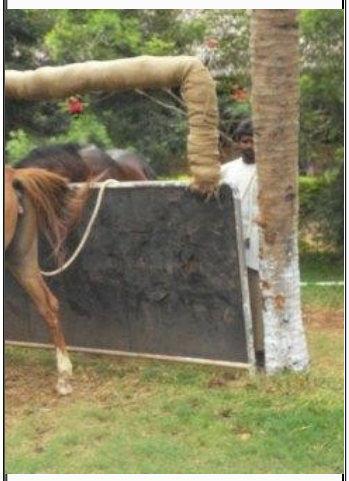
- *The breeding in spring season is considered to be best time because the heat in the brood mare is regular and invariably accompanied by functional ovulation, the stallions are most prolific and conception rate of the coverings is high.*
- *The maximum coverings should be aimed during this period as the foals are born after service in this season, at a time of the year when plenty of good fodder is available and the climate is favourable for their quick growth.*
- *Nearly 70-80 percent of the mares should be covered in this season. Autumn breeding season may be used for breeding of problem mares after their treatment.*

*Spring breeding season Februar to June (main breeding) Autumn breeding Sep-Oct for problem mares*

## TRYING OF MARE AND DETECTION OF HEAT

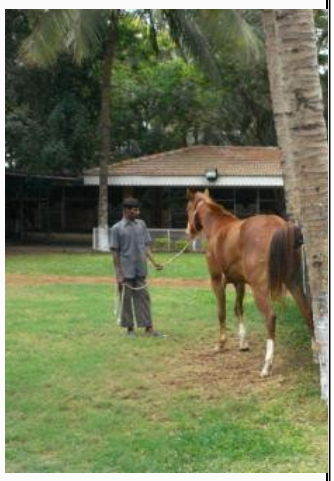
- *Trying or teasing of mare is introduction of mare to teasing stallion during the breeding season. The main advantage of this preliminary trying is firstly to overcome the natural nervousness of the mares in the presence of teasers and secondly to get a clue as to the likely date of mare will be in season from February onwards.*
- *One should start trying all maiden and empty mares from 1 sty Feb. The main advantage of this preliminary trying is firstly to over-come the natural nervousness of the mares in the presence of teasers and secondly to get a clue as to the likely date the mare will be in season from 15 Feb onwards. It is done by allowing the mare and stallion to have a contact which is separated by a wooden (trying bar/teasing bar) bar or wall.*
- *It is better to miss covering of the mare in the first heat of the breeding season as percentage of ovulation is much less.*
- *In the presence of the teaser the brood mares in season exhibit the heat by raising the tail, by standing quietly, by i.e. twitching of the clitoris, by squirting urine frequently, bending her hind quarters followed by contraction and relaxation of vulval lips and passing of vaginal discharge, which subsequently becomes thick, scanty and hangs out like a thin string.*
- *The vulva gets swollen and becomes slack. These external signs of heat are the indication of what is happening inside the genital tract of the mare.*
- *The mucous membrane of normal vagina is of pink colour, free from inflammation or offensive discharge and os uterus is seen projecting out in the vaginal passage, erect and rigid, like a piece of cartilage.*
- *In normal condition during dioestrus and pregnancy, the os is tightly closed. In heat, there is dilation and relaxation of vulva and the os and moistening of vagina to facilitate the passage of sperms.*
- *Taking an average period of heat as seven days, during first two days, there is no change in the condition of the os, next three days there is full dilatation followed by last two days rigidly increasing contraction.*

- *To detect rigid or relaxed os, it requires long practical experience. A tight hard rose bud represents rigid os, the full bloom rose just past its prime, is the relaxed os.*
- *When examined by speculum, the cervix in mares not in heat is seen protruding into the vagina standing erect above the lower spoon of the speculum.*
- *A mare may be covered for 4 days in succession during heat, yet the conception is the fruit of one day of these services. The other three are drain on the stallion's vitality. Every service should be aimed at conception and mare should be covered when she is unmistakably willing to accept the mounting of the stallion.*



**Winking of vulva**

**Squirting urine**



**Bending her hind quarters**

## PREPARATION OF MARE FOR COVERING

- The mare being found in a complacent mood and the generative organs in ideal condition. At this stage, the follicle should ripe, reaching about 3-4 cm in diameter. Occasionally two follicles may be present in one ovary.
- The service of the mare must be as close to the nature as possible. Service hobbles may be used as a protection of the stallion against the injuries from the kicks.
- Use of twitch is not recommended unless mare is maiden or nervous at the time of covering. If twitch is necessary it should be used temporarily. After the stallion has mounted, the twitch can be quit safely and should be immediately released.
- The mare should be prepared for covering by tying a bandage at the root of the tail to prevent loose hair being forced into vulva and causing subsequent laceration of the stallion's penis during service.

Tail banage

Service hobble

Teasing

## COVERING A MARE

Introduction of stallion

Mounting

Ejaculation

- The stallion is led out of the stable by two attendants and is kept well under control. Stallion should be walked round at a safe distance from the mare so that she may see him and get time to settle down herself.
- Later the stallion is made to stand 1 to 1.5 m away from the mare, not in direct line behind her, but to the left side of her so that mare and stallion form two sides of a square.
- The mare then can see all stallion's movement and understand his intention. The stallion will begin by curling up his lips and smell the air. He will accordingly get ready for his work, sometime at once and sometime not quite so quickly. However, he must not be led up to the mare until he is quite ready and the penis is fully drawn and erect.
- The mare's head is held little high when she will not be able to kick quite so easily or so hard.
- The stallion is then led up to the left side of the mare to within a distance of a meter or so, when he will be left to jump her without any further interference and trouble.
- Further movement of the mare should be prevented by the attendants in front of the mare, one holding her head and the other pressing his shoulder against shoulder of the mare.

## CARE AND MANAGEMENT DURING COVERING

- While mounting, the attendants holding the stallion should assist. The attendant on the right side pulls the mare's tail towards him with his left hand and places his right hand on the mare's hips, to keep her steady. The attendant on the left side places his left hand on mare's hip and guides the stallion's penis with his right hand into the vagina. Some stallions resent the holding of the penis by hand, the idea is only to help in penetration and the hand should be kept close to the penis to prevent it going to the side or entering into the rectum.
- Mares that have foal at foot, their foals must be separated from them temporarily when they have come to be tried and covered. It is further better that the mare should not hear the cries of her foal, which generally upsets her and distracts her attention from the stallion.
- It will be ensured that the stallion has ejaculated which is indicated by *flagging of the tail*, contraction of the anus and rhythmic pulsation in the urethra.
- Some stallions go through these false motions even without ejaculation, therefore the proper method of testing the discharge of the semen, is by placing a finger very tightly on the under side of horse's penis towards the close of the service.
- If the horse is ejaculating, the impulse throb will plainly be felt and all doubt be set at rest. The stallion normally ejaculates close to the cervix or directly into the os. The stallions which bite badly should be muzzled during service.
- Normally one service should be enough but if the stallion is having slack time and the judgment for selection for covering has not been correct, second service may be given. At the fag end of the breeding season, in case of mares having been continuously breaking, a third service may be given in the hope of winding up the season satisfactorily.

*Flagging of the tail and urethral pulsation indicates ejaculation*

## DHAMAN (FOAL HEAT) COVERING

- Foal heat or post parturient oestrus is a unique phenomenon in mares. The foal heat is invariably complete with follicle ovulating.
- This is possible as the ovaries of the mare in the later stage of pregnancy do not contain functional corpus luteum so that new follicles begin to develop, as soon as level of the estrogens and progesterone, by the placenta, drops low enough as to exert inhibiting effect on the pituitary ovarian activity and new follicles start developing before parturition.

- Furthermore, post parturient uterus of the mare is capable of involution in a short time, because of primitive loose non deciduate type of placenta of the mares, which permits separation of foetal placenta without major damage to the uterine endometrium.
- If the restoration of the uterine epithelium after parturition is not complete, it may result in abortion. Foal heat is of about the same duration as cyclic oestrual periods.

## TIME OF FOAL HEAT COVERING

- Majority of foaling mares are ready for the stallions on the 9th day after foaling and in calculating 9$^{th}$ day, the day of foaling and day of covering are also counted.
- Normally it is arrived at by adding 8 to the date of foaling. Best general practice with foaling mares is to try every day from 7th day after foaling till satisfactory result is obtained up to 15$^{th}$ day.
- If the mare has not shown heat after foaling and is not covered during 1st or 2nd post parturient heat, the dioestrus is unduly prolonged in heavy milkers, till after the foals are weaned.
- Presumably this is due to the pituitary principally putting out lactogenic hormones at the expense of gonadotrophins. The characteristics of individual mare have to be studied and recorded. The dates are very useful guides to probabilities and should not be rigidly followed.

*Trying stars by 7th day, covering by 15th day*

## UNFAVOURABLE CONDITIONS FOR FOAL HEAT COVERING

The result of Dhaman (Foal heat) covering has been found very satisfactory and certain precautions are necessary before enforcing this into an organized Stud. However, Dhaman (Foal heat) covering should be avoided when the following conditions are encountered:

- When there is a difficulty in foaling and foal is taken out manually even if it is alive.
- When the foal is born dead or dies within 7 days after foaling.
- When placenta is retained for more than 3 hours in the uterus.
- When placenta weighs more than 6.5 kg.
- When the placenta is thick, oedematous and having ulcers on its surface.
- When foal is born as weakling.
- When the mare is continuing vaginal discharge more than 4 days after foaling.
- When the mare has sustained injury to the genital tract during foaling.
- When the uterus has not involuted to its normal size as detected by rectal examination.
- If the mare is weak in condition.

*Mare with retained placenta or weight more than 6.5 kg unfit for foal heat covering.*

## MANAGEMENT OF IN-FOAL MARES

- *Each mare should be kept in very good breeding condition. Sole function of the brood mare is to be a machine for the production and rearing of young.*
- *Exercise is most important during pregnancy. Liberty stabling and grazing provides enough exercise for these mares and those confined to stables suffer ill effects of it. While grazing, the mares should be scattered all over and not allowed to stay in groups. Any mare isolating from others and standing alone may be examined for illness.*

- *Provided the mares are properly trained, there is no harm in riding or using them in cart during early stages of pregnancy but they should be worked at a slow pace and not more than 1 ½ hours daily. As the time approaches for the mare to foal, care should be taken to prevent sudden frights and violent galloping.*
- *It is good plan to divide the mares into convenient sized groups according to their expected date of foaling.*
- *The mares generally bring forth their foals at an average 338 days after covering. Some mares invariably go overtime while others do the reverse. Mares with low condition exceed their time for foaling by about two weeks, while mares in good condition foal in time or several days in advance of it.*
- *30 days before foaling, the mare should be given a booster dose of tetanus to booster the high antibody titer in the mare's colostrum.*
- *All pregnant mares should be shifted to the foaling boxes about 3 weeks before the expected date of foaling.*
- *The mares foaling 20 days ahead of expected date should be considered as premature foaling, if the foal is alive. The birth of a dead foal 20 days before should be presumed as an abortion. The birth of a dead foal within the range of normal foaling i.e. 20 days either side may be considered as stillbirth.*

*1 1/2 hours exercise daily,booster dose of tetanus 3 weeks before foaling*

## MANAGEMENT OF FOALING MARE

- Generally foaling takes place during night time.
- All in foal mares should be closely watched for signs of approaching parturition when they get within a fortnight of their expected date of foaling.
- As the foaling time draws nearer, the filling of udder increases, which becomes firm and of rather turgid consistency. Doughy swelling under the skin in front of the udder often appears in some mares. There is nothing to worry about it as it disappears when the flow of milk starts after foaling.
- The advanced stage of foaling is marked by sinking of the quarter on each side of the croup, in the hollow on both sides of the root of the tail.
- The pelvic muscles between hip joints, croup and back to the root of the tail may feel slackened and depressed due to influence of hormone 'Relaxin' (which is produced during last days of pregnancy). The swelling and relaxation of the vulva is often seen.
- There is appearance at the end of the teat of little nodules of wax like substance produced by the secretion of clear thick serum like material from the teat canal. It is always better to get the waxing mare into foaling box at night and keep her under constant observation.

- It is a good plan to inspect the mare's udder each morning and evening for a week or so before due date of foaling and make a note when wax has appeared.
- Mare usually foals within 12 to 24 hours after the wax drops off and milk begins to drip away, soiling the lower part of the hind legs.
- Once this stage has reached, the mare may foal at any time. Some maiden mares may foal without previous waxing or letting down milk.
- Before foaling, all items of foaling kit (two bucket, mild soap, mild antiseptic, tincture iodine, tail bandage, towels, garbage bag for waste disposal, obstetrical sleeves, lubricant, syringe and needles, oxygen cylinder) should be kept ready and sterilized.
- Arrangements for warm bran mash containing jaggery should be made available. After foaling, not only the foal but the mare herself is liable to get infection if a foaling box is not previously kept ready duly disinfected. Her bedding and surrounding should be absolutely clean and healthy. Bedding should be thick and consisting of good clean straw. Danger of infection to the foal and to a lesser degree to the mare, persists for considerable time after foaling and is at its height during the first nine days.

*Udder filling, doughy swelling infront of udder, waxing of mare, milk drip are sign of nearing foaling*

## SIGNS OF NEARING PARTURITION

- As a mare approaches parturition, the concentration of calcium ions in the mare's milk increases. A water hardness test strips can be used for this purpose.
- The usual symptoms of approaching labour are that the mare shows excitement, pacing uneasily round and round in the foaling box, profuse sweating, paws the ground, gazes around her flanks, lies down and gets up again repeatedly and passes small quantity of urine frequently.
- At this stage, care should be taken to regulate the ventilation while the mare is perspiring and is in a heated state.

*Excitement, pacing the foaling box, profuse sweating, pawing the ground are sure sign of foaling*

## AFTER CARE OF FOALING MARE

- The placenta of the mare should normally drop within one hour after foaling.
- In case of delay beyond three hours, it should be removed by administration of hormones and by manual interference.
- After foaling, a mass of tangled foetal membranes will be hanging from the mare and if these are inclined to get in the way and strangled or stampeded upon as the mare turns and moves about in the foaling box, then the membrane should be tied up by a string into more compact mass, a little above the level of hocks.
- Tying the weight to the placenta is not advocated as it might cause pull at the roots and cause injuries to the uterine walls. It should be ensured that the placenta is expelled as a whole and intact and no piece is left inside.
- The placenta is then examined thoroughly by spreading and opening it inside out. Any defect or abnormality should be noted.
- Before disposal, the placenta should be weighed and disposed of either by burning or by burial. A normal weight of placenta ranges between 5.9 to 6.4 kg. If it weigh about 8.2 to 9.1 kg and is very bloody, the uterus may be infected and need treatment. The container and the attendant's hands should be thoroughly disinfected.
- If the expulsion of placenta is delayed beyond three hours, it is liable to become infected with organisms and may lead to uterine infection and consequent sterility. Haemorrhages after foaling should be viewed seriously. a
- The colostrum of the mare is rich in protein, minerals and vitamins and is heavily loaded with antibodies produced in the mare's serum against most of the common harmful bacteria. It has stimulating and slightly laxative effect on the meconium *(first faeces voided by the new born).* The first secretion of colostrum only is rich and after 12-15 hours, its original antibody concentration is reduced to nearly half and in about 36 hours, the amount of antibody is very small and practically normal milk is secreted.

*Placent should shed within 1 hour, correct weight is 5.9-6.4 kg, foal should drink colostrum immediately*

## MANAGEMENT OF FOAL AT FOOT MARES

- After foaling, the mare with her foal should remain in the foaling box for about 4 days.
- By this time, mare would have cleansed herself. The mare then is taken out of the foaling box in an open loose box and kept there with her foal for about 15 days, by that time the foal starts recognizing its dam and is ready for mixing with the other foal at foot mares of approximately the same age.
- The foal at foot mares should be kept in small groups of not more than 10 in the paddock, according to the age of the foals.
- The mares which foal in a month may be kept together, similarly other foal at foot mares should be grouped according to the month of foaling.
- A general rule to deworm a foal at foot mare, is the next day after her dhaman (foal heat) covering.
- As the foals start growing in age, the suckling of milk causes drain on the mares and some start losing condition due to the heavy drain on their health. Best care and management is required to keep foal at foot mares in reasonably good condition.
- They should be given extra grain feed, barley should be fed after boiling. Good grazing pastures have tremendous effect in maintaining the falling condition of these mares.

## MANAGEMENT OF WEANLING MARES

- The foals are separated from their dams when they are 6 months old.
- Early weaning of foal may be carried out on veterinary grounds if the foal is maintaining healthy condition and the mare is rapidly going down in condition.

- For 12 hours prior to separating mare and foal, the mare should be deprived of food and only small quantity of water is allowed to her.
- The foal's regular drain on milk supply and withdrawal of mare's food, combined, will ensure that the udder will be practically depleted of milk at the time of actual separation.
- After the separation has been completed, the mare can have small quantity of hay and on expiration of 4 hours, the udder should be fully relieved if distended.
- If small quantity has been secreted, it should not be milked dry but only a portion is drawn off.
- The object to be kept in view, is to dry up the milk supply as quickly as may be, while avoiding any risk of congestion or inflammation. Engorged udders are liable to cause damage to the tissues.

## MODULE-11: RACE AND SHOW HORSES

Learning objectives

This module discuss about,

- importance of race horse, some facts about race horse like date of birth, stud book, breed used etc.
- feeding and management of race horse
- doping, detection of doping
- preparation of animal for race, show and judging competitions.

## SOME FACTS ABOUT RACE HORSE

- Regardless of when a foal is born,its birth date is always considered as January 1.
- Thus a foal born May 1, 1980 will be 10 years old on January 1990. This is done from the standpoint of racing and showing.
- As a result, horseman who race or show make every effort to have foal arrive as near January 1 as possible, thereby getting the advantage of more growth than animal born later in the year. This is especially important in the younger age groups.
- Artificial insemination should not be in thoroughbred stud farms

*AI not allowed, January 1 is the date of birth of a foal*

## BREEDING OF RACE HORSES

- In breeding of race horse's selection of male and female is most important as it depends upon its winning performance, health, soundness, racing power and age. Such horses are priced and their foals are also equally costly.
- Second parameter given importance to its pedigree, in which, parent performance on the basis of its winning, stamina, running performance, health and soundness are counted.
- Pedigree has 80% of reliability, thus total records of winning, soundness and confirmation are emphasized.
- Stud prices are in lakhs depending upon its performance in the race.
- While selecting the stallion his winning performance, breed characteristics and performance of his progeny if available in racing should be tested.

*Pedigree has 80% reliability, winning performance of mare or stallion play a vital role*

## CARE OF RACE HORSES

- Race horses are kept on the basis of its running performance, stamina, confirmation and soundness. Thus all the race horses including young ones are to be cared since beginning.
- Little mistakes and lack in managemental practices lead to spoiling good horses.
- Such horses are to be kept for running at least 3 to 4 hours daily and their average performance on the basis of time required for completing particular running distance should be judged.
- In race horses utmost care of the feet is necessary. If any deformity to feet which leads to injury or fracture makes value of the horse zero.
- Grooming twice daily is a must for race horses. Jockey should be well acquainted with the horse as race horses do not tolerate change of the Jockey on and often.
- They should be fed regularly with balance nutrition and plenty of greens and hay. The stables should be clean and not slippery which brings deformity in legs and posture.

## FEEDING RACE HORSES


- The race horses must not be allowed to become fat. They need to be kept in trim and thrifty condition for which it is important that they receive protein, energy, vitamins and minerals in adequate amount to develop their body and perform to the maximum of their inherited potential.
- The concentrate feeding can increase or decrease depending upon whether the horse is under light training or heavy performance. The condition of the horse can serve as a guide as to whether too much or too little concentrates are being fed in relation to forage intake.
- The racehorses should be fed high quality hay/pasture and should always have access to mineral lick and fresh clean water should always be available.
- The energy level in the concentrate diet could be increased by replacing some of the oats with corn and decreasing wheat bran and alfalfa meal.
- Excess high energy grain is to be avoided since it may cause digestive disturbances because of carbohydrate overloading.
- Many horse trainers prefer to add 5-10 percent fat to the concentrate diet for high level performance.
- Fat increases the energy density of the diet and may allow reduction in total feed intake required to meet energy requirements which is important as it is difficult to take enough total feed during intense work.Moreover, it minimizes the possibility of colic, founder and other digestive disturbances occurring from too heavy concentrate consumption during intense activity.
- The concentrate diet of high performance horses should supply about 18 percent protein which will allow the use of hay and/or pasture with a protein percentage of 7 to 10. So overall, a protein percentage of 12 to14 percent would be supplied. It is always better to supply protein on higherside rather than the risk of a lack of protein.

*5-10 percent fat to the concentrate diet, 18 % CP*

## DOPING

- Doping in animals is defined as administration of any substance, drug or food which affects speed, stamina, courage so that in any competition or race such animal may get more marks than inferior animal.

## TYPES OF DOPING

### Intentional doping

- It is defined as any stimulant or tonicor compound having direct effect immediately or after some time affecting cardiovascular or central nervous system for improving or decreasing the performance. Such agents are known as stimulants and are commonly used as doping agents.

- Doping agents are methylxanthine, Sympathomimetic amines and Vitamins, harmones, anabolic ateroids. Administration of such drugs during 24 to 48 hours prior to the race decreases the performance of race animals so that it should not win, this is a common malpractice used in a race horses.

### Unintentional doping

- This doping includes accidental and therapeutical medicines administered as a treatment.

## DOPING AGENTS

- *Stimulants:* Amphetamine, Loidocaine, Procaine.
- *Anabolic Steroids:* Stanozolol, Methyl Testosterone.
- *Analgesics:* Fentanyl, Phenylbutazone.
- *Glucocorticoids:* Dexamethasone, Prednisalone.
- *Tonics and haematinics:* Arsenicals, Iron compounds.
- *Vitamins:* Thiamine, Cyanococobalamine.
- *Diuretics:* Flurosemide, Chlorothiazide.
- *NSAIDS:* Ibuprofen.
- *Tranquilisers:* Acetylpromazine, Resorpine.
- *Hypnotics and Sedatives:* Bromides and Xylanzine.
- *Hallucinogens:* Scopolamine, Heroin, Marijuana.

## EFFECT OF DOPING

- It improves the animals activity leading to permanent impairment of female reproductive organs.
- It may cause tissue anoxia and interfere with body temperature.

## DOPING TEST

- It can be carried out by urine and by saliva.

### Urine test

- Catheterization is difficult in horses, Diuretics such as Bumetanide at 10 mg/kg body weight given intravenously helps in urinating the animals.
- Urine and saliva can be tested for doping with
    - Spectrophotometry
    - Fluorometry
    - Eliza Test
    - RIA technique
    - Mass spectrometer

## HORSE SHOW AND JUDGEING

- A *Horse show* is a judged exhibition of horses and ponies. Many different horse breeds and equestrian disciplines holdcompetitions worldwide, from local to the international levels.
- Most horse shows run from one to three days, sometimes longer for major, all-breed eventsor national and international championships in a given discipline or breed.
- Most shows consist of a series of different performances, called *classes,*wherein a group of horses with similar training or characteristics competeagainst one another for awards and, often, prize money.
- There are two types of shows via
    - Horseshow
        - In horse show breed characteristics, soundness, confirmation is more accounted.
    - Fancyshow
        - In fancy shows they should be more decorative and attractive.

## PREPARATION OF HORSE FOR SHOW

- The horse must be appropriately groomed and clipped, as the exhibitor is being judged on the ability to fit and show a horse "in hand".
- The horse must be prepared months ahead of the event by being provided good nutrition to develop a healthy, shiny coat.
- Their hooves should be trimmed regularly by a farrier and kept balanced, smooth and neat.
- It should be brushed and otherwise groomed frequently to further promote a shiny coat and good overall health.
- The horse should also be exercised regularly, either in-hand or under saddle, to develop good muscle tone.
- The day before the show, the horse should be bathed and hair on its mane, tail, legs and head trimmed or clipped to meet the style standard for the particular breed of horse.
- Often special conditioners are used on the hair to make it extra shiny or silky.
- It is very important for competitors to be very familiar with the most minute grooming and style details for the breed of horse and style of tack and clothing they choose to use in the ring.
- A style required by one breed association may be considered illegal by another.
- Depending on the breed of the horse and the style of tack used, the mane might be braided, left loose, or "banded" (having small rubber bands put around small sections of a short mane at the roots in order to help it lay down).
- Horses shown with loose, flowing manes sometimes have their manes put into 5 or 6 large braids the night before, taken out just before the class and brushed to give an attractive, wavy appearance.
- Horses required to have naturally long tails sometimes have them kept "up" when not showing, the long hairs braided up to the bottom of the dock, then the braid rolled up, with a bandage or old sock put around the hair to keep it from breaking off and to keep the tail clean. When taken down and brushed out, a tail kept in this manner is wavy and flowing in the ring. If kept up at all other times, a tail may grow so long that it drags on the ground.
- On the day of the show, shortly before it goes into the ring, the horse is not only groomed to remove every possible speck of dirt, but it will usually have polish applied to its hooves, a light oil or conditioner placed on its muzzle, around the eyes,and other strategic areas of the head to accent its best features, and usually have a light coat dressing sprayed on its entire body for a bit of last minute shine.

Click here for animation "Preparing for a show - Pulling"

Click here for animation"Preparing for a show - Braiding the Mane.swf"

Click here for animation "Preparing for a show - Pulling"

Click here for animation"Preparing for a show - Washing"

Click here for animation "Brushing the tail"

## TRAINING THE SHOWMANSHIP HORSE

- The horse must be trained to respond instantly to any command by the handler. It must lead off promptly at a walk or trot, and stop immediately when asked.
- It must back up straight and quietly and learn to turn in a very tight circle from a walk and trot.
- The horse is also taught to "set up" to place its feet in a position, usually square on all four legs, that best shows the conformation of its breed.
- Often the horse also needs to learn to hold its head and neck up in a certain flattering position as well.
- The horse has to learn to accept standing in the setup position for long periods of time without fidgeting or falling asleep, as showmanship classes often are very long, due to the fact that exhibitors work the pattern one at a time.

## EQUIPMENT AND CLOTHING

- A horse can be shown under saddle in either English or Western equipment, the handler may choose their style of equipment, but it cannot be mixed between the two styles.
- The horse shown western style is required to wear a halter and be handled with a lead shank.This is usually a well-fitted leather halter with a slim leather lead shank.
- The horse shown hunter style wears a proper English style bridle, with the handler either leading the horse by the reins or with a lead shank attached to the bit.
- The horse shown saddle seat style may, depending on breed, be shown either in a modified form of the bridle used in riding classes or in an extremely thin, refined leather or leather like halter.
- The exhibitor, male or female, must wear pants, a shirt with a tie or brooch, and boots. Some show rules require a hat. Gloves are optional, but usually worn by winning exhibitors because they provide a better grip on the lead shank and give a polished look.

## EXHIBITION [Web link..]

- The rules for showmanship classes are set by organizations such as United States Equestrian Federation and the American Quarter Horse Association. While rules vary a bit from one breed or organization to another, there are general principles that usually apply in all competitions.
- It must be memorized and riders cannot carry notes or be coached while in the ring.
- Horses are usually led into the ring at a walk. Depending on the breed and the pattern, exhibitors may enter and perform the required pattern one at a time, then line up in a group on one side of the ring, other times they may all enter the ring, line up first,then work the pattern.
- Most patterns are deceptively simple: The exhibitor will lead the horse at a walk and trot, make one or two turns, stop at specific locations, and sometimes back up.
- However, all straight lines must be perfectly straight, all turns smooth and crisp, all changes of speed executed promptly.
- Orange highway cones are often used to designate the precise spot a horse and exhibitor are to walk,trot, turn or back.
- An exhibitor is not allowed to touch with the horse during a class. An exhibitor should treat each part of the pattern as a separate task leaving the maneuvers crisp, as opposed to sloppy

and run together. An exhibitor should appear confident and happy;ultimately selling themselves and their horse to the judge by acting in a confident and professional manner.

- The winner of a showmanship class is usually determined by a formula that varies by the organization that sanctions the show, but usually counts grooming and cleanliness for about 40% of the score, and the pattern and handler's showmanship for about 60%.

## MODULE-12: INTRODUCTION TO LABORATORY ANIMALS

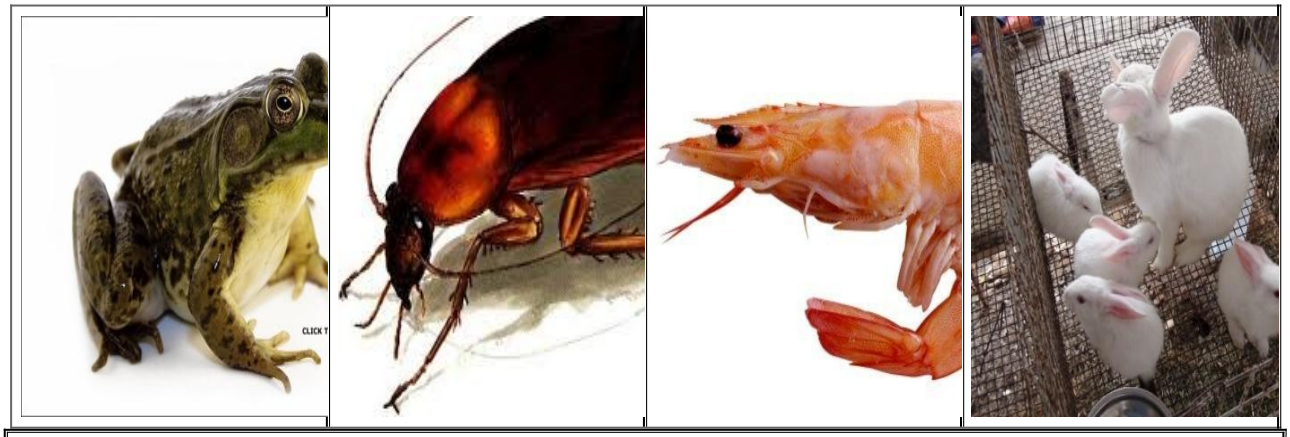
Learning objectives

This module discuss about,

- importance of laboratory animals and their role in bio-medical research
- common laboratory animals
- SPF animals and how to produce SPF animals.

## WHAT IS A LABORATORY ANIMAL?

- Laboratory animal is any non -human member of the animal kingdom which is kept in captivity for experimental or observational purposes.
- Laboratory animals cover a wide diversity of orders, from prawns to primates, and they range from domesticated species such as mice (bred specifically for use in laboratory) to wild species such as bats and snakes.
- Any animal species which is used for experimental purpose in biomedical, veterinary and other research purposes should be considered as laboratory animal.
- However, in normal sense, animals like mouse, rat, hamster, guinea-pig, rabbit and restrictedly dog and monkeys are considered as laboratory animal.



*From prawns to primates are used as lab animals, used in veterinary and biomedical research*

## IMPORTANCE OF LABORATORY ANIMAL IN BIO-MEDICAL RESEARCH

- Laboratory animals are used mainly in fundamental biological research, applied medical research and diagnosis.

- Important disciplines using laboratory animals are physiology, pharmacology, toxicology, experimental surgery, microbiology, pathology, bio-assay of vaccine, drugs and infusion fluids, preparation of immune sera.
- Bio-assay
    - The safety and potency of vaccine, level of toxin and toxoids needed are to be standardized in laboratory animals for use in field condition. Efficacy of drugs and their safety are to be tested on experimental animal only.
- Diagnosis of disease
    - Materials collected from diseased animals need confirmation through microbiological and pathological means of diagnosis. Confirmation of causative agent is usually done reproducing the disease in susceptible laboratory animals.
    - For this purpose *mouse, guinea pigs and rabbits* are commonly used.
        - Mice are susceptible to toxoplasmosis, trypanosomiasis.
        - Guinea pigs are vulnerable to leptospirosis, brucellosis, tuberculosis.
        - Hamsters are susceptible for some strains of leptospirosis.
- Toxicological study
    - Rats, Beagle dogs and primates are engaged in toxicological research.
- Teaching
    - To study the functions of organs , response of a particular organ or the whole system to drug and the method of evolving surgical techniques and demonstration of experimental surgery need experiment animals.
    - The *common laboratory animals* for these purposes are primates, dogs, rabbits, rats, mice, frogs. Use of primates is restricted due to non availability.

*Lab animals are used in drug assay, disease diagnosis, toxicological research and to study the function of organs*

## COMMON LABORATORY ANIMALS

- The most used invertebrate species are *Drosophila melanogaster* popularly known as fruit fly and *Caenorhabditis elegan* a nematode worm
- Non-primate vertebrates like mice, rat, guinea pigs, hamsters, gerbils, rabbit, fish, amphibians
- Cats are most commonly used in neurological research.
- Dogs are widely used in biomedical research, testing, and education — particularly beagles, because they are gentle and easy to handle.
- Non-human primates are used in toxicology tests, studies of AIDS and hepatitis, studies of neurology, behavior and cognition, reproduction, genetics and xenotransplantation.

| Mouse | Rat | Guinea pig | Hamster | Gerbil |
|---|---|---|---|---|

|  |  |  |  |  |
|---|---|---|---|---|
| **Beagle dog** | **Cat** | **Non-human primate** | **Fruit fly** | **Rabbit** |

## WHY LABORATORY ANIMAL?

- They are smaller in size so they need minimum space and less feed.
- So that *cost of production and maintanence is less.*
- Most of the laboratory animals are not a natural host for most of the diseases human or animal so that they can be used in microbiological (vaccine production, diagnosis etc.) and virological research.
- The results so obtained can be applied directly for human or veterinary medicine.
- *Rat and mouse* are better adaptable due to omnivores in habit, robust physical constitution, prolific breeding, shorter generation interval and easy to tame. Moreover they are living in harmony with human environment.
- *Guineapigs* are very sensitive to a number of human pathogens, hence used extensively in biomedical research.
- *Rabbits* are prolific breeders and relatively having a huge body size compared to rat, mice and guineapigs. They are mainly used in therapeutic trials, raising hyper immune sera and to identify pyrogen in infusion fluids.

*Small size, low cost production, natural host for human disease, omnivorous feeding habit, prolific breeding are the reason for usingh laboratory animals*

## HOUSING OF MICE

- Housing systems for laboratory animals have often been designed on the basis of economic and ergonomic aspects (such as equipment, costs, space, workload, ability to observe the animals and to maintain a certain degree of hygiene) with little or no consideration for animal welfare. The environment of an animal consists of a wide range of stimuli, including the social environment of conspecifics (same species), contraspecifics (other species) and humans, and the physical environment such as the cage and its contents.
- Environmental conditions such as housing and husbandry have a major impact on the laboratory animal throughout its life, not only during the experiment itself, but also before and after the experiment. The traditional care and maintenance of laboratory animals does not usually consider the species-specific needs in relation to housing and feeding regimes. The variability in the specific needs is not only different between species but also, due to variability in the genetic background, among strains of a species.
- However, laboratory mice are usually housed throughout their lives in relatively barren cages and provided with ad libitum food, which frequently results in adverse effects on the animal's behavior and physiology and in ashortened life span due to overfeeding and inactivity.
- Environmental enrichment has been increasingly introduced into laboratory animal research facilities. From a welfare point of view this seems to be a good development as it is generally accepted that with the provision of environmental enrichment the animal's well-being improves.

*Environmental conditions should be given much importance*

**Space requirement**

- It is difficult to scientifically specify the minimum cage sizes for maintaining laboratory mice, as much depends on the strain, group size, age of the animals, their familiarity with each other and their reproductive condition.

- Specifications for laboratory housing of mice are expressed in two documents issued in 1986. One is the European Convention for the protection of vertebrate animals used for experimental and other scientific purposes (Convention ETS 123) from the Council of Europe, with its Appendix A, Guidelines for the Accommodation and Care of Animals (Council of Europe 1986) .
- The other is the very similar European Union Council Directive on the approximation of laws, regulations and administrative provisions of the Member States regarding the protection of animals used for experimental and other scientific purposes (Directive 86/609/EEC) with its Annex II, Guidelines for Accommodation and Care of Animals (European Council Directive 1986) .
- Comparison of space allowances for mice during procedures of the Council of Europe Convention ETS 123 Appendix A from 1986, the revision of the Appendix A expected in 2004, and the U.S. National Research Council's Guide for the Care and Use of Laboratory Animals (Institute of Laboratory Animal Resources 1996)

- Comparison of space allowances for mice during procedures of the Council of Europe Convention ETS 123 Appendix A from 1986, the revision of the Appendix A expected in 2004, and the U.S. National Research Council's Guide for the Care and Use of Laboratory Animals (Institute of Laboratory Animal Resources 1996)

| | 1986 Appendix A | Revised Appendix A | Guide for the Care and Use of Laboratory Animals |
|---|---|---|---|
| Cage height | 12 cm | 12 cm | 13 cm |
| Minimum floor area | 180 $cm^2$ | 330 $cm^2$ | Not recommended |
| Floor area / animal $cm^2$ | | | |
| < 10 g | 40 | 60 | 39 |
| Up to 15 g | 50 | 60 | 52 |
| Up to 20 g | 60 | 60 | 77 |
| Up to 25 g | 70 | 70 | 77 |
| Up to 30 g | 80 | 80 | 97 |
| Up to 35 g | 90 | 100 | 97 |
| Up to 40 g | 100 | 100 | 97 |
| > 40 g | 100 | 100 | 97 |

*Cage height should be 12 cm and floor space ranges between 40 to 100 $cm^2$*

**Cage materials**

- Laboratory mice are usually bred and housed in cages made of polycarbonate or polypropylene with solid floors. Wire-mesh floors are used if experiments require continuous collection of feces and/or urine or elimination of contact between the animal and bedding material.

- However, since mice are nesting animals, they prefer solid floors with sawdust for digging, nesting and resting rather than grid floors . Solid floor cages containing bedding and nesting materials should be used whenever possible.
- Bedding is comfortable for resting, absorbs urine and is used by the animals to establish odor patterns. There should be a balance in terms of cleaning between on the one hand increasing the anxiety of the animals by removing familiar odor patterns and on the other the build-up of harmful ammonia.
- Wood shavings are widely used as bedding material, but fine particles can cause preputial and respiratory disorders. The type of wood can affect physiological parameters in the animal, such as hepatic microsomal enzyme function

*Polycarbonate or polypropylene cages are more suitable, wood shavings are widely used bedding*

## OPTIMAL ENVIRONMENT

- The laboratory mouse has partially adapted to captive life, but still shows similarities to its wild counterparts. The animal's environment should cater for physiological and behavioral needs, such as resting, nest building, hiding, exploring, foraging, gnawing and social contacts.
- Mice are highly susceptible to predators and are thus likely to show strong fear responses in unfamiliar situations if they cannot shelter, including attempts to flee, biting when handled or sudden immobility to avoid being detected.
- Careful handling from young stage onwards together with conditioning to experimental and husbandry procedures is likely to reduce stress responses considerably. For this reason, cages should be provided with shelter / hiding places. Ideally, the animal should feel secure in a complex, challenging environment, which it can control. Security can be achieved by nestable and manipulable nesting material, hiding places and compatible cage mates.
- Hygroscopic material should be avoided as it may cause dehydration in the new born. Nesting material, such as paper towels, tissues, and wood wool, can provide shade from lighting, the opportunity to regulate the animal’s microclimate, a shelter to hide from conspecifics and the ability to control the environment.
- Bedding and nesting material should be in accordance with the mouse's needs - not toxic or harmful to the animal, absorbent, but not dehydrating for neonates, not excessively dusty, economical to use and dispose of, and interfering as little as possible with experiments
One of the possibilities for improving living conditions of laboratory animals is to provide opportunities for the animals to perform a more species-specific behavioral repertoire by providing environmental enrichment. Environmental enrichment or modifications to the environments of animals in order to improve their biological functioning , has been increasingly introduced into laboratory animal research facilities.

*Cage should be provided with shelter, hiding places to over come fear responce; Hygroscopic materials should be avoided to prevent dehydration of young*

- From a welfare point of view this seems to be a good development as it is generally accepted that with the provision of environmental enrichment the animal's well-being improves. It has been shown that barren, restrictive and socially deprived housing conditions interfere with the development and function of brain and behavioral functions. Beneficial effects of environmental enrichment have been described in animals with brain damage and disturbed motor function and an increased arborization of dendrites has been seen in the brain .

- A number of aspects of the animal's environment can be identified for enrichment. These include the social environment (conspecifics and human beings), and the physical environment, consisting of sensory stimuli (auditory, visual, olfactory and tactile) and nutritional aspects (supply and type of food). Furthermore, there is the psychological appraisal of the environment with aspects such as controllability and predictability, which can be increased by structuring the cage with nest boxes, tubes, partitions and nesting material. The nesting material such as tissue was highly preferred by mice.
- Environmental enrichment should meet the animal's needs, be practical, inexpensive and pose no risk to humans, the animals and to the experiment. Enrichment items should be designed and tested, mainly based on knowledge gained in enrichment studies.
- There is concern whether or not environmental enrichment conflicts with the standardization of experiments. Standardization increases the reproducibility and comparability of experiments. It aims at reducing unwanted variation caused by animal and environmental factors and at the reduction of the number of animals needed in experiments.
- Some researchers fear that 'enriched' animals show more variability in their response to experimental procedures because they show more diverse behavior.
- In complex environments animals are not just responding to one stimulus in isolation but to many variable stimuli at once. This may cause increased variation within subjects.

*Nest boxes, tubes, partitions and nesting material like tissue paper are prefred by mice.*

## CLIMATIC REQUIREMENTS

### Temperature

- Environmental temperature has been demonstrated to influence reproduction, organ weight, food and water intake and hematological parameters. These data indicate that the optimal temperature range for mouse rooms is 20-26 °C. According to the European Directive the environmental temperature requirements range between 20- 24 °C.
- Slightly higher environmental temperatures (22 to 24 °C) should be considered if the mice have to be housed in wire bottom cages because of greater air exchange between the cage and the room, or if hairless mice are being housed in cages with limited amounts of bedding.
- The preferences of mice for temperature and found that individual ALB/c mice preferred cage temperature of 28 °C, whereas C57BL/6 preferred 24 °C and that preference depended upon the type of cage flooring.

*Optimum temperature ranges between 20 and 28 °C depending upon the mice strain, cage material used*

### Relative humidity

- Relative humidity should be kept at 55 ± 10% (Council of Europe 1986).
- At low humidity levels, mice may suffer from respiratory problems due to dust from bedding and feed, and drying of mucous membranes.
- At high humidity levels, bedding may fail to evaporate moisture leading to rapid soiling of cages and increased production of ammonia by urease-producing bacteria. Furthermore, infections of the upper airways may occur more easily.

*Relative humidity should be 55 ± 10%*

### Light

- Lighting conditions for the essentially nocturnal mouse are very important. Mice exposed to too high an intensity of light may show retinal atrophy in the long term.
- Animals should be subjected to a regular light: dark cycle, generally 12 hours light, 12 hours dark, but there is some debate concerning the beneficial effect on the animal of an artificial 'dawn' and 'dusk' period.
- A reversed lighting schedule, with lights on at night, can be useful for observing activity of rodents during the day; red light can be used to facilitate daytime husbandry as most rodents are less sensitive to red light than other animals and humans .
- Mice show a preference for a low light intensity and the retina of albino animals may be easily damaged by strong light. Maximum light intensity in the room should not exceed 350 lux and the intensity levels within the cage should be lower, or the animal should be given the opportunity to withdraw to shaded areas, such as a shelter or nest.

*Mice are nocturnal, 12 hours light and 12 hours darkness is advisable, light intensity should not exceed 350 lux*

**Noise**

- Many sounds audible to the human ear and ultrasound (frequencies higher than the human range) are important for rodents .
- Mice are more likely to be disturbed by high-pitched sounds and ultrasounds than they are by lower frequencies; care must be taken not to use equipment that emits these ultrasounds, such as electronic devices and computer-screens .
- It has been suggested that a constant background noise, such as radio music has some benefits in facilitating breeding and making animals less excited, although it could also stress some animals.
- However it may benefit the personnel more, which could have beneficial consequences for the animals in turn .
- The frequency certainly should not exceed 55 dB

*Human audible and ultrasound are important for mice, the noise should not exceed 5 dB*

## REPRODUCTION

- Sexual maturity in mice occurs very early in life and varies with strain and environmental influences. Ovarian follicle development begins at 3 weeks of age and matures by 30 days. Puberty in males occurs up to two weeks later.
- Female mice are poly-estrous, spontaneous ovulators and cycle every 4-5 day. Factors such as season, diet, genetic background and environmental factors influence the estrous cycle. The cyclicity of estrus and ovulation are controlled by the diurnal rhythm of the photoperiod.
- Mating, estrus and ovulation most often occur during the dark phase.
- Light cycles of 12-14 hours light and 12-10 hours dark are necessary to maintain regular estrus cycles. Light intensities either too low (5 lux) or too high (250 lux) in animal rooms can affect the estrous cycle. Circadian rhythms are especially sensitive to interruption of the dark phase by short periods of light.
- Elevated environmental temperatures (> 28 °C) reduce fertility, whereas lower temperatures tend to slow growth rates and delay puberty. High noise levels reduce female fertility .

*Mice are sensitive to light and darkness, high temperature and noise reduces fertility in female*

- Pheromones and the social environment also affect the estrous cycle. Female mice housed in groups will become di-estrous, an-estrous or pseudopregnant, while the introduction of a male into such a group will synchronize their estrous cycles (the Whitten effect).
- If the female is housed with a second male within 24 hours after a successful mating, implantation of fertile egg cells will be prevented and the female will return to estrus in 4-5 days (the Bruce effect). These effects are due to pheromones in the urine of the males.
- Mating can be detected within 24 hours after copulation by the formation of a waxy vaginal plug (a mixture of sperm and secretions from the seminal vesicles and the coagulating glands of the male).
- The gestation period is 19-21days, depending on the strain.
- The effective reproductive life of a female mouse approaches 2 years but,as litter size decreases with aging, females are usually retired by 1 year of age.
- Litter size commonly ranges from 1-14 pups, depending on the strain.

*Pheromones play a vital role Whitten effect, Bruce effect, mating can be confirmed by vaginal plug*

- Pregnant females build nests for giving birth. Unnecessary disturbance or manipulation of a post-parturient female and her litter should be avoided for the first few days following birth. If handling of neonates cannot be avoided, the risk of cannibalism or rejection of the litter can be reduced by gentle
- Handling of the dam and offspring, placing the dam in a separate cage while the litter is being handled, and wearing plastic gloves in order to prevent the neonates from acquiring human scent.
- Cannibalism (which is strain-dependent) can be minimized in most cases by providing a quiet place with reduced light intensity and nesting material and in case mother or pups have to be separated for a while, by rubbing the pups with bedding from the home cage.
- Nursing females usually lactate for 3 weeks. The ‘milk spot’ in the pups (the stomach filled with milk, visible through the transparent skin) indicates sufficient milk uptake in the first 4-5 days after birth .
- If the dam dies or lactation fails when the litter is about 14 days of age, placing a moistened or soft diet and water in the cage may improve survival of pups.
- Sex, strain, age, reproductive phase and environment can have a dramatic influence on physiological and behavioral data. Body weight and growth curves are also influenced by the above-mentioned factors. Body weights of both sexes increase rapidly during the first 6-8 weeks, but they grow more slowly afterwards until 6 months of age, when a plateau has been reached for a few months, followed by a decline

*Female builds nest, while handling litter use plastic gloves, reduced light intensity reduce cannibalism*

## CAGE REQUIREMENT FOR RAT

- There has been a tendency in recent years to enlarge and heighten the cages of rats. A minimum requirement is that the animal should have enough space to turn around and express normal postural adjustments (National Research Council 1996). Obviously, the size needed depends on such factors as the size of animals, whether they are breeding or undergoing experiments.
- For rats, the minimum cage floor size shluld be large enough to allow the rat to sit or lie without any torsion of the body or the tail.

- The cage should also be large enough so that enrichment objects can be offered to rats and they can perform different activities with them. Moreover, since rearing is frequently observed during the exploratory behaviour of rats, the cage should be high enough to allow this.
- A height of 14 cm has been claimed to be too low to allow the upright postures needed in explorative and play behaviours, while heights of 23 cm or even 30 cm have been suggested as being more suitable for rats.
- However, rats also spend most of their time in burrows if given the choice. Rats also tend to prefer lower cages to higher cages or at least the motivation for rearing did not exceed motivation to be in a shelter.
- Hence, the rat cage should have enough height for rearing, as well as the possibility of withdrawal into lower parts, such as below the food hopper. Indeed, the literature seems to indicate only a limited value of space *per se* for rats and places greater emphasis on the complexity of the space and the advantages of group housing

*Cage height upto 30 cm is good*

**Space recommendations for rat cage**

| | Body weight (g) | Minimum floor area ($cm^2$/animal) | Minimum cage height (cm) |
|---|---|---|---|
| Council of Europe 2002 | <200 | 200 | 18 |
| Revision of Appendix A | <300 | 250 | 18 |
| Draft | <400 | 350 | 18 |
| National Research Council 1996 | <100 | 110 | 18 |
| | <200 | 150 | 18 |
| | <300 | 190 | 18 |
| | <400 | 260 | 18 |
| Home Office 1989 | <50 | 100 | 18 |
| | <150 | 150 | 18 |
| | <250 | 200 | 18 |
| | <350 | 250 | 20 |
| Council of Europe 1986 | <100 | 120 | 14 |
| Appendix A | <200 | 170 | 14 |
| | <300 | 230 | 14 |

*Cage height upto 30 cm is good, 100 to 350 square cm floor space depending upon the body weight.*

### The cage material

- The caging material has to be harmless for the animals, inedible, easy to clean and sterilize, resistant to waste products and must be able to withstand attempts to escape.
- Polycarbonate or polypropylene cages are usually preferred by investigators over stainless steel cages, because they are lighter, less noisy and thought to give better heat insulation. However, thermoregulatory responses (e.g. metabolic rate, evaporative water loss and core temperature) were not affected by the floor type (acrylic vs aluminium) within the ambient temperature range of 20-28 ⁰ C .
- There is also some evidence that rats prefer steel over polycarbonate, if accustomed to stainless steel cages. However, for animals raised in polycarbonate cages, neither of these materials appears to be favoured.

*Polycarbonate or polypropylene cages are better than stainless steel cages - they are less noisy, lighter and better heat insulation.*

### Nesting materials

- Nesting materials, such as paper towels or wood wool, are highly recommended for rodents, especially for breeding animals. Pre-weaning mortality can be decreased in some rat strains through the use of proper nesting material.
- Although no studies have determined which type would be best for rats, studies in mice have found no differences in reproductive performance (number of litters, litter size, neonatal mortality) between aspen wood-wool and paper towel as a nesting material.
- Provision of nesting material as a method of enrichment is considered to have a more obvious effect on the welfare of rodents than other cage additions, such as toys. Rats prefer cages with either a nest box, nesting material or both to empty cages.

*Paper towels, wood wool are best choice, nest box also preferred.*

## REPRODUCTION DETAILS OF RAT

- As a nocturnal animal, the rat is most active in the dark and rests during the light period. In the laboratory, rats have a clear circadian rhythm, which follows the light cycle, corresponding usually to 12/12 hours of light and dark.
- The most active periods occur at the beginning and end of the dark period. In addition to activity, this rhythm is also known to regulate various physiological variables. For example, the levels of different hormones can vary according to the time of day, as well as heart rate and food intake.
- The body temperature during the hours of daylight is 35.6- 36 °C increasing during the hours of darkness to 37.8-38 °C.
- The senses of smell and touch are probably the most important senses in rats. These senses enable rats to receive and convey important information about their social and physical environment. For example, such information as the sex, identity, social status and reproductive status of individuals are transmitted by odours .
- Rats can hear sounds in the range of 0.25-80 kHz at 70 dB (Voipio 1997, Barnett 2001) and they emit a large repertoire of ultrasonic vocalizations ranging from 22 to 80 kHz ).

*Nocturnal animal, 12/12 hours light and darkness, sense of smell is vey important in rat reproduction.*

- Vision is thought to be a less important sense to the nocturnal rat. However, it is known that rats have cones sensitive to visible light and others to ultraviolet, and evidence of dichromatic colour vision in the rat has been found in behavioural discrimination tests.
- The average lifespan of laboratory rats varies between 2-4 years, depending on the strain and sex of the animal, its diet and living conditions. For example, the maximum lifespan of Wistar rats under laboratory
- conditions is about 1200 days for males and 1400 days for females .
- The rat reaches sexual maturity on average at the age of 2-3 months. Like other rodents, rats can breed throughout the year. Females have a continuous, short oestrous cycle of 4-5 days, a gestation period of 20-21 days and litter sizes averaging 10 pups in outbred rats. Female rats can reach maximum weights of 400 g and males 800 g, though body weights can vary greatly with the stock or strain.
- In nature, the Norway rat is omnivorous, eating a wide variety of plant matter as well as invertebrates and small vertebrates.
- In the laboratory, commercial feed is generally supplied *ad libitum* in pelleted form. The nutritional requirements of rats also varies with sex, physiological condition and age (National Research Council 1995).
- The major physiological features of the rat's digestive system include a stomach containing both nonglandular and glandular regions, a relatively well developed cecum and the absence of a gallbladder .
- Moreover, rats ingest their own faeces (coprophagy), as a source of such vitamins as vitamin K and biotin.

*Age at sexual maturity 2-3 months, breed throughout the year, estrous cycle 4-5 days.*

## HOUSING STANDARDS FOR GUINEA PIGS

### Housing in pairs (1 male, 1 female)

- This housing condition is appropriate for guinea pigs, since no fighting and threat displays are found between the sexes in this species.
- Moreover pair reared males can cope more effectively with adversity than can individually housed conspecifics.

### Housing in harems (1 male, several females)

- This housing condition is also appropriate for guinea pigs.
- Although agonistic interactions can occur between females, such aggression is rare and of low intensity: escalated fights and bites almost never occur.

### Female groups

- Housing in all-female groups can be recommended. The number of individuals is limited only by the enclosure size (at least 0.25m²/animal), since females can be housed without problems in large groups.
- Although in all-female groups levels of aggression are slightly higher than in groups with one male and several females, aggression is rare and of low intensity.
- As is also the case in groups of one male and several females, escalated fights and bites almost never occur. Moreover, females living in large all-female groups are not subjected to high degrees of stress.

### Male groups

- Agonistic behaviour is rarely or never found in groups consisting of two males. In contrast, from the age of about 3-4 months escalated agonistic interactions frequently occur in groups of more than two males. Additionally, animals that live in groups of two or four individuals show lower concentrations of the stress hormone cortisol than those living in groups of six or twelve.
- Thus, good welfare seems to be promoted in groups of two males, while indicators of social stress regularly occur in larger groups.
- Therefore, we recommend - if mixed sex housing is not possible- that male guinea pigs be kept in groups of two.

Mixed-sex groups of a few males and females

- Housing in small mixed-sex groups can also be recommended. However, the formation of such a group with animals of unknown origin should be avoided since it frequently leads to intensive threat and fighting behaviour, as well as extreme stress responses and injuries

*Harem or mixed group housing is advisable.*

**General Housing**

- Guinea pigs can be kept in either pens or cages. Good experiences have been achieved with ground housing.
- In this case, bedding (such as wood shavings) - is necessary. However, it should be noted that flagstones can be irreversibly contaminated with urolithic acid.
- It is also important to provide sufficient space. Overcrowded conditions in cages can lead to endocrine stress reactions and higher frequencies of aggression. The minimum cage size should not be less than 2500 $cm^2$ per animal (according to the European convention Appendix A 600 $cm^2$ for adult guinea pigs, Council of Europe 1986).
- A height of about 15 cm (as in Makrolon cages type III: 39x23x15 cm) does not provide sufficient space, as it can impair the play behaviour (frisky hops) of juveniles and prevents adult individuals from fully rising. We suggest a minimum height of 30 cm.
- Specific forms of gratings (e.g., in metabolic cages) can also cause problems and cages with grid floors are inappropriate, since they are often the cause of diseases (e.g., pad abscess).
- Especially young animals are vulnerable, because their extremities can be injured in wide meshed grids. Structural divisions, such as huts, should also be offered, to provide all animals with a place of refuge.

*ground housing had better performance, minimum space is 2500 $cm^2$ per animal, minimum cage height 30 cm*

## GUINEA PIG REPORDUCTION

- New-born guinea pigs are precocial. They look like small-sized adults. They are fully furred, their eyes are open and the teeth are fully developed.
- On the day of birth the young guinea pigs start to eat solid food and drink water, although lactation lasts for 2-3 weeks. Young males reach their sexual maturity within 2-3 months of age (body mass about 500 g), while young females may reach sexual maturity at less than one month of age (with a body mass of about 300 g).
- Guinea pigs are fully grown at the age of 8 to 12 months. Under laboratory

conditions they can live for 3 to 4 years and reach a body mass ranging from 800 to more than 1000 g. Adult guinea pigs measure up to 30 cm in length.

- Female guinea pigs show a postpartum oestrus, thus becoming receptive immediately after giving birth. If they do not become pregnant at that time, females show periodical oestrus cycles of about 16 days. They show some behavioural changes like increased locomotor activity and increased frequencies of marking behaviour during their oestrus cycle.
- The young are born after a gestation period of around 67 days. Usually 1-4 young are born in one litter. Guinea pigs do not show a day-night cycle of activity. Instead, they are characterized by an ultradian rhythm, that is, alternating phases of activity and rest that lasting for about 2-3 hours. Thus the activity of these animals is not dependent on the light-dark regime.

*Precocial, day old young eat solid food, sexual maturity in less than one month, postpartum estrus is common, gestaton 67 days, activity not depend on light-dark regime*

- The vision of guinea pigs is characterized by two types of cones in the retina, having peak sensitivities of about 429 nm and 529 nm. This suggests a retinal basis for a colour vision capacity. Behavioural tests show that guinea pigs have dichromatic colour vision with a spectral neutral point centered at about 480 nm. However, they may have poor depth perception.
- In contrast, the auditory range of guinea pigs appears to be better than that of humans, especially at high frequencies. Although guinea pigs have a maximum sensitivity ranging between 500 and 8,000 Hertz, they are known to be responsive to an even broader range of frequencies between 125 to 32,000 Hertz. However, the upper limit of their auditory sensitivity most likely approaches 40,000 to 50,000 Hertz.
- Olfactory perception in guinea pigs plays an essential role in the social behaviour of these animals Male guinea pigs mark individual females with their anal glands. Guinea pigs also mark the environment with their anal glands. Urine has a high communicative value for this species. Young guinea pigs, for example,discriminate between maternal urine and urine of an unknown lactating female

*Olfactory perception is important, vision is of poor perception*

Last modified: Monday, 4 June 2012, 01:37 PM

## SPECIFIC PATHOGEN FREE TECHNIQUE

- Specified Pathogen Free (SPF) animals may be defined as animals that are *free of specified microorganisms and parasites*, but not necessarily free of those specified.
- Animals must be drawn from stock that has originally been established by hysterectomy and maintained within a barrier designed to discourage the entry of undesirable organisms.
- They are cared for by skilled technical staff and maintained on diets, bedding and nesting materials known to be free of pathogenic microorganisms.
- In the SPF unit the animal technician still has direct contact with the animals, compared with a Germ Free unit where the animals are entirely enclosed within an isolator. The successful operation of an SPF unit depends on a *high standard of management* to prevent ingress of pathogens.
- The results of experiments in which SPF animals are used are likely to be more meaningful due to the lack of interference by overt or sub-clinical disease. There is evidence to indicate that fewer animals need be used in an experiment because of the more reliable results obtained.

*Free of specified microorganisms, animals drawn orginally by hysterectomy, high standard of management required, more reliable results*

## DESIGN, OPERATION AND CONSTRUCTION OF THE BUILDING

- The building is constructed to a high specification to make it virtually air-tight so that only air from the air-conditioning plant is introduced to the animal unit, which is at positive pressure to the atmosphere.
- All materials entering the unit are sterilized and staff may only enter after taking precautions against carrying in infections.
- They are usually required to shower thoroughly and change into sterile clothes. Colloquially the inside of the unit behind the shower is known as the *'clean'* side, and the outside is the '*dirty*' side.
- Walls floors and ceilings are of solid construction with no voids or cavities which could easily be pierced from the inside or outside of the building; this means extensive use of brick and concrete.
- Windows are usually absent from the animal rooms and are only provided, if at all, in the staff room and then they are double glazed with toughened or even armored glass. Finishes to walls, floors and ceilings are usually of tough, flexible materials applied as thick plastic paints or vinyl sheeting, which are easily cleaned and discourage the adherence of dirt.
- The gaps around doors, windows, pipes, ventilator terminals etc. are sealed with a non-setting mastic which accommodates the slight movement which occurs when dissimilar materials such as brick and wood are adjacent.
- Rodent barriers consisting of vertical metal sheets with a 5 cm (2 in) lip at the top are placed across the doors at each end of the shower unit to prevent wild or escaped animals entering or leaving the unit. They are usually about 45 cm (18 in) high and can easily be stepped over by staff.

## SHOWERS

- The shower suite usually consists of *five sections*.
    - The *first* forms an air-lock and should contain an insecticide dispenser or electric insect killer to prevent flies entering the unit.
    - The *second* section is where outside clothing is removed before proceeding to the *third* section, the shower itself. The spray may be controlled manually or started by closing the door and will run for a pre-set time before the door to the next section can be opened.
    - The *fourth* section is a drying and dressing area where sterile clothing (supplied daily) is put on before passing to the *fifth* and final section which is an air-lock leading to the animal area.
- The air flow through the shower suite is always from the interior to the exterior and air pressure should be detected when opening the doors on entering the shower suite. When personnel leave the unit they need not shower although they may do for cosmetic reasons. The 'clean' side clothing may be left inside the unit or taken to the 'dirty' side for laundering and re-sterlization.
- Personnel represent the greatest hazard to the SPF unit and anyone with cuts, sores, colds or intestinal upsets, for example, which may result in infectious conditions being transmitted to the animals, should not be allowed to enter. Similarly those who have been in contact with conventional laboratory animals should undergo a *'waiting period'* before entering the SPF unit. This period varies from 3 days to 2 weeks depending on local conditions and judgements. Because of the risks staff should be discouraged from keeping pets at home.
- Because staff are such a hazard to the unit only those of a high integrity should be selected to work in SPF units. At weekends the unsupervised technician is on trust to carry out the unit's protocol.

## CLOTHING

- A variety of suitable clothing is available. Underwear with shirt, trousers or a boiler suit are common, together with a paper hat which covers the hair.
- Face mask and surgical gloves may also be worn. Footwear usually consists of lightweight wellington boots or plimsolls.

## AIR FILTRATION

- Air entering the unit is sterilised by filtration. The air first passes through a roughing filter which removes gross debris such as insects and large dust particles and requires changing frequently either by pulling a clean section of a roll of filter material into position across the inlet duct or by having two filters in series and changing only one at a time so that all air passes through a roughing filter.
- The air passes over a heater battery and usually through a humidifier consisting of a fine water spray or steam jet before entering the fan chamber. Up to this point the air has been sucked through the filters by the fans but having passed through the fan chamber it is then forced through intermediate fine filters and finally through absolute or **HEPA** (High Efficiency Particulate Air) filters.
- When the absolute filters are changed it is essential to have two filters in series or parallel so that the inside of the unit never comes into direct contact with partially filtered air.
- Air is delivered to the unit at a greater rate than it is removed by the extraction system thus creating a positive pressure. Air should leak out through the shower suite to prevent unfiltered air blowing in. The pressure of the rooms is usually 12 mm (1/2 in) water gauge to the corridors which are at 12 mm (1/2 in) water gauge to the outside.

- Air is extracted from the animal room through a medium filter which retains dust and fur, by a fan in the exhaust duct which blows the air through a non-return flap or damper which closes automatically in the event of a failure of the air supply to prevent unfiltered air entering the unit.

## WATER TREATMENT

- Some users consider that as ordinary chlorinated tap water is fit for human consumption it is adequate for SPF animals.
- Others prefer to add more chlorine to a level of 15 ppm or to acidify the water to pH 2.5.
- More sophisticated water treatments involve sterilisation by filtration through porous ceramics or by using ultra-violet (UV) light.
- Piped 'on tap' disinfectant systems for washing down rooms and floors are of dubious value; apart from the very high cost of adding the disinfectant there is evidence to suggest that certain micro-organisms thrive even in high concentrations of the disinfectant solution.

## STERILISATION OF NEW SPF BUILDING (BLOCKS)

- After the building has been handed over by the contractor it should be thoroughly cleaned and washed down. The ventilation system should be run at full power before the absolute filters are fitted to blow any dust out of the ducts.
- The absolute filters should then be installed. Walls, floors, ceilings andthe outside of ventilation ducts should be thoroughly swept down. This should be followed by a further wash down with a hot solution of 4% washing soda which will substantially reduce the microbiological load and remove any oil or grease that may be present.
- The dunk tank should be filled with the liquid sterilant to be used. All doors except those to the outside air-lock of the shower suite should be propped slightly open to allow the fumigant to penetrate the shower unit.
- The external intake and exhaust grills of the air conditioning system should be sealed with polythene sheet attached with PVC tape. (All the trunking of the air conditioning system should be gas tight but this should be checked with the site engineers) A sterilized set of clothing should be placed in the inner changing room ready for the first entrant after fumigation.
- The total volume of the SPF unit should be calculated to determine the amount of formalin solution (37% solution of formaldehyde gas in water and stabilized with methyl alcohol) that will be required to be evaporated. (Useful rule of thumb figures are 1 ml of a 10% formalin solution per cubic foot or 35 ml per cubic metre.
- The safest and most convenient method of evaporating formalin is to use electrically heated vessels, fitted with thermal cut-out devices strategically placed around the unit.
- Prills which release formaldehyde when heated may also be used and require their own appropriate type of heating vessels. A simple method of switching on all these vessels at once is to use the main switch for the power circuits (not lighting) situated outside the SPF area.
- The heating vessel should be filled with the appropriate quantity of formalin or prills and if possible the relative humidity in the unit raised to about 80%. (The most practical way of achieving this is to wet the floors with hot water and allow evaporating). The exit doors to the unit should be closed and sealed with tape and warning notices displayed. The main switch is turned to ‘on’ and fumigation proceeds.
- After a few minutes fumes should be visible through the viewing window. The building should be left for at least 24 hours before it is purged of fumigant. This is done by removing the sealing cap from the intake to the air conditioning system and switching on the intake fan. After a few minutes the unit becomes pressurised and the sealing cap is removed from the exhaust grill: finally the exhaust fan is turned on. One or two days should elapse before entering the unit.
- A normal SPF entry can be made taking care that the outer door to the first air lock is shut before the second door is opened leading to the changing room.

- The usual showering routine is followed, unpropping and closing each door as the entry proceeds. The previously supplied sterile clothing is put on in the inner changing room. All equipment, such as racking, cages and domestic supplies, is passed into the unit via the autoclave or dunk tank as appropriate. The unit is now ready for use.
- (NB. If the unit forms part of a larger building considerable caution should be exercised and investigation undertaken before fumigation as there is a risk of fumes leaking to other parts of the building.)

## DIET STERLISATION

- There are *three effective methods* of slterilising diets:
  - Autoclaving
  - Fumigation
  - Irradiation

### Autoclaving

- The autoclave may be programmed to provide a high temperature, short exposure cycle (130° C for 1-2 min) or a lower temperature, long exposure cycle (121° C for 10-15 min).
- The first method is preferable as the total amount of heat applied to the diet is less and the damage to nutrients is less in consequence. The procedure for autoclaving diet is to spread the pellets on shallow wire trays to a depth of 2.5-5.0 cm (1-2 in) to allow rapid steam penetration. If the autoclave is a high vacuum machine it is beneficial to draw a vacuum for 10 minutes after the sterilising cycle in order to dry the diet.
- Autoclaving may damage nutrients by destroying vitamins and denaturing proteins and pellets may be physically damaged by the time sterilisation temperature is reached throughout the pellet.

### Fumigation

- Fumigation employs a modified autoclave into which a sterilising gas such as ethylene oxide is introduced. A serious disadvantage is that the diet has to be ventilated for up to 3 days before it is free of fumigant and there is a suspicion that some toxic compounds are formed. Therefore this method is not widely used.

### Irradiation

- The most common method of sterilization is irradiation using gamma rays produced by the radioactive isotope $^{60}$Cobalt ($^{60}$Co). These highly penetrating rays are effective for destroying microorganisms without causing the exposed materials to become radioactive. The unit of measurement of radiation is the rad and diets intended for SPF animals usually receive a dose of 2.5 megarads (Mrads). Diets for germ free animals are generally passed through the irradiation plant twice and so receive a total dose of 5.0 Mrads.
- An important advantage of this method is that the nutritional and physical damage to the diet is minimised as the temperature rise is limited to 2 or 3 ° C. The diet is packed in a plastic bag (12.5 kg is usual) which is evacuated to prevent oxygen reacting with the gamma rays and then sealed. This bag is then sealed in a second bag and finally placed in a fibre-board box or paper sack. The package is now passed between the radioactive sources within the irradiation plant.
- A previously applied yellow or orange indicator sticker should have turned dark red when the package emerges indicating that it has received a dose of 2.5 Mrads. (Diets intended for germ free animals receive a second sticker and the process is repeated, the doses being

cumulative). The high capital cost of the irradiation plant and the expenses of double wrapping, packing and transportation are reflected in the market price.

- On receipt at the SPF unit the packages should be carefully handled and stored to prevent any of the wrappings becoming punctured or damaged. The diet is passed into the unit as follows:
- There should be two operators on the outside ('dirty side') of the unit wearing sterilized outer clothing and gloves. At a point very close to the dunk tank the package is opened by an operator who must only handle the outside of the package and who checks the indicator sticker is dark red. The second operator withdraws the double wrapped bag of diet and checks that the inner bag feels hard and is therefore still under vacuum. The outer bag is opened and the inner bag containing the diet carefully slipped into the dunk tank. The bag of diet is passed through the germicidal solution and is withdrawn by staff inside the SPF unit.
- Care should be taken to prevent trapped air bubbles reaching the inside of the SPF unit. Diet which appears wet indicates a punctured wrapping and must not be taken into the SPF unit.

## INTRODUCTION OF ANIMALS

- Animal colonies are established within the unit by introducing stock from an SPF or germ free source.
- Further pathogen-free young obtained by hysterectomy of pregnant animals outside the unit are passed aseptically through the barrier and are fostered by the previously introduced pathogen-free females.

## MICROBIOLOGICAL SCREENING

- A sample number of animals are submitted to a pathology laboratory for screening. Alternatively swabs from animal faeces, walls or floors or samples of animal faeces or water supply may be sent for culturing.
- A Petridish of culture medium may be left open in the unit to monitor the air for organisms before being resealed and again sent for culturing. Submitting an animal for microbiological testing is the most useful and logical method as this is the product of the SPF unit.
- If on-site facilities for culturing are not available the Medical Research Council Laboratory Animals Centre, Regional Veterinary Investigation Centres, Local Public Health Laboratories or commercial diagnostic laboratories will provide this service.

## ISSUE OF ANIMALS

- Boxes for dispatching animals from the SPF unit are usually cardboard or plastic with a pad of fine filter material stapled or taped over the wire mesh vents.
- The whole box is autoclaved into the unit, animals for issue placed inside, the lid sealed on with tape and the whole box passed out through a special exit lock fitted with an ultra-violet lamp.
- Alternatively a single flap door may be used which relies on the outrush of air to maintain the barrier when the box is passed out.

## DISPOSAL OF WASTE

### Drains and lavatories

- Water may be used in SPF units for hosing down and general cleaning purposes. A standard drainage system is used with an extra water trap on the main exit pipe.

- If a drain remains unused for an extended period the water may evaporate sufficiently to break the seal and allow organisms from the sewer to enter the unit (though the second trap should prevent this). Water poured down the unused drain once a week will maintain the seal.
- Alternatively a small quantity of light oil poured onto the surface of the water will prevent evaporation. Dry cleaning systems where few drains are used considerably reduce this problem.
- It is generally accepted that providing lavatories inside the SPF unit presents no great risk or contamination if staff observe high standards of hygiene and is almost certainly less than if they had to leave the unit and return. The flushing mechanism is preferably operated by a foot button.

### Waste materials

- Apart from wastewater, which has already been considered, the waste materials from a SPF unit are dead animals, general refuse and large quantities of soiled bedding. These are usually passed out through the autoclave but not sterilized.
- When the autoclave has been unloaded front the clean side following a sterilization cycle, the outgoing refuse may be loaded in and passed out.
- In some instances the exit port used for issuing animals may be used. Refuse from an SPF unit is, of course, as microbiologically 'clean' as the unit itself.

## MODULE-13: CARE AND MANAGEMENT OF MICE AND RAT

Learning objectives

This module discuss about,

- biology, anatomy and reproduction of laboratory mice and rat,
- their feeding, housing, and handling management,
- reproductive management and sexing and
- common diseases of laboratory rat and mice.

## THE MOUSE

- The mouse is the most commonly used experimental animal, probably because of its small size and fecundity.

- A mouse can produce a litter every 3 weeks and 5 generations can be achieved in one year. There are many inbred and outbred strains in a variety of coat colours; these include leukaemic, spontaneous tumour bearing, obese, blind, tail-less and athymic nude.
- The majority of mice are used for cancer research.

## BIOLOGICAL DATA

### The mouse (*Mus musculus*)

| | |
|---|---|
| Body temperature | 37.40°C (99.50°F) |
| Age at sexual maturity | 5 weeks |
| Age at first mating | 6 weeks |
| Oestrous cycle | 4-5 days |
| Duration of oestrus | 10-20 hours |
| Gestation | 19-21 days |
| Litter size | 8-11 |
| weaning age | 18 - 21 days |

*Age at first mating 6 weeks, litter size 8-11, weaning 18-21 days*

- Last modified: Monday, 4 June 2012, 01:48 PM

## ANATOMY

- The mouse is a rodent exhibiting the typical dentition of this order.

- Only the female has nipples, a fact which can assist in sexing the very young animal prior to their becoming obscured by hair growth.

## REPRODUCTION

- Oestrus last for 10-20 hours in the 4-5 day oestrous cycle.
- After mating, a copulation plug may be seen in the vagina or on the droppings tray of a wire floor cage.

- Gestation is *19-21 days* and the young are born blind and naked. Fur is seen at 5 days of age, the eyes open at 14-15 days, and the ears open at 14 days.

- The young may be weaned at 18-21 days. *Mice* come back into breeding conditions immediately after giving birth to their young and if kept with a male mating is likely to occur at the post partum oestrus.

- It is then essential to wean the first litter before the second is born or the newborn litter may be smothered, or cannibalism may occur.
- Pseudopregnancy lasts for 12-14 days and may be induced by a sterile mating.


*4-5 days estrus cycle, 19-21 days gestation, weaning at 21 days*

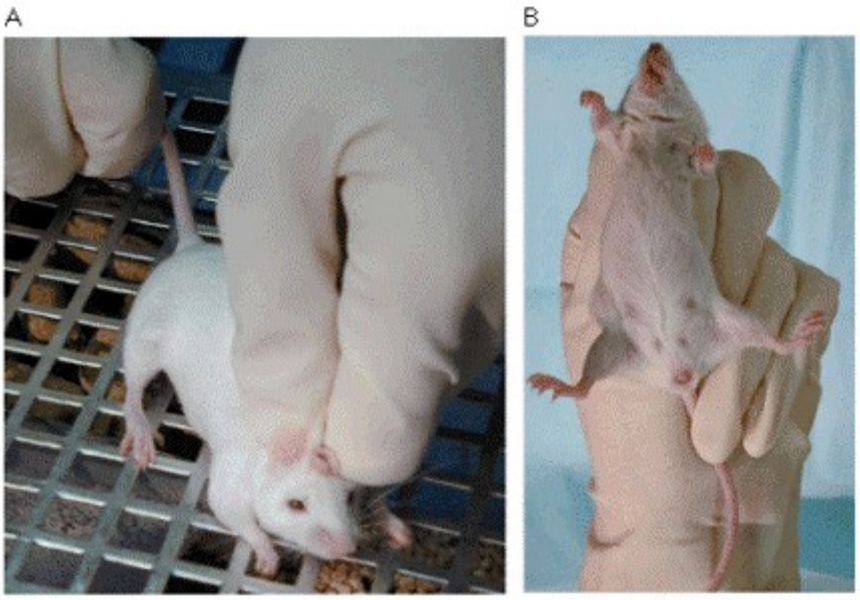
## NUTRITION

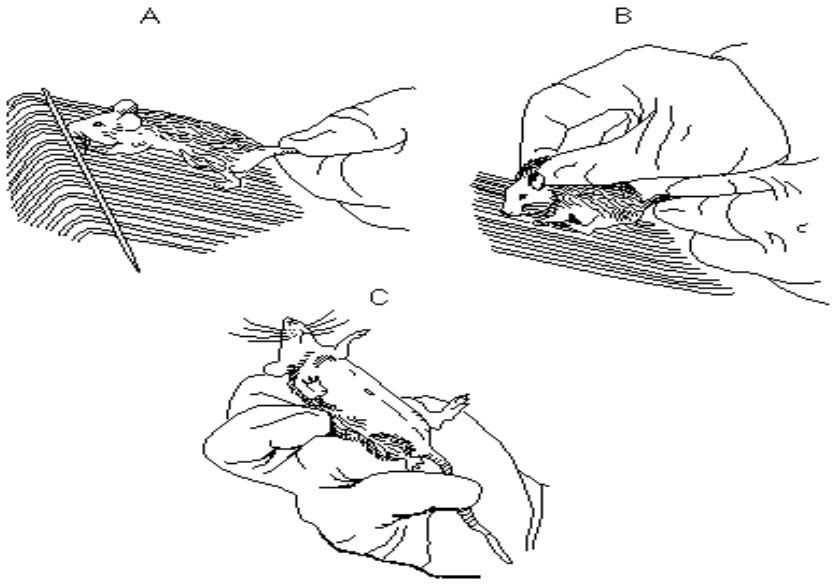
- Food and water should be available at all times.
- A diet containing 18-20% protein for breeders and 15-16% for stock is given in a pellet about 25 x 10 mm diameter (1 x 3/8 inches).
- Some black strains have difficulty in gnawing hard pellets, possibly due to congenital tooth malformation.

## HANDLING

- The mouse should be picked up by the scruff of the neck using thumb and forefinger, or by holding the base of the tail with one hand and gripping the scruff with the other as described.
- With the mouse held this way, the handler is unlikely to be bitten and the animal is secured.
- A refinement of this technique allows one hand free for dosing or injecting.

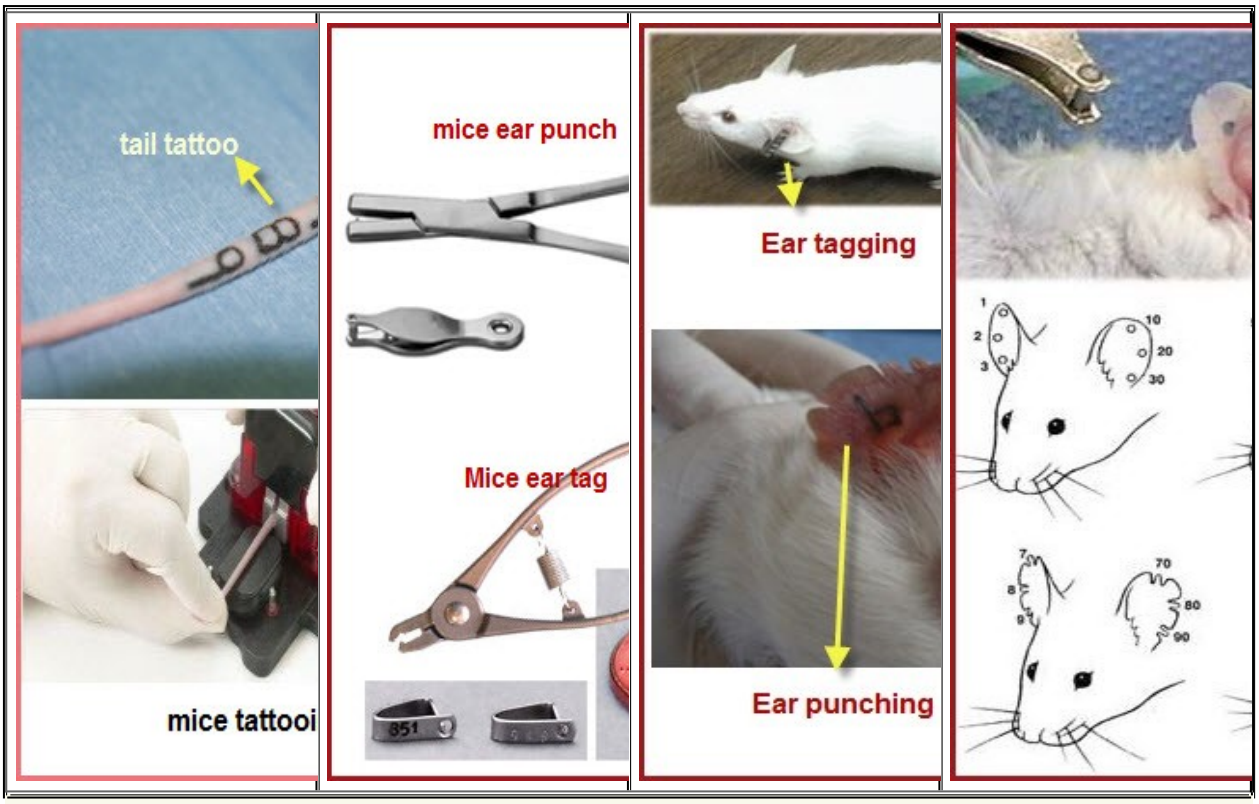
| | | | |
|---|---|---|---|
| **Handling and sexing** | **Holding a mouse** | **Giving intravenous injection** | **Giving S/C injection** |




## IDENTIFICATION

- White or light coloured mice may be individually identified by using fabric or histological dyes as a code on the coat.
- It has been found that some green dyes cause hair loss and picric acid is unsuitable as it is believed to be carcinogenic.
- *Mice* may be identified by a tattoo at the base of the tail using a specialised instrument, or by punching a code of holes in the ears with a chicken toe punch.




## ENVIRONMENT

- The room temperature should be about 21°C (70°F) with a relative humidity of about 50%.
- There should be a definite lighting regime of approximately 12 hours light and 12 hours darkness for breeding animals.
- Permanent light gives rise to anoestrus and the females will not allow mating.
- Natural light through windows may cause seasonal variation in breeding performance.
- Some strains of mice do not breed well when kept in close proximity to another particular strain, the reason for this is not known but pheromones may be involved.


## CAGING AND BEDDING

- Breeding pairs or trios are usually housed in cages with dimension of 25x13x13 cm (10 x 5 x 5 inches), harems (1 male - 5 females) or stock mice (15-20) in cages 50 x 25 x 15cm (20 x 10 x 6 inches), contructed of polypropylene or other heat stable plastics with a wire mesh top designed to hold food and a water bottle.
- Soft whitewood shavings or sawdust may be used as bedding material and shredded paper for nesting if necessary.

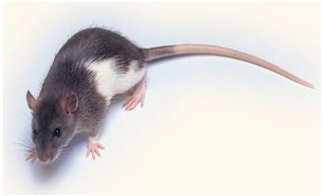

## COMMON DISEASES

| Type | Common name | Causal agent |
|---|---|---|
| Bacterial | Salmonellosis<br>Tyzzer's disease | *S.enteritidis,*<br>*S.typhimurium Bacillus piliformis* |
| Viral | Ectromelia-mousepox Enteric mouse hepatitis virus (EMHV) Mouse hepatitis virus (MHV) | Virus Virus Virus |
| Endoparasitic nematode | Round worms | *Aspicularis tetrapetra and Syphacia obvelata* |
| Ectoparasitic mite | Body mange Head and neck mange | *Myocoptes musculinus Myobia musculi* |

## THE RAT (Web link...)

- The rat is an intelligent animal easily tamed by handling.
- There are inbred strains such as PVG/C, WAG, Lewis and DA.

- The non-inbred strains include Wistar,Sprague-Dawley and hooded Long Evans. They are used extensively for nutritional and toxicological studies.

| | | |
|---|---|---|
|  |  |  |
| **Hooded Long Evans** | **Wistar** | **SPrague-Dawley** |
|  |  |  |
| **Lewis** | **Zucker rat - obesity** | **Hairless rat** |

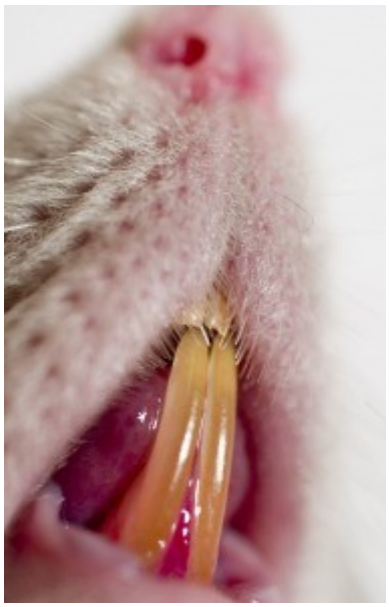
## BIOLOGICAL DATA

### THE RAT (*Rattus norvegicus)*

| | |
|---|---|
| Body temperature | 37.5°C (99.5°F) |
| Age at sexual maturity | 40-50 days |
| Age at first mating | 70 days |
| Oestrous cycle | 4 – 5 days |
| Duration of cestrus | 10 – 20 hours |
| Gestation | 21 – 22 days |
| Litter size | 9 – 11 |
| Weaning age | 18 – 21 days |

## ANATOMY

- The rat is a rodent with typical dentition for this order. Like the mouse only the female has nipples which are a guide to sexing very young animals.



- The rat does not have a gall bladder, bile is produced in the liver and passes directly to the duodenum via the bile duct.

## REPRODUCTION

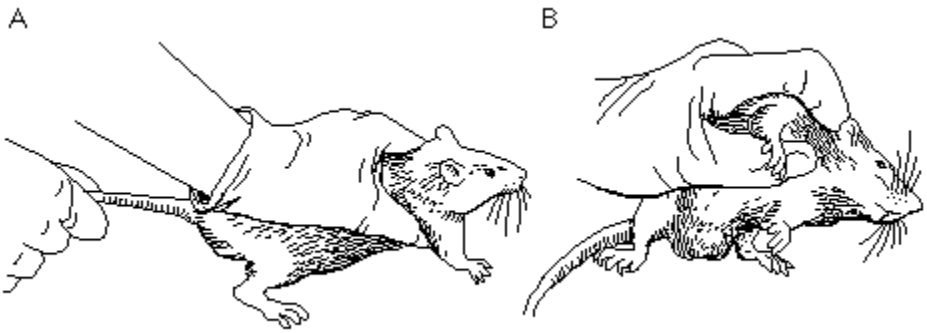
- Oestrus lasts for 10-20 hours of the 4-5 day oestrous cycle.
- A straw coloured copulation plug may be seen in the vagina or because of its size on the droppings tray of a wire bottomed cage.
- Gestation is 21-22 days and the young are born blind and naked.
- *Rats* may be kept in monogamous pairs, all their breeding lives thereby taking advantage of the postpartum oestrus, or in harems with one male to 6-8 females, removing the females to separate cages when they are obviously pregnant and returning them to the harem after the young are weaned.

## NUTRITION

- Food and water should always be available. Breeding animals require a diet containing 18-20% protein and stock 15-16 % given in pellet form approximately 25 x 10 mm (1x 3/8 inches) in size.
- Many commercially available rat diets are suitable for breeding and maintenance.

## HANDLING

- The rat should be picked up by placing one hand over its back and grasping it firmly round the neck so that it cannot turn its head to bite.
- When animals become tamed they can be picked up by holding them around the shoulders.



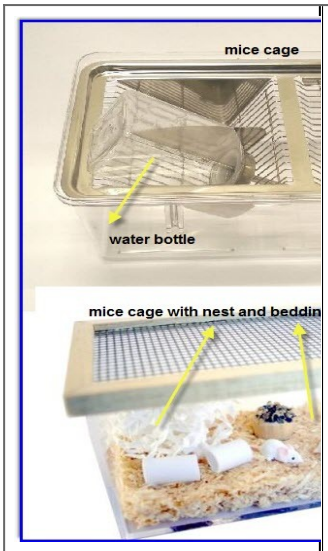
- A pregnant animal should be given additional support by cupping the other hand round the lower part of the animal's body and legs.

## ENVIRONMENT

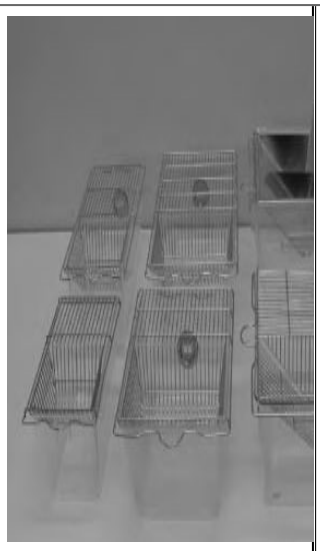
- The room temperature should be about 21°C and the relative humidity at about 55%.
- Low humidity is thought to cause 'ringtail', a condition where the rat's tail becomes ringed or constricted and in extreme cases can slough off. In a very dry atmosphere the humidity may be increased by leaving floors wet after washing or by placing open pans of water in the room.

## CAGING AND BEDDING

- Breeding pairs can be housed in boxes with a minimum height of 25 cm and an area of 55 x 27 cm, with a wire mesh top to hold food and water bottle. Harems and stock (e.g. 6 adults) should be housed in larger boxes, harems and animals over 100 gm need 250 $cm^2$ per animal and stock up to 100 g 150 $cm^2$ per animal.
- Solid floors or wire grids with a tray for faeces below are both suitable, the latter allowing greater air flow through the cage thereby decreasing the immediate humidity.
- White softwood shavings or sawdust can be used for bedding material and shredded paper or wood wool for nesting.

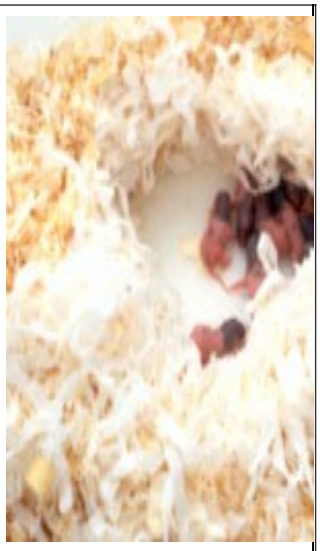



**mice cage**

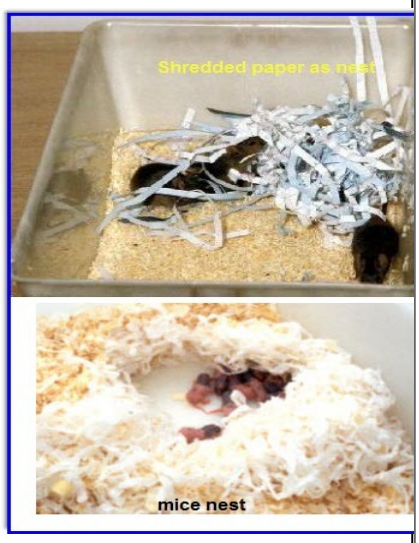


**mice cage with watering bottle**


**bedding maerial**



**mice nest**




**shredded paper nest**

**wood shaving as bedding**

**mouse nest**

## COMMON DISEASES

| Type | Common name | Causal agent |
|---|---|---|
| Bacterial | Labyrinthitis (Middle ear disease) | *Streptobacilius moniliformis* |
| | Paratyphoid | *Salmonella enteritidis Salmonella typhimurium* |
| Viral | Chronic respiratory disease (CRD) | A mycoplasma and a virus |

| | | |
|---|---|---|
| | Endemic pneumonia | |
| Endoparasitic nematode | Round worm | *Syphacia obvelota* |
| Ectoparasitc mite | Mange | *Myobia ratti*<br>*Myobia musculi*<br>*Notoedres spp* |
| Physiological | Ringtail | Possibly low humidity<br>  |

# MODULE-14: CARE AND MANAGEMENT OF GUINEA PIG AND HAMSTER

Learning objectives

This module discuss about,

- biology, anatomy and reproduction of guinea pig and hamster,
- their feeding, housing, and handling management,
- reproductive managemetn and sexing and
- common diseases of guinea pig and hamster.

## THE GUINEA PIG

Know more...

- Guinea-pigs have been extensively bred by pet fanciers and there are now three main varieties
  - English (smooth hair),
  - Abyssinian (rosetted hair) and
  - Peruvian (very long hair).
- There are many colour variations of these and new ones are constantly being bred.

## BIOLOGICAL DATA

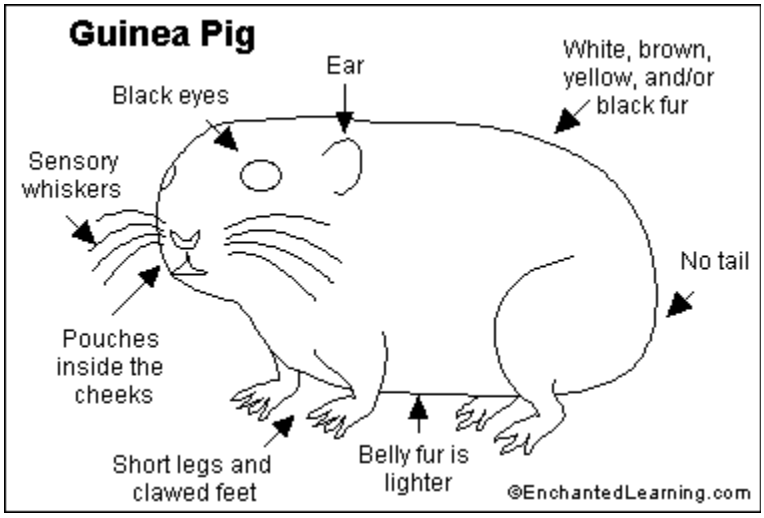
- **The Guinea- Pig** *(Cavia porcellus)*

| | |
|---|---|
| Body temperature | 38.3-40°C (100-104°F) |

| | |
|---|---|
| Age at sexual maturity | 60-80 days |
| Mating weight | 500 g |
| Oestrous cycle | 14-16 days |
| Duration of oestrus | 6-11 hours |
| Gestation | 59-72 days |
| Litter size | 3-6 |
| Weaning age | 14 days |

## ANATOMY

- The guinea-pig is an herbivorous rodent, a fact which is reflected in its anatomy.
- It has rodent dentition and the alimentary canal is typical of a herbivore, having a large caecum for cellulose digestion.
- There are two mammary glands and the nipples, situated in the groin, are found in both sexes.
- The guinea-pig has no tail, has 4 toes on the front foot and 3 on the hind foot.




## REPRODUCTION

- There is no defined breeding season but in an environment influenced by natural light, seasonal variation may be apparent.
- Guinea-pigs are commonly bred in harem systems of 1 male to 5-7 females.
- Oestrus can be observed by the degree of vaginal opening and copulatory plugs, usually found on the floor of the cage, will indicate mating has taken place. By recording these signs mating can be timed.

- When the guinea-pig is not in oestrus the vagina is normally sealed by a membrane. However, it is possible to rupture this and it is therefore not a full proof indication of the stage of oestrus.
- Guinea-pigs exhibit a post-partum oestrus and if the harem is left intact further mating will occur.
- The young are well developed at birth and will suck any lactating female in the harem. Accurate breeding records are difficult to keep with this system. Young are normally weaned at 14 days but with care can be weaned from birth.

*No defined breeding season, harem mating is best, copulation plug on floor inicate mating, post-partum estrus is common, weaning at 14 days*

## SEXUAL MATURITY

- Guinea pigs usually shows sexual activity by 10$^{th}$ week but it is better to breed them after 12 weeks of age and their breeding life is about 2 years.

## SEASONALITY OF BREEDING

- Non-seasonal breeding is noticed under laboratory condition but females kept in outdoor condition show *anoestrus in winter*.
- Guinea pigs are *polyoestrus*. Oestrus lasts for about *8 hours* and ovulation is spontaneous and occurs *1-2 hours later*.

## OESTRUS SIGNS

- Most of the time a thin membrane will cover the vagina, when the female is not in oestrus and it will be ruptured at the time of oestrus.
- Some times this membrane may be intact and has to be ruptured while copulation. *'Lordosis response'* by the female is more reliable than membrane.
- Female which shows Lordosis (provoked by stroking the posterior part of the dorsal surface) will mate within the following *24 hours*. Metoestrus bleeding from the vagina also an indicator of stage of oestrus.

## SEX RATIO

- A *male female ratio of 1: 8-12 is optimum*.
- The male should be kept along with the female throughout the oestrous cycle.

## CHECKING OF MATING

- The rupture of vaginal membrane should be examined daily.
- In addition to this a copulatory plugs can also be noticed in some cases. presence of copulatory plug on the floor of the cage also an indication of occurence of mating.

## REARING OF MATED FEMALE

- Mated females can either be left in the breeding cage to rear their young, or they can be removed to single or colony cages of females.
- Leaving the female along with male have an advantage, since guinea pigs have a *postpartum oestrus* and this can be utilized if females are left with the males.

## GESTATION

- Gestation lasts for between *63 and 69 days*, depending upon the strain and litter size.
- If the mating occurs at the *postpartum oestrus*, gestation length is extended by about 5 days.
- *Pseudopregnancy does not appear* to occur in guinea pigs.

## METHOD OF SEX DIFFERENTIATION AND WEANING

- There is no difference in the anogenital distance of male and female.
- In neonates, sex can be determined by the shape of the genital opening. It is round in male and longitudinal slit in females.
- Gentle pressure anterior to the genital opening of the male will extrude the penis and it is also possible to palpate the undescended testes.
- Young guinea pigs should be *weaned at between 3 and 4 weeks* of age.

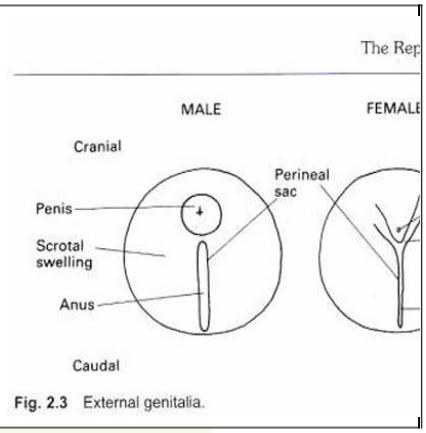



Fig. 2.3 External genitalia.

## CARE AND MANAGEMNET OF NEW BORN

## ANIMALS

- Guinea pigs are born at a well advanced stage of development, with a full coat and eyes open.
- They are active and start moving in the first day itself and try to take food on the same day.
- *Litter size ranged between 1 and 6,* with an average of 3 or 4.
- In communal breeding cages, all females with litter co-operate in the nursing the young one.

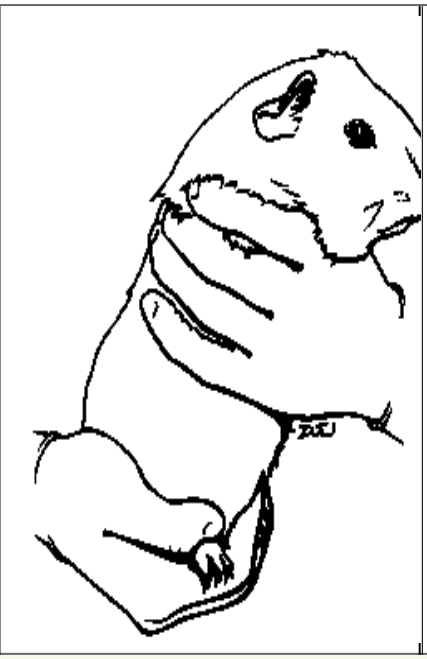
## NUTRITION

- The most important feature of guinea-pig nutrition is that like primates it is one of the few species unable to synthesize its own vitamin C; this must be provided in the diet or drinking water as ascorbic acid. Vitamin C is destroyed by contact with metal and therefore only glass drinking spouts should be used.
- Fresh green food can be used to provide vitamin C but may often be contaminated with pathogens; 50 g of cabbage will provide a guinea-pig's daily need.
- Guinea-pigs eat about 25-50 g of pelleted diet per day. They drink approximately 85 ml of water per day.

## HANDLING

- Guinea pigs are often mishandled because they so rarely bite.
- When they are disturbed they will race around the cage.
- A guinea-pig should be caught by placing one hand in front of the animal and one behind.
- It can be lifted by grasping under the trunk with one hand while supporting the rear quarter with other hand.
- Two hand support is important particularly with adult and pregnant animals.
- The grasping hand should be beneath the thorax and abdomen and the supporting hand under the rear feet or hindquarters.
- Grabbing the animal around the thorax and abdomen may cause injury to lung or liver.

Click herefor animation


## IDENTIFICATION

*Identification can be a problem:*

- Ears are often coloured making tattooing difficult, tags tend to be torn out and notches and holes in the ear soon become confused with tears.
- In albino colonies ear tattooing is probably best; however for coloured animals a punched hole is the only practicable method.

## ENVIRONMENT

- Guinea-pigs require a room temperature of about 18°C (65°F). Breeding performance, for example, may be affected by high summer temperature.
- Windowless rooms with time controlled artificial lighting are advisable to prevent seasonal effects on breeding.

Last modified: Monday, 4 June 2012, 02:10 PM

## CAGING AND BEDDING

- The most common system is the wire floored cage with manual or automatic cleaning and/or flushing underneath.
- If solid floors are used softwood shavings and hay are suitable bedding and nesting materials.
- Automatic drinkers are widely used; these should be tamper proof and strong (preferably stainless steel) as guinea-pigs will constantly chew and play with them.

## DISEASE

- It is important to note that most antibiotics are reported to be toxic to guinea-pigs (especially penicillin, streptomycin and terramycin) and should not normally be used for treatment of this species.

Common important diseases are:

| Type | Common name | Causal agent |
|---|---|---|
| Bacterial | Salmonellosis<br>Pseudotuberculosis<br>Streptococcal pneumonia<br>Streptococcal lymphadenitis | *Salmonella typhimurium*<br>*Yersinia pseudotuberculosis* |
| Endoparasitic protozoal | Coccidiosis | *Eimeria caviae* |

| | | |
|---|---|---|
| Ectoparasitic lice | -- | *Gyropus ovalis*<br>*Gliricola porcelli*<br>*Trimenopon jenningsi* |
| Physiological | Intrauterine haemorrhage | Obscure dietary or liver metabolism imbalance |
| Dietary | -- | Lack of vitamin C<br>  |

## THE SYRIAN HAMSTER

- The Syrian hamster, *Mesocricetus auratus,* is also known as the *"Golden hamster"* although this term is rather inaccurate because coat colours within this strain vary considerably.
- The Syrian hamster as its name implies reached this country from Syria where three pairs were captured in 1937 in Aleppo.
- Hamsters are used mainly for cancer research, virological and toxicological studies.

## BIOLOGICAL DATA

**The syrian hamster *(Mesocricetus auratus)***

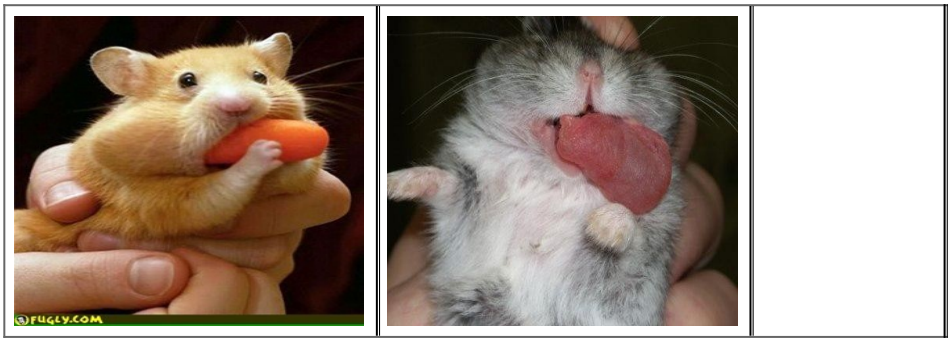
| | |
|---|---|
| Body temperature | 37.4°C (99.3°F) |
| Age at sexual maturity | 6 weeks |

| | |
|---|---|
| Mating weight | 100 g |
| Oestrous cycle | 4 days |
| Duration of oestrus | 12 hours |
| Gestation | 16 days |
| Litter size | 7–9 |
| Weaning age | 21 days |

## ANATOMY

- An adult Syrian hamster weighs about 100 grams and coat colours include albino, golden, ginger and cream


- Hamsters possess cheek pouches in which they gather food for later storage in their nests.



- The Syrian hamster should not be confused with the large European hamster or the Chinese hamster which is smaller, grey in colour with a dark stripe running down its back and has a short but almost prehensile tail.

## REPRODUCTION

- The hamster is a seasonal breeder and comes into oestrus from February to October; in a windowless room with controlled lighting giving at least 12 hours light it is possible to reduce seasonal variation.
- Hamsters are most active in the dark and because of this the lighting cycle can be reversed to provide darkness during the working day to facilitate the special mating system.
- The female is placed with the male and the pair are observed to check if mating takes place. Mating will take place immediately if the female is in oestrus, but if the female does not readily accept the male she is not in oestrus and should be removed before fighting occurs, this needs care by the handler because of the danger of being bitten.
- This method of mating can be time consuming and harems or monogamous pairs may be used in preference. If hamsters are grouped at weaning fighting rarely occurs.
- *Sex ratio:* On average a ratio of 1 male to 5 female is used in the harem and the females should be removed to a littering cage a few days before parturition and returned to the harem after the litter is weaned.
- Young hamsters are approximately the same size as young mice but they have a shorter tail.
- At about 12-14 days the eyes open and the young become active and grow steadily towards independence and weaning at 21 days.

## SEXUAL MATURITY

- Female Syrian hamster attain sexual maturity between 4 and 6 weeks of age, and male at 6 or 7 weeks of age.
- Males remain sexually active through out life, but females, depending upon the strain, have a reproductive life lasting to between 9 and 14 months of age.

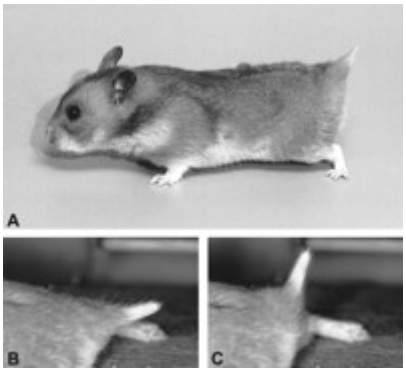
## SEASONALITY OF BREEDING

- Reduction in number of successful mating was noticed in winter, if the hamsters are reared under natural lighting.
- In artificially controlled illumination hamster do not show any seasonal breeding behaviour.
- Hamsters are polyoestrous, and the length of the oestrous cycle is 4 days.
- Ovulation occurs spontaneously between 6 and 10 hours after the beginning of oestrus.

## OESTRUS SIGNS

- Female exhibit ‘lordosis’ just before and during oestrus.
- This can be induced either by the attentions of the male or by stroking the animal’s rump.

- Other method of detect oestrus is, every day morning the animal should be examined for initial viscous discharge which normally occur post-ovulatory.
- If observed, then next oestrus can be calculated by counting four subsequent nights.




## SEX RATIO

- 1:5 in Harem

## MANAGEMENT DURING MATING

- After observing lordosis, males and females should be paired in dark light.


- Mating usually occurs at night and females are most receptive to the males about 5 hours after lights are extinguished.
- It is advisable to adjust the time clock in such a way that the darkness appears during working days and hamster required at least 3 months to adjust the change.


- The animals should be observed by using infra red light and if the female is receptive and exhibits lordosis they can be left together overnight. If fighting occurs, they should be separated and pairing should be attempted on subsequent 'night' until the female respond appropriately. This procedure is called *'timed mating'*.
- If timed mating is not required, they can be maintained as *monogamous pair or in harem group*. Monogamous pair should be formed soon after weaning and should not be separated subsequently. Though postpartum oestrus occur in hamsters, normally mating will not occur in monogamous pair, because nursing female will not allow the male to mate.
- Harems should also be established soon after weaning, with up to 5 females to each male. If females are mated, they should be separated from the harem before parturition and allow to raise the litter separately.
- While *reintroducing the female again* in the harem care should be taken to avoid fighting. If fighting continues for longer period. The female should be separated and kept in a separate small cage within the harem *(retaining cage)* and can be released back when the other member accept the female again.

## CHECKING OF MATING

- Hamsters produce viscous, creamy white discharge with pungent odour which is normally occur post ovulation. It becomes small yellowish plug in dioestrus. Mating can be confirmed by the presence of *copulatory plug* in the vagina

- or by examination of vaginal smear for *spermatozoa.*
- *Pseudopregnancy may occur and lasts for 8-10 days.*

## GESTATION

- Pregnancy can be confirmed by the absence of post-ovulatory vaginal discharge.
- Gestation period ranges between 15-17 days.
- Pregnant female should be separated form the male and rest of the harem and reared separately.
- Sufficient bedding materials should be provided.

## CARE AND MANAGEMENT OF NEW BORN

- Cannibalism is a common problem which can be avoided by minimizing the handling of newborn.
- Fostering should not be attempted in hamster. Because female hamsters are very aggressive and intolerant of fostering and they may kill their own litter if offspring from another litter is added.
- At the time of birth the young ones are naked and eyes closed. Normally the hair growth occur in 7 days and the eyes will be opened by $14^{th}$ day.
- Weaning normally done between 21 and 25 days of age and the average litter size is 6.

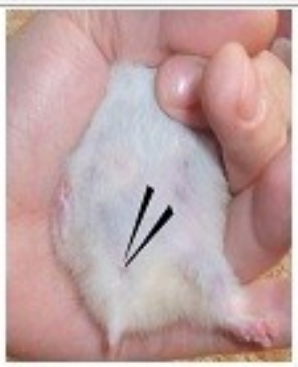
## SEX DIFFERENTIATION

- Male and female can be differentiated by the ano-genital distance.
- In males the distance is longer.

The two openings are further apart on the male

A 4 week old Male hamster.

A 4 week old Female hamster



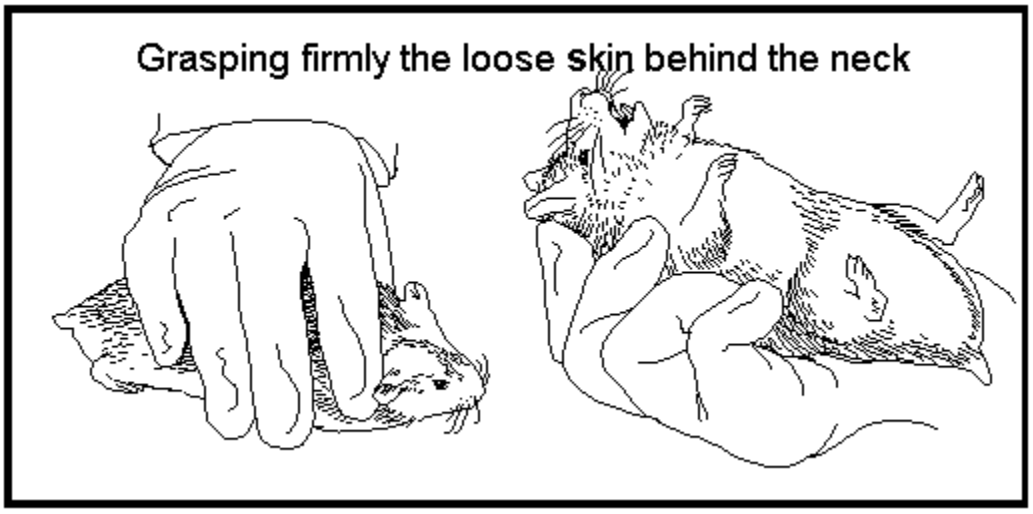
The two opening are too close in female hamster

## NUTRITION

- Laboratory hamsters are usually fed on compounded diets made into pellets; a typical rat and mouse diet is suitable.
- Supplements of sunflower seeds and a variety of cereals are also enjoyed by hamsters but it is not advisable to feed fresh vegetables because disease such as pseudotuberculosis may be introduced to the colony.
- Water should always be available from bottles or automatic drinkers in preference to open dishes which easily become soiled.

## HANDLING

- A frightened hamster often appears aggressive which it demonstrates by rolling on its back or by standing on its hind limbs and screaming at the handler.
- This is little more than a defence mechanism and should be ignored.
- The animal may be lifted in cupped hands if it is used to being handled or by firmly grasping the loose skin at the back of the neck.
- The latter method of handling is preferred if manipulation is necessary; the hamster should be supported so that the fingers may be wrapped around its legs ready for examination, injection or dosing.




## IDENTIFICATION

- There are not many successful methods of identifying hamsters.
- Coat colour can often serve as a method but becomes confusing when dealing with large numbers.
- Tattooing the ear with forceps is a difficult and time consuming job.
- Ear punching may be considered a useful method but the marks can be obscured by fighting.

## ENVIRONMENT

- The optimum temperature is 20-21°C (68-70°F) with a relative humidity of 50-60%.
- Hamsters need at least 12 hours of light, which maybe artificial, if they are to be bred successfully throughout the year.

## CAGING AND BEDDING

- Rat or mouse cages are equally suitable for hamsters.
- The addition of an activity wheel will provide hours of exercise and helps to prevent the animals becoming bored and destructive.


- Breeding cages should contain a small nesting area set aside to encourage good mothering although this is not a prerequisite.
- Absorbent materials such as sawdust or wood shavings should be used on solid floor cages and may serve as both bedding and nesting material.
- Pregnant females will spend a considerable amount of time in building nest out of woodwool or shredded paper.


## COMMON DISEASES

| Type | Common name | Causal agent |
|---|---|---|
| Bacterial | Salmonellosis | *Salmonella enteritidis and Salmonella* |

| | | |
|---|---|---|
| | | *typhimurium* |
| | 'Wet Tail' | *Escherichia coli and Proteus vulgaris* |
| Ectoparasitic mite | Body mange | *Demodex criceti* |

# MODULE-15: FEEDING, BREEDING AND DISEASE CONTROL OF LABORATORY ANIMALS

Learning objectives

This module discuss about,

- breeding methods to be adopted for different laboratory animals,
- feeding management of different laboratory animals and
- disease management of different laboratory animals.

## SELECTION OF BREEDING STOCK OF LABORATORY ANIMALS

- Foundation stock should be true to the breed. The animals should be healthy, free from any disease, active vigorous and of good quality. They should have good production record with respect to litter size at birth and at weaning, litter weight at birth at ant weaning.
- Breeding stock should be purchased from a government or recognized breeders. Selection of trios (one male and two females) from the same genetic line is desirable for achieving good results.
- The primary objective of a good breeding programme is to produce the maximum number of quality animal at lower cost. Selecting a breeding stock is important for consistent production of healthy and fertile animals. The criteria for the section of breeding stock may include the following.
    - The female parent should have a breeding record and not be prone to infanticide
    - The animal should be in good health and show no deformities
    - If possible animals should no be selected from the firs or second litters as they are usually small and do not reflect the size and standard weight of future litters.
    - Animals should be sleeted from litters showing an average litter size and weight for the strain/breed and equal sex ratio within the litter.
    - The parent stock should not be aggressive when handled.

*Stock should be true to breed, free from disease, active and good vigor, good production record, should be purchased from recognized breeder, stock should not be aggressive*

## BREEDING METHODS

- In general breeding systems of laboratory animal may be divided into two main groups, each of which can be subdivided into two classes
    - Permanently mated groups, in which the female is allowed to litter down in the presence of the male and other members of the groups there are two main sub-divisions of this system
        - *Monogamy*, i.e. a single male and female housed together.
        - *Polygamy*, ie one or more males are housed with several females

- Temporarily mated groups, in which the female are separated from the groups before parturition.
  - *Harem system*, in which the males and females are run together, but separated prior to parturition
  - *Hand-mating systems*, in which the male and female are left together only for sufficient time for mating to occur.

*Different mating systems are discussed.*

## COMMON BREEDING SYSTEM FOR LABORATORY ANIMALS

| | **Permanently mated** | | **Temporarily mated** | |
|---|---|---|---|---|
| Species | Monogamy | Polygamy | Harem | Hand mated |
| Mouse | + | + | - | - |
| Chinese hamster | + | + | - | + |
| Syrian hamster | + | - | + | + |
| Guinea pigs | - | + | + | - |
| Rabbit | - | - | - | + |
| Ferret | - | - | + | - |
| Cat | - | - | + | + |
| Dog | - | - | - | + |
| Rhesus | - | - | - | + |
| Baboon | - | - | - | + |
| Chicken | - | - | + | - |

## BREEDING SYSTEM FOR RAT

- From the stand point of genetics and maintenance of good records, monogamous mating provides the best system as in this way a check can be kept on the parentage of stock.
- Frequently, however, polygamous systems are used with one male, and two to six females. This effectively reduces the stock of breeding males and thus cuts cost.
- The outbreed colonies stock may be divided into blocks where males and females are rotated so that breeding close relatives is avoided.

*Monogamous mating gives best results*

## BREEDING SYSTEM FOR MICE

- Breeding systems like random mating i.e. mating between a female mouse and any one of the available male mice has an equal probability.
- Random breeding is impractical to use because of the time required.

- Inbred strains are usually maintained by brother to sister mating or younger parent to offspring mating.

## BREEDING SYSTEM FOR GUINEA PIGS

- The most common breeding system, and the one which probably give the highest out per unit area, is to mate the animals in polygamous groups of one boar and 4-20 sows.
- Once the groups has been set up, they are left together for the whole of their economic breeding life, which is usually about 18 months.
- Group size depends largely on the available facilities, but the optimum is probably about 12 sow to one boar.

## BREEDING SYSTEM FOR HAMSTER

### Monogamous

- Monogamous pairing is the most satisfactory method of breeding Syrian hamster. If paired at weaning they are entirely compatible and produce very good results .

### Hand mating

- It is also a successful method although extremely labour intensive. For large scale production this method is inefficient and out-dated. The hamsters are mated soon after dark, at the time when they are naturally most active.
- The usual procedure is to place the female in the cage of the stud male and to observe the animal to see whether mating occurs. If the female is on heat, she will exhibit lordosis and mating will occur almost immediately. If males and females started fighting, they should be separated immediately.

### Harem mating

- This method has also been successfully used for breeding but, like hand-mating, has similar disadvantage of being labour intensive.
- The usual procedure with Syrian hamsters is to groups one or four male with a large number of females and to separate the females prior to parturition.

## BREEDING SYSTEM FOR RABBIT

### Selection of breeding stock

- A doe selected should have 8 functional teats, so that she feed 8 young ones easily.
- She should be in good physical condition and good health, she should not be fatty.
- The best time to select breeding doe is when they are 6-7 months old and weight about 2.5 to 3 kg.
- Proper *selection of breeding bucks* is very important because each buck will mate with many number of does and pass on his good character to the progeny.
- The bucks should be selected on seeing the breeding record and pedigree.
- The selected buck should have two well developed testicles.
- He should be in good physical condition, good health and growth record, should not be fatty and lethargic but virile and active.

### Reproduction data

- *Male female ratio:* 1:10
- *Age at first mating:* small breeds 4 months; medium breeds 5-6 months; large breeds 7-8 months
- *Oestrous cycle:* A female rabbit appears to have no definite oestrous cycle
- *Signs of heat*
    - Restlessness, rubbing the chin on the side of cage
    - Lying in mating posture, lifting tail
    - Congested, purple and moist vulva

### Mating

- The doe is always taken to bucks cage for mating and if the doe is in full sexual receptivity it will lift the tail (lordosis) and within a minute the buck will mate.
- Mating is successful when the buck falls to one side or backward of the doe after mating with a screaming noise.

### Pregnancy diagnosis

    - Test mating
    - Weight gain
    - Abdominal palpation.
- Palpation technique is the most reliable method in determining pregnancy. It involves feeling the developing embryo with the thumb and fingers in the horns of uterus. Experience is essential for degree of accuracy. Patience, gentleness and experience is essential for successful palpation.
- The palpation should be done on $14^{th}$ day after mating, the doe should be preferably removed from her normal surrounding and placed on a table. It is essential for the doe to be completely relaxed before palpation is attempted. Struggling results in the abdominal muscles becoming tense, making it difficult to distinguish between the fetuses and internal organs.
- The does should be restrained by gently holding the fold of skin behind the ears and over the shoulders. Embryos are located by the gentle movement of the thumb and fingers in the sideways direction. Presence of small marble shaped objects, slipping backward between the thumb and finger indicates presence of embryo.
- Animals negative for palpation should presented again to the buck for mating. The positive cases should be transferred to kindling cage on $25^{th}$ day after mating with adequate bedding materials (coir pith or straw).
- A nest box should be provided to facilitate the doe to built a nest.

## GENERAL CONSIDERATION

- The obvious choice for feeding laboratory animals might be seem to be a diet closely resembling that found in nature.
- When the nutritional requirement of laboratory animals are finalized, a ration can be formulated from available local raw materials to provide a standardized product which will minimize variability in productivity and also experimental results.
- The diet must be presented as a uniform mixture so that it is impossible for the animal to select some ingredients and ignore others.
- Crumbs or pellets are more acceptable to the animals. Crumbs are easy to prepare in the laboratory by incorporating a binding agent such as methyl cellulose.
- In many ways pellets or cubes offer the most satisfactory form of diet. They are generally more acceptable to the animals, less easily wasted, simple to handle and have a good storage life.
- The optimal size and hardness of the pellet is important and differ between species. Rats, which gnaw their food, prefer a large pellet than those usually supplied to guinea pigs and rabbits.

- Soft pellets encourage waste, as they easily crumble in the storage bags or the hoppers. Very hard pellets are unacceptable, particularly for young animals, which may find them too difficult to chew.
- Diets intended for gnotobiotic animals must be sterilized. Those for specific pathogen free animals must be free from pests and pathogens, so that is preferable though not essential for them also to be sterilized.
- Commonly employed methods for diet sterilization are heat, ionizing radiation and fumigation and in all instances care must be taken to minimize drastic impairment in nutritional value.
- Pasteurization (80°C) and autoclaving (121°C for 15 minutes) render the diet sterile without much loss of nutrients.
- Ionizing radiation is a very effective method of sterilization of laboratory animal diet. The source of radiation is usually $_{60}Co$ and although for reasons of safety and cost the process is not available in many laboratories.
- Chemical sterilization by fumigation with ethylene oxide has been applied to diet with varying success.

*Food should be as natural as possible, uniform mixture, sterilization of diet can be done by pasteurization, autoclaving or by fumigation.*

## PRACTICAL FEEDING

- Many of the smaller or more common laboratory animals are fed diets ad libitum, however there is a tendency, particularly when the animal is not growing or reproducing, for them to eat more than they required and consequently become somewhat obese and more prone to disease and conditions associated with obesity such as kidney failure, liver necrosis and arteriosclerosis.
- This may be controlled in one of two ways, both designed to reduce intake of nutrients.
- First by physically controlling food intake and second by designing diets with a lower nutrient density so that, although it eats to satiation, the animal ingests less nutrients than it would on a more concentrated diet.
- Large quantities of uneaten food left in cage may create health hazards by decaying or becoming contaminated with faeces.
- This danger can be overcome by feeding a measured quantity of food once or twice a day.

*Controlled feeding, designing diets with low nutrient density.*

## FORMULATION OF DIETS

- Designing a satisfactory diet for any species requires an awareness of a number of practical and theoretical factor.
- Primary consideration must be the purpose for which the diet is required (for example maintenance or breeding), available raw materials, whether it needs to be sterilized for how long it may be stored before use.
- The diet formulation is usually based on the protein content, which is supplied by a combination of 'high quality' sources such as fishmeal and Soya bean meal, whilst cereals supply proteins of a 'lower quality'.
- These sources are adjusted to provide a dietary protein combination supplying as closely as possible.

## ACCEPTABILITY OF THE DIET

- Another aspect of great importance is acceptability of the diet to the animal.

- For certain species, cats, primates and to a lesser extent dogs, a taste and texture is of greater importance than for others such as the rodents.
- Texture, as well as taste, aids acceptability and diets are produced in a variety of forms, for moist, canned and soft-moist diets for dogs and cats, soft diets for monkeys, to various forms of pelleted and expanded diets for all species.
- Even for rodents the physical form of a diet can influenced food intake.
- Rodents have been shown to eat less of a unpelleted meal diet than the same diet following pelleting.
- Pelleted diets should not be too hard, a this can restrict food intake, particularly of smaller weaker animals.

*Taste and texture is of greater importance, rodent prefer pelleted diet, too hard pellet restrict feed intake of smaller and weaker animals.*

## SPECIALIST DIETS AND PRACTICES

- Laboratory animals required some specific diets to meet their nutritional requiments. they are
  - Purified diets
  - Chemically defined diets
  - Germ free diets
  - Handrearing
  - Paired feeding

## PURIFIED DIETS

- Is defined as the feed in which purified components such as carbohydrates (starch, sucrose), purified protein sources (casein, lactalbumin), refined oils and synthetic vitamins and refined mineral supplements are used as ingredients.
- Such diets have some times been referred to as ‘semisynthetic diets’ but the accepted terminology is purified diets.
- They have been in use in nutritional studies and other research.

## CHEMICALLY DEFINED DIETS

- For certain experimental purposes even the degree of refinement achieved by purified diets is inadequate so that “chemically defined diets “ may be required.
- These are made from the basic nutrients e.g. Glucose, triglycerides, essential fatty acids, individual amino acids, vitamins and minerals which can be obtained in a chemically pure form.
- Normally used in nutritional studies, immunological works.

## GERM FREE DIETS

- The gut microflora has a significant influence on the synthesis of certain vitamins (B vitamins and vitamin K). the germ free and other types of Gnotobiotic animals cannot therefore benefit from this source of nutrients.
- Because diets for Gnotobiotic animals must be sterilized they will required supplementation with those vitamins supplied by the flora in addition to the nutrients which may have been destroyed by the sterilization process.

## HANDREARING

- Rearing laboratory animal by hand is a costly and labour intensive process.
- Hand rearing is employed however, to produce valuable or rare animals and in circumstances where maternal rearing is impossible or contrary to experimental requirements (caesarian derived germ-free or SPF animals or where a study of immune systems derived from the milk is being carried out).

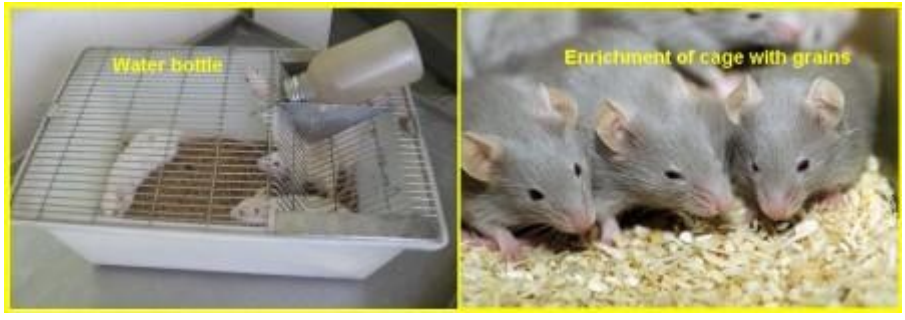
## PAIRED FEEDING

- Under many experimental conditions the interpretation may be obscured by a supplementary effect resulting from differences in food intake between experimental and control groups.
- If, for example, a group of animals undergoing treatment began to lose weight and food intake was also reduced, it would be difficult to determine whether the effect resulted from the treatment or the reduced food intake.
- Paired feeding allows food intake to be eliminated as a potential cause and to concentrate on the treatment.
- The simplest form of paired feeding is one in which each control is paired with a treated animal and feed the amount of food which the experimental animals consumed on the previous day, so that fluctuations in food intake in the experimental group are accurately reflected in the controls.

## COPROPHAGY

- Coprophagy, practiced by all rodents and logomorphs is the process of reingesting some of the faecal materials.
- Its value to the animal is to allow more efficient absorption of nutrients, particularly those e.g. B group vitamins, which might by synthesized by the gut microflora in the lower part of the intestine, beyond the area of maximal absorption.
- Coprophagy can seriously interfere with certain experimental procedures which involves tracing the absorption and utilization of administered materials.
- The practice may be eliminated by using certain devices designed to prevent the animal consuming faecal pellets either from floor or from the anus.

## FEEDING OF MICE




- Mice prefer cereal grains, especially oats, crushed wheat, meat and sugar. Natural ingredient laboratory diet for mice are usually based upon one or more grain or grain by-products to which fats, protein, vitamins and mineral are added.
- The source of fat is usually vegetable oil. Protein sources include fish meal, milk solid and soybean meal.

- Mouse diet can be prepared in pellet, meal, gel or liquid form pelleted diets are easy to feed and have minimal waste compared to the other forms of diet.
- Standardised laboratory diets for mice are usually formulated for maintenance of adult mice or for growth and reproduction.

| | Fat | Protein |
|---|---|---|
| Maintenance | 4-5% | 12-14% |
| Reproduction | 7-11% | 17-19% |

*More grain based diet, pellet diet are easy to feed and wastage is minimum.*

**Feeding mice**

- The mouse is an omnivorous animal. The incisors and molars grow continuously and are worn down by mastication. Attention should be paid to malocclusion leading to under-nutrition. Feeding behavior in rodents shows a diurnal pattern with the majority of food consumed during the dark period.
- Fasting overnight, which is sometimes part of an experimental protocol, might lead to an increase of activity, resulting in unwanted variation in experimental results.
- Food is mostly presented ad libitum as pellets in the food hopper on the cage, which prevents soiling of food by the animals. The food rack should be kept sufficiently full, as it is difficult for the animals to gnaw the food when there are only a few pellets left.
- Restricted feeding has been shown to be beneficial in the long run in terms of reduced morbidity and mortality.
- Enrichment related to food, e.g. grain scattered through the bedding, will meet the animal's need for foraging and will prevent boredom, although it might interfere with experiments in some cases.
- It was shown that BALB/c and C57BL/6 mice kept in enriched environments with nesting material weighed more than mice housed under standard conditions, although the latter consumed more food, probably due to the insulating effect of the nest or to reduced boredom.

*More feed consumed during night time, ad libitum feeding, feed enrichment, the need for foraging.*

**Watering arrangement**

- Water can be provided in a bottle attached to each cage or by an automatic watering system. Water bottles should be changed at least once a week.
- An automatic watering system supplies water through a valve connected to a piping system and serves a rack of cages from a central reservoir.
- The water valve can be located either outside or inside the cage.
- There is always some risk that the valve may become obstructed, resulting in dehydration of the animals or flooding in the cage.
- Automatic watering systems must be monitored to be certain that the water pressure is adequate and must be regularly cleaned and checked for contamination with bacteria and fungi.

*Water can be give through bottles, need to be changed once in a week, water valves should be monitored properly..*

## FEEDING OF RAT

- The rat is an omnivore, which generally regulates its food intake in relation to physiological needs.
- Feed is normally given ad libitum.

| | Crude fat | Crude fibre | Crude protein | Water |
|---|---|---|---|---|
| Maintenance | 2.9% | 4.5% | 18% | 10% |

- The form, content and presentation of the diet should meet the nutritional and behavioural needs of the animal, and uncontaminated drinking water should always be available to all animals.
- Feed intake can be influenced by the energy content of the diet, environmental factors such as temperature and light cycle, or by other management practices, such as group housing, restrictive feeders and cage design.
- The nutritional needs of rats (National Research Council 1995) are well known by diet producers, and a suitable diet can be chosen to meet situational needs, such as the breeding or maintenance of animals.
- As rodents, rats gnaw their food, thus the standard pelleted food may be considered to an optimal form for this animal.
- The consequence of ad libitum feeding is, in many cases, obesity and ultimately decreased survival, leading to an increased incidence of tumours in older animals, directly affecting animal welfare.
- The question is how much should we restrict feeding in rats. Moderate dietary restriction (25% restriction of ad libitum feeding) significantly improves survival, controls adult body weight and obesity, reduces age-related renal, endocrine and cardiac diseases, reduces study-to-study variability and increases statistical sensitivity.
- Conversely, severe restriction (40-50% reduction of the maximum ad libitum feeding) is not recommended.

*Omnivore, pellet feeding is better, 25% restricted ad libitum feeding recommended, CP 18%.*

## FEEDING OF GUINEA PIGS

- Guinea pig is strictly herbivorous. They will eat regularly during day as well as night.
- Water soaked Bengal gram mixed with water soaked wheat after removing excess water may be provided as feed. Salt and vitamin C added before distributing the feed in each tub.
- One kg wheat bran, 100 gm Bengal gram, 20 gm salt, 200 mg vitamin C are sufficient for 30 guinea pigs. Additionally beetroot and tomatoes can be given in the after noon hours.
- Adult guinea pigs are given wheat bran 50 gm, Bengal gram 10 gm, lucerne 125 gm, tomato 15 g, beet root 30 g; two water bottles are provided in each tub and 100mg vitamin C is added per liter of water.


*Strictly herbivore, supplementation of Vitamin C is essential*

## FEEDING OF HAMSTER

- Little is known about the natural feed of the Syrian hamster, though examination of the food stores of other species of hamster suggests that a large proportion of the diet consists of seeds.
- Although the nutritional requirement of the hamster has not been determined specifically, a pelleted rodent diet that contains approximately 16% protein (or higher), and 4-5% fat can be used conveniently. Low protein cause alopecia and high fat above 7-9% cause mortality.
- Dam with litter should receive their feed directly on the floor, as preoccupation with hopper-bound pellets may result in neglect of the young. Young hamsters begin gnawing solid food and drinking water at 7 to 10 days of age; therefore, the sipper tube should be extend low in the cage but not into the bedding.
- Hamster eat 8 to 12 g of feed and drink 10 ml of water per 100g of body weight daily. They eat several small meals approximately 2 hours apart.
- Hamsters are coprophagous and bend the upper half of their body at each defecation to take faeces. This behaviour occurs approximately 20 times daily.


*16% CP rodent diet sufficient, low protein 4-5% cause alopecia, high fat above 7-9% cause mortality, require 8-12 g feed, dam with litter should fed on floor, it is a coprophagous animal.*

## FEED AND RATION SCHEDULE

- Different laboratory animals have their own feed ration with their computation of feed ingredients.
- Presently composite pellet feeds are commercially available. The nutritional requirements for rabbits and guinea pigs are:

| Stage of animal | DCP % | TDN % |
|---|---|---|
| Normal growth | 14 | 45 |
| During pregnancy | 14 | 55 |
| During lactation | 20 | 72 |

Ration for rabbit and guinea pigs

| Feed ingredients | Composition |
|---|---|
| Ground yellow maize/barley | 30 parts |
| Ground nut cake | 33 parts |
| Wheat bran | 35 parts |

| | |
|---|---|
| Mineral mixture (micro+macro) | 2 parts |
| Vitamins A+$B_2$+$D_3$) | 10 g/100 kg |
| Vitamin C | 4 mg/day/adult (for guinea pig only) |
| Vitamin E | 0.3 mg/rabbit 0.15 (mg/guinea pig) |

## QUANTITY OF FEED TO BE FED FOR RABBIT/GUINEA PIGS

| Stage of animal | Concentrate (g) | Roughage (g) |
|---|---|---|
| Growing rabbit | 40-60 | 200-300 |
| Maintenance dose for rabbit | 60 | 200-300 |
| Pregnant dose for rabbit | 60 | 200-300 |
| Lactating rabbit | 160 | 200-300 |
| Guinea pig at all stage | 20-30 | 200-300 |

Composition of ingredients for mice, rat and hamsters

| Ingredients | Composition (g) |
|---|---|
| Crushed wheat | 500 |
| Skimmed milk powder/milk | 100/700 ml |
| Cod liver oil | 6 |
| Sodium chloride | 6 |
| Dried yeast | 6 |

- The above ration is sufficient for 100 mice a day but rat and hamster are fed 15 g per animal per day. In addition to the above green fodder must be given at 15 gram per rat and hamster and 5 g per mouse daily.
- A supplement of goat liver has to be fed every week at 4 g/rat and 1 g/mouse. Instead of milk or milk powder 0.5g fish meal or 2 g of cooked meat or egg per rat per day may be provided.

## MEASURES TO PREVENT DISEASE IN LABORATORY ANIMAL HOUSE

- Sanitation is a key operation in laboratory animal care.
- Various systems of husbandry have been devised to regulate the exposure of animals to infection, entry should be restricted, use of protective cloths, overshoes will minimize the bacterial and fungal load.

- Provision of barrier unit with liquid dip, showering, complete cloth changing will minimize contamination.
- Clean cages are important during pregnancy, lactation and weaning, after the removal of sick animals and introduction of new animals.
- Newly purchased animals should be purchased from approved breeders who are maintaining health profile.
- Waste accumulated in the cages should be washed with hot water (82°C) for at least 3 minutes or a disinfectant solution like phenol, quaternary ammonium compounds or halogens should be applied.
- Where ever possible heat should be the first choice for all saturations not involving animal tissues. Hot water used at 80 °C for 1 minute or 65 °C for 10 minutes will most spore forming microbes. Its application to room surface, especially floor, pens, cages and other equipment is the simplest and most reliable disinfection method.

*Sanitation, protective cloth, showering minimize contamination, cages should be washed at 82°C for three minutes*

- Rooms or complete building can be decontaminated by clearing with high pressure hose and use of disinfecting gases or aerosols. Use of formaldehyde fumigation is a satisfactory method. The minimum concentration of formaldehyde recommended is 900 mg/$m^3$ for 3 hours.
- The single commonest source of infection in the animal house is the introduction of disease-carrying stock. Animals may appear clinically healthy but carry a wide range of infective agents. Newly purchased animals should be quarantined for specific period.
- Guinea pigs scatter their bedding into feeders and crocks, are susceptible to Bordetella pneumonia and they require dietary supplementation of ascorbic acid. They should not be housed with rabbit, dog or cat because they may carry bordetella sub clinically.
- Hamsters are more susceptibility to climatic changes and food and water deprivation and should be cared properly.

*High pressure water hose cleaning,fumigation with formaldehyde, quarantine of newly pruchased animals, proper environement are the key facors of health management.*

## FACTORS INFLUENCING DISEASE SUSCEPTIBILITY

- It is important to prevent disease occurring in laboratory animals, not only for the benefit of the animal, but because the effect of disease can confound experimental results.

### Factors influencing disease susceptibility

- Various factors are involved in disease susceptibility of laboratory animals which includes environment, genetic, metabolic, experimental procedures and dietary factors.

### Environmental factors

- Climatic extremes, Climatic changes
- Inadequate ventilation, High ammonia level
- Excessive drafts, Dampness
- Over crowding, Improper bedding, Excessive noise
- Improper light, Waste accumulation, High or low humidity

### Genetic factor

- Sex difference, Strain difference
- Mutations, Congenital abnormalities
- Immune deficiency, Inbreeding

### Metabolic factors

- Age, Obesity, Concurrent disease
- Lack of exercise, Lactation, pregnancy
- Nonspecific stressors

### Experimental procedures

- Restraint, surgery, drug effect, radiation effect, pathogen inoculation, bleeding

### Dietary factor

- Insufficient quantity of feed or water, feeder or waterers inaccessible, not recognized, not working, feed supplied in a form that cannot be eaten by the age group of species involved.
- Increased demand of nutrients because of pregnancy, lactation, heat cold, diet composition or disease.
- Inadequate feed or water quality, improper formulation
- Dietary alterations.

## MODULE-16: INTRODUCTION TO RABBIT FARMING

Learning objectives

This module discuss about,

- biology, anatomy and reproduction of rabbit,
- difference between rabbit and hare,
- important breeds of rabbits used in India and abroad and
- introduction of rabbit in India, their advantage and disadvantage.

## INTRODUCTION TO RABBIT FARMING

- Rabbits are basically reared for meat, fur and wool production.
- They have great potential to convert the absolute feed into quality products for the use of human beings.
- All the domestic breeds of rabbits are descendants of the European wild rabbits, *Oryctolagus cuniculus*.
- The first recorded rabbit husbandry was in early roman times, when rabbits were kept in walls rabbit garden.
- Domestication of the rabbit is relatively recent and man has bred most of today's rabbit breeds the last 200 to 300 years.
- Until 1950 the rabbits were mainly used for research purpose.


## BIOLOGICAL DATA

**The rabbit (*Oryctolagus cuniculus*)**

| | |
|---|---|
| Body temperature | 38.3-39.5°C (100-103°F) |
| Age at sexual maturity | 4-5 months depending on size |
| Mating weight | Variable according to breed |
| Oestrous cycle | Continuous |
| Gestation | 30-32 days |
| Litter size | 6-8 |
| Weaning age | 4-6 weeks |

## ANATOMY

- Rabbits are not closely related to rodents and their resemblance is only superficial.
- In both groups the incisor teeth grow continuously; rabbits however have a smaller second pair.

- They have three premolars in the upper jaw and two in the lower. The molar teeth have cutting edges whereas in rodents they are modified for grinding.
- Both the male and female have nipples, normally four pairs. The alimentary tract has a large caecum and a well developed appendix, as might be expected in an animal eating a high proportion of cellulose. The pancreatic duct enters the duodenum well below the bile duct.
- A large number of breeds now exist and several are used for experimental work.
- The breeds can be grouped according to body size: small, medium and large. Breeds from each group can be found in the laboratory –
    - Small Polish: 1 - 1½ kg,
    - Netherland Dwarf: 1½ kg;
    - Medium Dutch: 1½ - 2½ kg;
    - Large Flemish Giant: 6 kg,
    - New Zealand White: 5 kg,
    - Californian: 4 ½ kg.

## DIFFERENCE BETWEEN RABBIT AND HARE

- Rabbits (chromosome no. 44) are clearly distinguished from hares in that rabbits are altricial, having young that are born blind and hairless. In contrast, hares are generally born with hair and are able to see (precocial).
- All rabbits except the cottontail rabbit live underground in burrows or warrens, while hares live in simple nests above the ground (as does the cottontail rabbit), and usually do not live in groups.
- Hares are generally larger than rabbits, with longer ears, and have black markings on their fur.
- Hares (chromosome number 48, *Lepus nigricollis* ) have not been domesticated, while rabbits are often kept as house pets.
- In gardens, they are typically kept in hutches—small, wooden, house-like boxes—that protect the rabbits from the environment and predators.
- The Indian Hare (Lepus nigricollis), also known as the Black-naped Hare, is a common species of hare found in South Asia. The European Rabbit (*Oryctolagus cuniculus*) is a species of rabbit native to south west Europe.

|  |  |  |  |
|---|---|---|---|
| **Rabbit** | **Hare** | **New born rabbit** | **New born hare** |

## ADVANTAGE OF RABBIT BREEDING

- Rabbits can be fed with high forage, low grain diets that are largely noncompetitive with human food requirements.
- Rabbits have high feed conversion efficiency, with feed/grain ratios of 2.5-3.0 on high grain diets and 3.5-4.0 on high forage, grain free diets.
- They have a high growth rate reaching market weight of about 2 kg at 12 weeks of age.
- Rabbits have the potential of being in a constant state of reproduction they can be bred within 24 hours of kindling, utilizing post-partum heat.
- Rabbits convert forage into meat more efficiently than ruminant animal such as cattle and sheep. From a given amount of alfalfa, rabbit can produce about five times as much meat as beef cattle.

*Non competitive with human food grain, high feed conversion efficiency, high growth rate, good reproductive efficiency, good converter of forage to meat*

**Comparative efficacy of rabbit as meat producer**

| Type of animal | Young / year | Total carcass weight (kg) of offspring / year | In relation to dam weight |
|---|---|---|---|
| Cattle | 0.9 | 173 | 0.35 |
| Sheep | 1.0 | 25 | 0.42 |
| Goat | 1.5 | 24 | 1.0-1.5 |
| Pig | 20 | 3200 | 16 |
| Rabbit (intensive) | 30-48 | 72-117 | 18-29 |

- Rabbits are prolific animals. The rabbit is the only animal that will produce ten to fifteen time and more of its own weight in a year.
- A large number of rabbits are used in the laboratories due to its small size, less space requirement and involvement of less expense in feeding

and care.

- Compared with the meat of other species rabbit meat is richer in protein (21%) and vitamin but has less fat (8%).

**Comparative nutritive value of rabbit meat**

| Type of animal | Protein % | Fat % | Moisture % | Calories / 400 g | Cholesterol mg / kg |
|---|---|---|---|---|---|
| Rabbit | 20.8 | 10.2 | 27.9 | 795 | 50 |
| Chicken | 20.0 | 11.2 | 67.0 | 810 | 60 |
| Veal | 18.8 | 14.0 | 66.0 | 910 | 100 |
| Lamb | 15.7 | 27.7 | 55.0 | 1420 | - |
| Pork | 11.9 | 45.0 | 42.0 | 2050 | 105 |

- Rabbits are suited to both small scale (backyard) and to large-scale commercial production.
- Rabbit keeping is not restricted by any taboos
- Rabbit is a convenient one meal size thus avoiding the need for storage.

*Relation to dams weight more meat, rich in protein and low in fat, suitable for both backyard and large scale production, convenient size for sigle meal*

Last modified: Monday, 4 June 2012, 03:37 PM

## CONSTRAINTS IN RABBIT FARMING

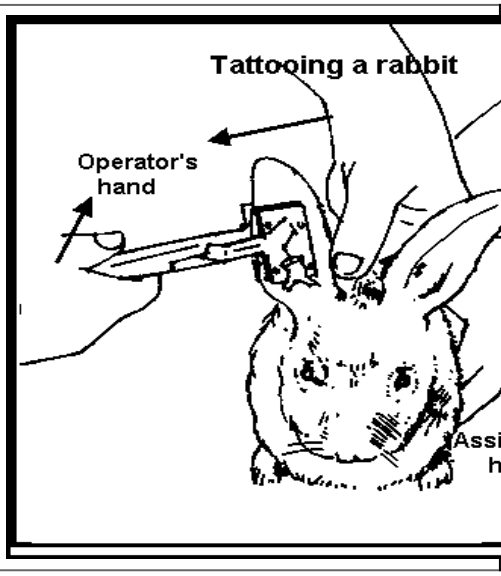
- The major constraint is the shortage of germ plasm. The available germplasm of broiler type rabbits with the CSWRI Avikanagar and its stations at Garsa and Mannavanur falls much *short of demand*.
- *Lack of technical know-how*, preventing the farmers to put a step forward. Another major constraint is *non-availability of a well-organized market* for rabbit meat.
- There is *no organized regular slaughter* of rabbit.

- Constant *availability of wild rabbits* plays a vital role in limiting the rabbit slaughter.
- Most meat consumers *recognize rabbit as a pet / fancy / toy animal*, which prevents them slaughter and consume.
- Comprehensively, *low consumer demand*, insufficient promotion, unsteady supply, unreasonable price, competition with other meats, lack of product diversification and poorly developed market channels are the true constraints.

*Lack of good breeding stock, poor technical know-how, no well organized market, considering rabbit as pet, unsteady supply*

## IDENTIFICATION OF RABBITS

- Rabbits can be marked by ear tattoo, ear tags, or leg bands.
- As young rabbits grow relatively quickly, it is important to select the correct size of leg bands to avoid discomfort when mature.
- The most satisfactory method is tattooing, although with a few dark breeds this may present problems.
- The majority of breeds, including some with dark fur, have light skins and black tattooing pastes show up clearly.

# BREEDS OF RABBIT

- A large number of breeds now exist and several are used for experimental work.
- The breeds can be grouped according to body size: *small, medium* and *large*.
- Breeds from each group can be found in the laboratory
    - Small Polish 1-1½ kg,
    - Netherland Dwarf 1½ kg,
    - Medium Dutch 1½ -2½ kg,
    - Large Flemish Giant 6 kg,
    - New Zealand White 5 kg,
    - Californian 4 ½ kg.

## HEAVY BREEDS

### Flemish giant

- Originate from Belgium, as its name suggests this is a giant breed, which at maturity can weigh well over 6 kg. It comes in different colours.

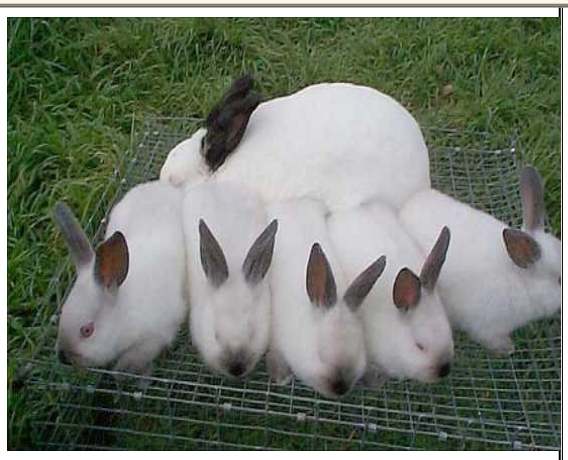
### White giant

- White Giant is white coloured larger rabbit. It is a larger rabbit known for its prolificacy and fast growth.

### Grey giant

- This breed is also native of U.S.S.R. Adult weight is 4.5 to 5.0 kg.
- Due to its resemblance of its fur with that of hare, this is often mistaken as hare. This is also reared for meat and fur skin production.

## AVERAGE BREED

| | | |
|---|---|---|
|  |  |  |
| New Zealand White | Californin | New Zealand Red |

### New zealand white

- This breed was evolved in England. Fur is white and skin is albino.
- The eye colour is red due to the absence of melanin pigment.
- Adult weight is 4.5 to 5.0 kg.
- Meat and fur skin are the main products of this breed. This breed is the one used most widely through out the world for meat production.

### Californian (Synthetic American)

- This is second most popular breed for meat production.
- The colour is all white with black tipping on the nose, ears, feet and tail.
- The weight range for mature Californian is 3-4.5 kg.

### New zealand red

- It is essentially a red New Zealand white type, which has not been as intensively selected for meat production.
- Mature body weight is 3-4.5 kg.

## LIGHT WEIGHT BREEDS

### Soviet chinchilla

- This breed is blue grey in colour with a white belly. It has a characteristic 'ruff' or 'dewlap'.
- It is a thick fold of skin around the front of chest, which is very obvious when the rabbit is in good condition.
- Matured body weight is 3-4.5 kg. Although this breed is reared for meat, its fur is a fancy in fur crafts.

### Dutch

- Dutch is a small breed with a mature body weight of 2.5-3.5kg. It has a wide white band of fur around its body at the shoulder as well as a white stripe down the middle of its face.
- Its front feet are well with in its white band. Tip of the back feet also white.

### Himalayan

- Himalayan is white with black extremities.
- It is thought to have originated in China and spread from there to Russia.

## FUR / WOOL BREEDS

Angora rabbit

- The **Angora rabbit** is a variety of domestic rabbit bred for its long, soft wool. The Angora is one of the oldest types of domestic rabbit, originating in Ankara (historically known as Angora), Turkey, along with the Angora cat and Angora goat.
- The rabbits were popular pets with French royalty in the mid 18th century, and spread to other parts of Europe by the end of the century. They first appeared in the United States in the early 20th century.
- They are bred largely for their long Angora wool, which may be removed by shearing, combing, or plucking.

## CROSSBREDS

- The crosses between the above mentioned breeds and local types have been produced. They are found to be highly adaptable to Kerala conditions.
- The adult weighs 4.0 to 4.5 kg. and breeds all through the year. Fur colour is not uniform.

## INTRODUCTION OF RABBIT IN TO THE COUNTRY

- In India, rabbit was introduced very recently by 1978.
- During March 1978 first batch of 60 New Zealand white rabbits (10 male and 50 females) were imported from United Kingdom by Central Sheep and Wool Research Institute.
- Again during November 1979 another lot of 25 males and 100 females of Soviet Chinchilla, Grey Giant and White Giant were received under Indo-USSR protocol for agricultural development as free gift.
- These rabbits were initially reared at NTRS, Garsa and later shifted to Avikanagar and Mannavanur to study their adaptability and performance in different agro-climatic conditions of India.
- Studies at temperate, sub temperate and semi-arid regions have demonstrated that broiler rabbits can be raised successfully almost all over the country with some variation in managemental practices to suit the local climatic condition.

*Introduced by 1978, adaptability studied at NTRS Garsa and Avikanagar and introduced to all part of India*

## POPULATION STATISTICS

- In the 1987 census published in 1991-92, Kerala state recorded 77,187 rabbits while in Himachal Pradesh the numbers of rabbits were 29,982 during 1991-92. As per 17$^{th}$ livestock census (2003-2004) Tamil Nadu accounted 66,878 rabbits.
- There is no census available on the population statistics of other states, but it is believed that a sizable population of rabbits has become established in the northeastern states, west Bengal, Karnataka and Andhra Pradesh.
- As per the livestock census 2003 the total rabbit population in India is 480000
- In the North Eastern hill region of India 91.50% of the population accepted rabbit meat as 79 %of the people are tribal and almost 100% of the people are non vegetarian who has no taboo regarding consumption of different types of meat. In west Bengal, a centrally sponsored

scheme “National programme for Rabbit Development” has been launched in 1999 looking into the scope and popularity of rabbit for meat among rural poor and tribal.

- In India rabbit meat production has a great scope as a small back yard enterprise with higher outputs as lower inputs involving no off-farm purchase that would supply inexpensive meat for the family, improve farm productivity, and supplement income through the sale of surplus stock.
- Our country also has a large and thriving domestic fur industry mainly centered in Jammu and Kashmir.
- About 25 lakhs fur skins are estimated to be imported every year and the fur industry in India utilizes about 5 lakhs rabbit fur skins per year worth 30 million rupees most of which are imported from.
- Farm reared rabbits can thus fulfill this domestic demand for rabbit skins and also relieve pressure on illegal hunting of animal and save valuable foreign exchange.

*2003 census rabbit in India is 4.8 lakhs, in Tamil Nadu, 66,000, information from other states information are lacking*

## BREEDS OF RABBITS USED IN INDIA

- Exotic breeds of rabbits like Soviet Chinchilla, White Giant and Grey Giant were imported from former USSR while New Zealand White from UK in the year 1978 by CSWRI and kept at its North Temperate Regional Station at Garsa in the Kullu Vally of Himachal Pradesh.
- Later two new colour segregates viz., Black brown and Dutch were evolved from Grey Giant and Soviet Chinchilla breeds.
- In 1983, a rabbit research unit was established at Avikanagar to study the performance of broiler rabbits, as the semi-arid region constitutes about 50% of the geographical area of the country.

**Broiler rabbit breeds and their characteristics**

| Sl. No | Breed | Fur colour | Adult weight in Kg | Country of origin | Availability |
|---|---|---|---|---|---|
| 1 | Soviet Chinchilla | Chinchilla and steel grey | 3.5 - 4.0 kg | Former USSR | NTRS |
| 2 | Grey Giant | Greyish brown | 3.5 to 4.0 kg | Former USSR | CSWRI, NTRS, SRRC |
| 3 | White Giant | White | 4.0 kg | Former USSR | NTRS |
| 4 | New Zealand White | White | 3.0 – 3.5 kg | UK | CSWRI, NTRS |
| 5 | Black Brown | Blackish brown | 3.5 – 4.0 kg | India | CSWRI, NTRS |
| 6 | Dutch | Dutch pattern | 3.0 kg | India | NTRS |

*Soviet Chinchilla, White Giant, New Zealand White, Grey Giant and Dutch are the common breeds used in India*

# MODULE-17: FEEDING, BREEDING AND GENERAL MANAGEMENT OF RABBITS

Learning objectives

This module discuss about,

- selection of breeding male and female rabbits,
- mating management,
- pregnancy diagnosis,
- kindling and kindling management and
- care of new born upto weaning.

## REPRODUCTION

- Sex ratio: 1:10 (1 male for 10 females)
- Age at which first bred:
    - Small breeds: 4 months age (Polish, Dutch)
    - Medium breeds: 5-6 months (New Zealand White, Chinchilla)
- Oestrous cycle: A female rabbit appears to have no definite oestrous cycle although a certain rhythm exists in their sexual receptivity.
- Signs of heat:
    - Restlessness, rubbing the chin on the sides of the cage.
    - Lying in mating posture, lifting the tail.
    - Congested purple and moist vulva.

### Reproductive details

- Rabbits are well known for their ability to reproduce quickly. Puberty occurs at 4–9 months with smaller breeds maturing earlier than larger breeds.
- Like the cat and the ferret, rabbits are induced ovulators.
- Although they do not show a regular oestrus cycle, they do vary in receptivity and a cyclic rhythm exists. Follicle stimulating hormone (FSH) stimulates ovarian follicles to develop and produce oestrogens that cause the female to be receptive.
- Follicular development occurs in waves with five to 10 follicles on each ovary being at the same stage of development at any one time.
  When the follicles reach maturity they produce estrogen for about 12–14 days.
- If ovulation has not occurred during this period, the follicles degenerate with a corresponding reduction in estrogen level and sexual receptivity.
- After about 4 days a new wave of follicles begins to produce estrogen and the doe becomes receptive again.
- Many factors influence this cyclic rhythm including nutrition, light, temperature, sexual stimulation and individual variation.
- In general, the receptive period lasts 14–16 days with a period of non-receptivity for 1–2 days.
- Mating stimulates ovulation approximately 10 hours post coitus. Ovulation can also be induced by proximity of an entire male, mechanical stimulation of the vagina or by the act of being mounted by another female.

## SELECTION FOR BREEDING

- When the rabbit reach 4to5 months of age the future breeding stock can be selected. While selecting for breeding the following points should be considered.
    - Select the heaviest animal but take account of any difference in age.
    - The rabbit should be selected from the largest litter.
    - Healthy animal should be selected for breeding purpose. A healthy rabbit will have normal eating and drinking habit. It is always alert and having curiosity in searching the cage. Similarly a healthy rabbit will groom its body regularly and the fur will be smooth and shinny.
    - Males should be selected on the basis of the above and in addition they should be checked to confirm that each has two testicle in its scrotum. The testicle descends from the body cavity into the scrotum at around 12 weeks.

## ESTROUS CYCLE

- Like other animal rabbit does not have any estrous cycle with regular period of heat. They are *spontaneous ovulators*.
- A female rabbit is therefore considered to be in heat when she accepts service and in dioestrous when she refuses. A vulva is a strong indication of heat.
- A doe in heat assume a characteristic pose clalled "*lordosis",* with the back arched downward and hind quarters raised. A doe in dioestrus tends to crouch in a corner of the cage or exhibit aggression towards the buck.

## TYPE OF PRODUCTION CYCLE

### Extensive reproduction

- Fully utilizing the maternal instinct by allowing the doe to nurse their young for 5 to 6 weeks and re-breeding soon after weaning. Does are therefore mated once every 2 ½ month. Best suited for tropical countries.

### Semi intensive reprodoction

- Serving the doe 10 to 20 days after kindling and young ones are weaned by 4-5$^{th}$ week.

### Intensive reprodction

- Serving the doe immediately after kindling and youngs are weaned by 4$^{th}$ week.

### Choosing the reproduction rate

- Semi-intensive and intensive reproduction systems are only suitable where does get the right quantity and quality of feed.
- If these conditons and not met, the does will usually accept the male but will abor. In intensive reproduction in European rabitries 1 doe can produce 50-60 weaned young annually.
- At the same technological level 45-55 rabbits can be produced in a semi-intensive reproudction system. In a wet tropical climate, with balanced feeding, it is possible for a doe to produce 40-50 weaned young a year by a combination of intensive and semi-intensive rates.
- Using the extensive rate the best breeders may obtain 30-35 weaned young per doe per year.
- For further information click here

## MATING MANAGEMENT

- At the time of mating the female should be lifted to male's cage. Service is always done in the buck's cage to avoid fighting.
- Before transferring to bucks cage the female should be examined for any respiratory diseases.
- Mating should be done in the coolest part of the day, better during early morning or late evening.
- After successful mating the male usually produce a typical cry and fall down on one side of the doe.
- Soon after the acceptance of the male, the doe should be removed to her cage.
- Buck should not be used more than 3 to 4 days in a week and not more than2 to 3 times in a day. The ratio of buck to doe is 1:10.
- Reaching 80% of their adult body weight is an ideal criteria for mating.


*Female should to moved to males cage, buck should not be used for more than 3-4 days in a week and 2-3 times in a day.*

- A red vulva is a promising but not infallible sign (80-90 percent chance of mating success). A buck can fertilize a doe with a white vulva (10-20 percent chance of success).
- When the doe has accepted mounting and the buck has serviced her the breeder removes the doe and puts her back in her own cage. Altogether this should not take more than 5 minutes.


- While the doe is being handled the producer can carry out any treatment necessary-anti-mange, for example. If the doe refuses to mate,the breeder can try to present her to another buck. As a last resort he can leave her for 24 hours in the buck's cage but then he cannot be sure that mating has taken place. It is better to mate the animals in the morning or evening, to avoid the hottest hours of the day.
- In intensive breeding 1 buck can serve 7 or 8 does. In the extensive system 1 buck can serve 10-15 does. The buck, however, should not be used more than 3 or 4 days a week, and not more than 2 or 3 times a day. So even if there are only, say, 10 does in the unit, there should be at least 2 bucks so that successful mating is not dependent on 1 buck alone.
- When the size of the unit permits (at least 50 does), 1-2 reserve bucks are kept. If a balanced pelleted feed is used the bucks should be fed from 120 to 180 g a day, depending on their weight.
- The first mating of medium-size, properly fed does takes place around 4 months. Bucks are first mated at about 5 months. If production conditions are not optimum the first mating will be delayed until the animals reach 80 percent of their adult weight. There is no advantage in delaying it further. The breeder should carefully supervise the first mating. For the first month the young buck should not be mated as often as an adult.


| | | |
|---|---|---|
| Estrus vulva | Rabbit matting | Breeding of rabbit |

*Buck and doe should reach 80% of adult weight at the time of mating, red vulva of doe is a promising sign of estrus.*

## PREGNANCY DIAGNOSIS

- The methods adopted to determine the state of pregnancy are
  - Test mating
  - Weight gain method and
  - The 'palpation technique'
- The palpation technique is the most reliable method of determining pregnancy. It involves feeling with the thumb and fingers the developing embryos in the horns of uterus. It should be down between $10^{th}$ to $14^{th}$ day after mating. After $14^{th}$ day palpation should be avoided because of a risk of abortion.
- Experience is essential for any degree of accuracy to be guaranteed but providing patience and gentleness are exercised, the palpation technique is very successful.

### Palpation method

- The doe should preferably but not necessarily be removed from her normal surroundings and placed on a table, which has been covered in sacking to prevent her from slipping. It is essential for the doe to be completely relaxed before palpation is attempted. Struggling results in the abdominal muscles becoming tense, making it difficult to distinguish between the fetuses and internal organs.
- The does should be restrained by gently holding the fold of skin behind the ears and over the shoulders.
- Embryos are located by the gentle movement of the thumb and fingers in a sideways direction. If small marble shaped objects can be felt slipping backwards between the thumb and fingers then the existence of embryo is confirmed.
- Care must be exercised in this technique, too much pressure resulting in the tissues being torn, with possible fatal consequences to doe and embryos. The experienced breeder can determine pregnancy by eighth to tenth day of mating.

## CARE AND MANAGEMENT DURING PREGNANCY AND AT KINDLING

- The doe should be transferred to kindling box by $27^{th}$ to $28^{th}$ day after mating.
- Kindling should be take place in quite hygienic surrounding. Providing dark environment is essential.
- Provision of adequate nesting or bedding material in the nest box is essential.

- A good mother will give a layer of fur bedding by plucking the abdominal fur and this formation of nesting is an important indication of nearing kindling.

- Kindling last for 15 to 30 minutes according to the size of the litter.
- After kindling nest should be examined for bunnies and if any dead animals it should be removed. It can be performed easily by removing the mother. Daily inspection of nest is important.


- Normally the rabbit nurse their bunnies once in a day preferably in the early morning.
- Rabbit are born without any fur and with their eyes closed. Their eyes open at around 10-11 days and the fur begins to develop at about the same time.

*Transfer the doe to kindling cage by 27th day, pluckig the fur to for nest is a surest sign of kindling.*

## FOSTERING

- There are 8-12 teats in a female rabbit. Loss of newborn usually increases when the litter size is larger than the number of teats and vice-versa.
- In rsbbits the dsam - offspring bond is totally lacking for which fostering can be practiced. While fostering following points should be considered.
    - Can be done if the litter size is more or the doe is dead.
    - Not more than 3 young rabbits should be give to a foster mother.
    - Maximum age difference between the foster doe's litter and fostered litter should be 48 hours.
    - Fostering should be taken place within 5 days of kindling.

*Age difference should not be more than 48 hours and only three bunnies can be given to a foster mother.*

## WEANING

- Young rabbits should not leave the nest box until they are about 3 weeks of age. Weaning of bunnies can be done by $4^{th}$ to $6^{th}$ week of age.
- The doe should be removed from the cage and the young can be retained for the next 4-5 weeks. During weaning abrupt change of feed is to be avoided to reduce the mortality in weaners.

*Weaning can be done at 4th to 6th week, care should be taken to avoid abrupt chage in feed.*

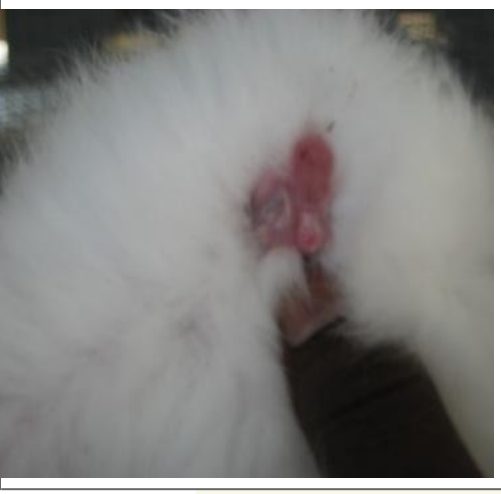
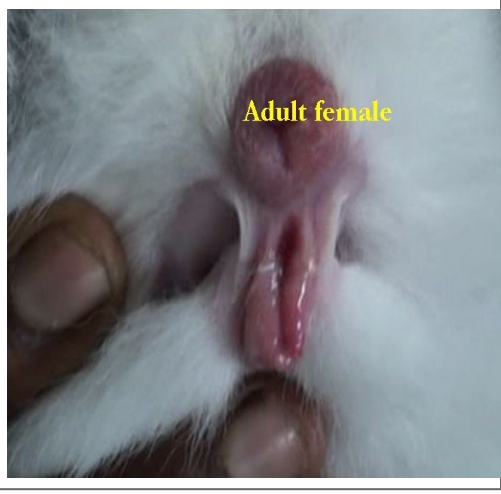
## HANDLING

- The rabbits should always be handled firmly but gently. A rabbit should be picked up by obtaining a firm grip on the loose skin over the scruff of the neck with one hand and use the other hand to support the hind quarters.
- Young rabbits can be lifted by grasping them firmly over the loins, the fingers on one side and thumb on the other.

*Young can be held by loins and adult by firm grip over the scruff.*

## SEXING

- Sexing is usually done at weaning along with tattooing.
- When the vent area is gently pressed the female will show a slit like aperture and a male will show slightly raised cylindrical round tip.

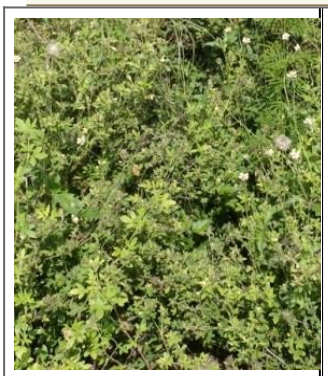
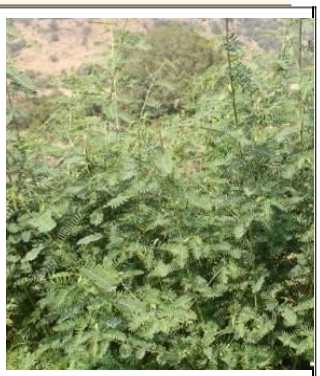
| Young male | Young female | Adult female |
|---|---|---|
|  |  |  |

## LEARNING OBJECTIVE

This chapter discuss about

- Feeding requirement and feeding management of commercial rabbits
- Housing requirement and different type of cages for rabbit
- Common bacterial, viral and prasitic diseases of rabbit and their control measures.

## IMPORTANT POINTS IN FEEDING OF RABBITS

| | | | |
|---|---|---|---|
|  |  |  |  |
| | **Clitoria** | **Morus alba** *(web* | |

| | | | |
|---|---|---|---|
| | **ternatea** *(web link)* | *link)* | |

- Rabbits are primarily monogastric herbivorous animals and consume common type of grains and pulses (Sorghum, Bengal gram, wheat etc.) and legumes (alfalfa, berseam, etc.) as greens or as hay and even kitchen wastes and garden vegetables (cabbage, carrot etc) or their leaves.
- The dam imposes feeding pattern. A doe feeds her young only once in 24 hours.
- From the 3rd week of life the young rabbit begin to move about, taking few grams of dam's milk. With in few days they also start feeding grains and forages.
- Normally rabbit feed and drink water through out the day but feeding nocturnally is the common phenomena. Lactating doe need the richest and most concentrated feed.
- In organized farm feeding of concentrate in palletize form is the most common practice. The diameter of the pellet should be 3-4 mm with 10-15 mm length. Feeding of rabbit in pellet form is more desirable than mash or ground form.

| | | |
|---|---|---|
| | | |
| Feeding of adult rabbit | Feeding of young rabbit | Feeding schedule |

*Monogastric herbivores, nocturnal feeding is common, pellet feeding is more desirable.*

## NUTRIENT REQUIREMENT

- Concentrate feed requirement and nutrient requirement is given below.

**Feeding schedule for different categories of rabbits**

| Item | Approximate Body Weight | Quantity to be fed per day | |
|---|---|---|---|
| | | Concentrates | Green grass |
| Bucks | 4-5 kg | 150 gm | 600 gm |
| Does | 4-5 kg | 150 gm | 600 gm |
| Lactating does | - | 200 gm | 700 gm |
| Weaner (6 weeks) | 600-700 gm | 50 gm | 200 gm |

- Rabbit consumes dry matter 6-8 % of their bodyweight out of which roughage can contribute up to 60 %.
- The dietary crude protein content should be 12 to 15 % for dry non-lactating does and 16 to 20 % for growers and lactating does with litter respectively.

| Type of nutrient | Fattening or growing stock | Lactating doe | Does in kindle | Animal on maintenance |
|---|---|---|---|---|

| | | | | |
|---|---|---|---|---|
| Digestible energy MJ/Kg | 10.4 | 10.9 | 10.4 | 9.2 |
| Fat% | 3 | 4 | 3 | 3 |
| Crude protein% | 14 | 19 | 14 | 15-16 |
| Crude fibre% | 15.5 | 18 | 16 | 13 |

*Dry matter requirement 6-8%, growing and lactating doe required 16-20% protein.*

## FIBRE REQUIREMENT

- Fibre is the single most important component of the rabbit diet. The particle size and digestibility of the fibre are also important. . The rabbit needs large indigestible fibre particles (containing lignocellulose) to drive the gastrointestinal system, and to maintain healthy peristalsis. Gastric stasis and the subsequent accumulation of a `felt' of ingesta and hair is rarely seen in rabbits on high fibre diets.
- Large fibre articles ensure the natural wear of the molar teeth with a side-to-side chewing action. Small particles tend to be eaten with a crushing action which encourages unnatural wear on the teeth. .
- High fibre, low energy diets will result in complete caecotrophy, and avoid the development of `sticky bottom syndrome'. Such diets also prevent obesity. . High fibre (hay) diets allow the rabbit to `graze' for several hours daily, which closely parallels the behaviour of wild rabbits, and reduces boredom and stress.
- This reduces fur chewing of itself or its companions, and reduces destructive chewing of the environment. Fibre should make up 18 to 20% of the diet, and of this at least 10% should be crude indigestible fibre. As most complementary dry foods contain less than this (between 5.7 and 14%) every diet should be complemented with good hay.
- Fibre is particularly important for the maintenance of a healthy digestive system: a high fibre diet keeps the correct balance of bacterial flora in the caecum.
- If the fibre content of the diet falls, the caecal pH alters, and the populations of Clostridia and Escherichia coli rise. This is particularly significant at life stages when the gastrointestinal system is most vulnerable, such as weaning, or during antibiotic usage.
- Rabbits on high fibre diets rarely suffer from mucoid enteritis, or enterotoxaemia. High fibre diets will also protect against enterotoxaemia when antibiotics are given.

*High fibre results in complete caecotropy, fibre in diet should 18-20 %.*

## PROTEIN REQUIREMENT

- The recommended protein level of the diet is 12 to 14%. Higher protein levels of 16 to 20% may be used for breeding stock, and 15% for growth. Protein is part of the concentrated ration, but is also found in hay.
- High protein diets will lead to an increase in the production and excretion of ammonia, and this may increase the rabbit's susceptibility to respiratory disorders, and eye infections.
- Excess protein may also lead to incomplete coprophagy and the development of `sticky bottom syndrome'.

*High protein may cause incomplete coprophay.*

## FAT REQUIREMENT

- The dietary requirement for fat is 1 to 3%; 1% fat is suitable for maintenance, and 3% for pregnancy and growth. However, many rations have increased fat content to increase palatability.
- The fat content of concentrated food is listed in the food analysis as oil. Vegetable oils, soya and linseed are more digestible than animal fats. Excess dietary fat may lead to the development of arteriosclerosis.
- A fat deficiency is rare; however, the oils in the dry food are the rabbit's only source of essential fatty acids, and if the dry food that is fed is old or musty, an essential fatty acid deficiency will manifest as a dry dull haircoat.

*1% fat for maintenance and 3% for pregnancy and growth, dry and dull hair coat may be due to deficiency in essential fatty acids.*

## CARBOHYDRATE REQUIREMENT

- Rabbits have little requirement for carbohydrate. However, many pet and house rabbits are fed starchy and sugary treats regularly. This causes obesity and encourages enterotoxaemia.
- The `starch overload' theory suggests that excess carbohydrates will exceed the stomach's capacity to absorb them, and these carbohydrates provide fuel in the caecum for the multiplication of E. coli and Clostridia .

*Excess carbohydrate promotes E.coli and Clostrial growth.*

## VITAMINS AND MINERALS

- During the process of digestion the microflora in the caecum synthesize vitamins B, C and K. These are then returned to the rabbit in the caecotrophes ingested during caecotrophy.
- Vitamins A, D and E are included in the pelleted ration. Concentrated ration should not be stored for longer than 3 months as the vitamin content will deteriorate over time.
- Vitamin B and K supplementation must be considered for rabbits that are unable to practice caecotrophy.

### Vitamin A

- This should be incorporated into the average concentrate ration at a rate of 10 000 iu/kg.
- Vitamin A deficiency will result in infertility, abortions, resorption and increased neonatal mortality.
- Vitamin A deficiency or excess can cause hydrocephalus. Alfalfa is rich in vitamin A, and if fed alongside vitamin A rich pellets may also lead to the development of hydrocephalus.
- Hepatic coccidiosis will lower the liver levels of both vitamins A and E.

### Vitamin C

- This vitamin is also synthesized during the process of digestion. However vitamin C supplementation may be of benefit in the treatment of respiratory disease, and in the prevention of enterotoxaemia, as it may inhibit toxin production.
- It can be given at a dose of 50 to 100 mg/kg daily. Over dosage does not occur as any excess is excreted through the kidneys.

### Vitamin D

- This is incorporated into the average concentrate ration at a rate of 900 iu/kg. Excess vitamin D may be a factor in excessive calcium uptake, and the development of dystrophic calcification of renal and aortic blood vessels (at levels of 2300 iu/kg of feed) although the rabbit has a unique calcium metabolism (see calcium).

### Vitamin E

- This is incorporated into the average concentrate ration at a rate of 50 mg/kg. Vitamin E deficiency can lead to reduced fertility, and additional vitamin E can be added to the diet by supplementation with wheat germ.
- Vitamin E deficiency can cause muscular dystrophy and hind leg paralysis in young rabbits. These symptoms may be seen if less than 16 mg/kg vitamin E is incorporated into the diet. Blood biochemistry in a case of hypovitaminosis E will reveal a raised creatine phosphokinase (CPK).

*Vitamin A and E deficiency may result in infertility, vitamin E deficiency cause muscular dystrophy, vitamin C supplementation will be helpful in treating respiratory diseases*

### Calcium

- The rabbit has an unusual calcium metabolism. The level of plasma calcium is not regulated by vitamin D and parathyroid hormone as in other mammals, but varies directly with the level of dietary calcium.
- Excess calcium is excreted through the urinary system, making bladder and kidney stones a common occurrence if diets are high in calcium. Metastatic calcification can also occur with high calcium diets.
- Conversely, as much of the dietary calcium is held in the pelleted portion of the ration, rabbits that are selective feeders and leave their pellets may have a low calcium intake. This leads to osteoporosis, particularly evident in the vertebrae, and jaw bones.
- Poor mineralization of the teeth, and acquired malocclusion are consequences of a diet too low in calcium. Osteoporosis of the vertebrae leads to vertebral fractures. The daily requirement for calcium of a medium-sized pet rabbit is approximately 510 mg.

### Copper

- Copper is added in the form of cupric sulphate to the concentrate ration at a rate of 4 to 30 mg/kg. It is thought to reduce enteritis and increase weight gain in young stock. There are no toxic effects from feeding this level of copper.

*Plasma calcium vaires with level of dietary calcium, copper thought to reduce enteritis.*

## WATER

- Fresh water should be available at all times, even when the rabbit eats a large amount of greens and may seemingly not drink much.
- Water can be provided in bowls or sipper bottles; the latter is more hygienic.
- It is important to use whichever the rabbit is familiar with, as if presented with an unfamiliar water source the rabbit may fail to drink, and dehydrate.
- Sipper bottles must be cleaned regularly, and checked for leakage.

- `Blue fur disease' is a moist dermatitis associated with Pseudomonas contamination of leaking sipper bottles.

*Fresh water should be made available at all times*

## GRASS

- Grass is one of the most neglected components of the rabbit diet. Whilst its wild counterparts feed exclusively on grass, most pet rabbits are never given fresh grass, although they receive dried grass as hay. Grass is an excellent source of fibre and has a more abrasive action on the teeth than hay.
- Eating grass encourages the side-to-side chewing action essential for the proper wear of the molars.
- Grass should be gradually introduced into the diet, when the grass growth is rapid, as eating too much at this time can cause digestive upsets.
- The grass that is fed should be pulled rather than as grass clippings as the latter have a tendency to overheat and ferment, again causing digestive disturbances.

## FEEDING MANAGEMENT

|  |  |  |  |
|---|---|---|---|
| ***Erythrina Idica*** *(web link..)* | ***Sesbania grandiflora*** *(web link..)* | **Desmanthus virgatus** *(web link)* | ***Leucaena leucocephala*** *(web link)* |

- Along with concentrated pellet, green forage including cabbage, lucerne, hedge lucerne, Berseem, Paragrass, Sesbania leaves are best suited. The green should be fed ad libdum.
- The rabbit should not feel stress in feeding so the regular routine should be followed properly. Concentrate should be fed in the morning and roughages should be fed in the evening.
- Supply of clean and cold water is very much essential, an adult rabbit requires about only litter of water a day. The water intake of rabbits in a temperate climate is 1.5-2.5 times that of dry matter consumed.

- In warm climate the ratio may raise to 4:1. Water can be provided in pot, by a nipple attached to either a pipeline or a bottle. In lactating and pregnant does water should be provided round the clock.

**Composition of two rabbit feed mixture**

| Feed mixture 1 | | Feed mixture 2 | |
|---|---|---|---|
| Ingredients | Parts | Ingredients | Parts |
| Bengal gram | 35 | Bengal gram | 10 |
| Wheat | 30 | Groundnut cake | 20 |
| Groundnut cake / Gingelly cake | 10 | Gingelly cake | 5 |
| Meat cum bone meal | 10 | Rice polish | 35 |
| Rice polish / wheat bran | 13 | Wheat | 28 |
| Mineral and vitamin mixture | 1.5 | Mineral and vitamin mixture | 1.5 |
| Salt | 0.5 | Salt | 0.5 |

- Leaves of Murungai, Agathi and cultivated fodder grasses like guinea, napier and paragrass are palatable to rabbits apart from the leguminous fodder Such as cowpea, lucerne, stylosanthes etc.

## COPROPHAGY / CAECOTROPHY

- Digestion in rabbit is of typical one. The functioning of the rabbit's digestive tract is virtually the same as that of other mono-gastric animals. Its unique lies in the dual function of the proximal colon.
- When the caecum content enters to colon in the early morning, the colon will secrete a mucous which envelops the pellet to form *soft pellet or night pellet* (more scientifically caecotrophes) and the rabbit directly eat the soft pellet in the morning from the anus.
- The soft pellet contains high value protein and soluble vitamins particularly B complex vitamin. The second expulsion is the *hard pellet*. This action is called caecotrophy or coprophagy.
- To encourage caecotrophy the feed should contain adequate quantity of roughages.

*Soft pellet contains high value protein and vitamin B complex.*

## HOUSING

- Climatic stress is the major factor, which affects reproduction and growth in rabbit husbandry. The ideal temperature and humidity for rabbit is between 10 to 20°C and 75% RH at 16°C.

- The RH should not be more than 5% of outside and the temperature should not differ from outside by 10°C.
- Broiler rabbits can be reared in deep litter system and cage system and in hutches.

## DEEP LITTER SYSTEM OR PEN SYSTEM

- In this system the floor must be of concrete which will make it easy for cleaning and prevent making hole by rabbits being their habit.
- The floor is to be covered with paddy husk, paddy straw, saw dust etc., with 4 to 6 inch thickness.
- The manure on the floor is to be changed regularly. The house may be of any length. But it is never desirable to have more than about 30 young together. So maximum desirable size of each pen is 5feet x 12 feet.
- Young rabbits can be kept in pens. Once rabbits attain puberty, they may be housed singly; especially, adult males. If kept together they will fight and cause injury.

*Growers can be reared in deep litter, adult require individual pen.*

## CAGE SYSTEM

- The cage housing system is better than any other system of housing for management, though its initial expenditure is high.
- In shed the cages are arranged in single or multiple tieres.

### Different types of cages

Flat deck cages or single tire system

- In this system the cages are all on one level. They usually open at the top and they can be suspended by chain or wire from the roof or set on feet. Litter and urine drops into pits under the cage.
- The depth of pit ranges from 20 cm to 50 cm. Shallow pits are cleared every 2-3 days and deep pit are cleared after a year. The advantages of this type of cages are convenient in supervision and handling of animals.
- The materials are having long life. In this type of cage arrangement no elaborate ventilation is required. The major disadvantage is low animal concentration per square metre of bedding.

California cages or multiple tire system

- In this system, the cages are placed step by step. One deck higher than other but not above it. The cage on lower level opens on its top and those on upper level opens at front. Litter drops beneath the cage and is collected same as that of flat deck system. The advantage of this type of cage arrangement is slight increase in animal density per square meter of building. Remaining is same as that of flat deck cages. The disadvantage is access to upper cage and supervision of upper cage is difficult.



Multiple tier cages

- In this system cages are arranged one above other and the manure and urine is collected in a tray beneath the cage. The advantage of this system is higher animal concentration per square meter of area. But this system required elaborate ventilation and more labour in cleaning the sheds daily.

*Flat deck cages require more space but easy to manage.*

## Cage materials

- Rabbits are usually kept in cages with wire floors through which faeces can fall. The floors may be welded mesh, usually 17 mm (3/4 inch), rods or aluminium sheet with punched holes.
- There is some controversy concerning optimum cage sizes but stock cages of 46 x 46 x 46 cm (18 x 18 x 18 inches) and breeding cages of 92 x 46 x 46 cm (36 x 18 x 18 inches) appear adequate. For breeding female's next boxes containing coir pith, hay and softwood shavings are provided a few days before parturition.
- The adult male and female should be housed individually hence they require single cages. The measurement of single cage for adult animal is 18 inch length, 18inch width and 18 inch height. The floor of the cage should have a weld mesh with ½ inch x ½ inch size dimension. Where as other five sides should be of 1inch x 3 inch weld mesh or 1x 1 inch weld mesh. The door should be opened from top.
- In general the floor space requirement for weaners is 0.2 $m^2$ per kg of live weight. Based on this weaners or growers can be housed in groups of 3 or 4 in the adult cages.

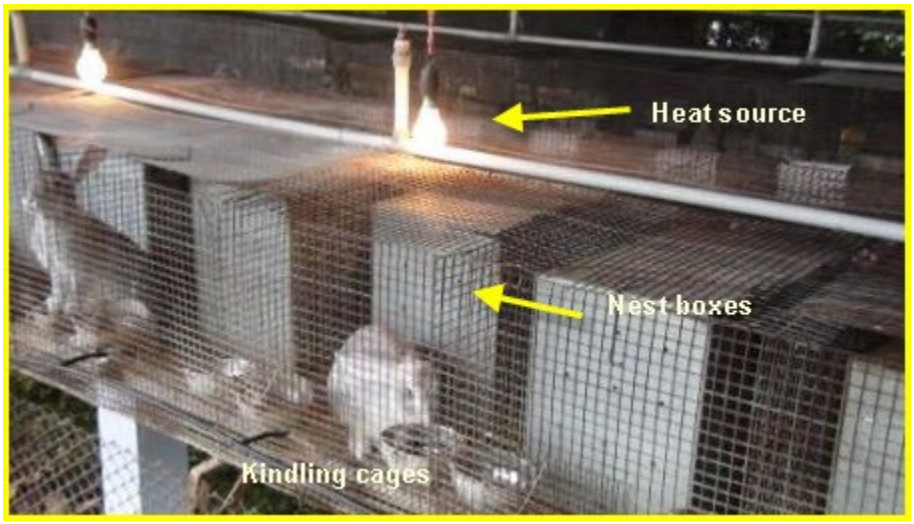
## HUTCHES

- Outdoor hutches should be in a sheltered location, raised off from the ground with sloping, waterproof roofing and well protected from predators. Hutches are made out of
    - Wood
    - Asbestos and

- Welded wire mesh.

## KINDLING CAGES

- *Kindling cages*, these cages lodge the female in the late pregnancy and during lactation. The cage should have 18 inch width, 18 inch height and 36 inch length.
- The floor of the cage should have a weld mesh of ½" x ½" size and other sides should be of 1" x 1" size.
- From the bottom up to 6" height all the four sides should be covered with ½" x ½" inch size weld mesh. This is to prevent the escape of young bunnies during the early part of life.




*Bottom and side up to 6" should be 1/2 x 1/2 size weld mesh to preven escape of bunnies.*

## NEST BOX

- For calm kindling and better protection of the bunnies a nest box is essential. The nest box is made up of wood or plywood where as the floor is made up of galvanized wire mesh with ½" x ½" weld mesh. The measurement of nest box should be 22 inch length, 12 inch width and 12 inch height.
- The nest box with bedding materials is to be placed in the kindling cage in about 27 days of pregnancy. In the nest box paddy straw or streded paper or dried grass or coconut pith is to be spread at about 2 inch thickness to provide a soft bed for the bunnies. The place where the nest boxes are not available a empty kerosene tin can be modified as nest box.
- Nest boxes vary in size and design but in general the size is 50 cm length, 30 cm breadth and 15 cm height. Nest boxes are made out of wood and should have provision for adequate drainage and ventilation. It is advisable to have the bottom with wire mesh.

- The entrance for the mother in the nest box should be of 15 cm diameter hole at one side and the opening should be 10 to 12 cm above the bottom so that it can prevent the escape of bunnies too early from the nest box.
- *Advantages of nest box is as follows*
    - Nest box allow the doe to kindle and nurse her young in comfort.
    - It keeps the young in a healthy, clean environment.
    - Maintains the temperature constantly for the young bunnies.
    - Keeps the young from leaving the nest too early.
    - Prevent scattering of bunnies in side the cage results in failure of suckling milk.



*Should be provided at 27th day of pregnancy, essential for calm kindling, prevent scattering of bunnies and escape of bunnies too early*

## FEEDING AND WATERING ARRANGEMENT



## CLASSIFICATION OF DISEASES

- Diseases / disorders can be classified into
  - Bacterial
  - Viral
  - Parasitic

- Nutritional
- Other causes

## IMPORTANT BACTERIAL DISEASES

### Bacterial diseases

- *Pasteurella multocida* is almost invariably present in most rabbits, and pasteurellosis is probably the cause of the greatest loss to the rabbit farmer. The organisms are usually located in the nasal cavities of the rabbit and therefore for the most usually symptoms observed are in that region. Common diseases condition produced by *P. multocida* is
  - Haemorrhagic septicemia, sudden death in acute case, hemorrhages may be found in the lungs and lymph nodes or glands
  - Chronic conjunctivitis, also known as weeping eye, is a condition in which there is a discharge from the eye
  - Reproductive tract infection, in buck swollen testicle, in doe metritis
  - Snuffles, a thick sticky, white discharge from the nose, which the animal wipes away with its forelegs, sneezing and coughing.
  - Torticolis or wry neck (animal holds its head on one side) due to inner ear infection.
  - Pneumonia
- Prevention is by strict hygiene and treatment is with Sulphaquinoxalines and Sulphadimidine (1 mg per liter of water).

| Snuffle | Torticolis | Weeping eye |
|---|---|---|

### Abscesses

- Abscess can be produced by several types of bacteria, but the most commonly involved is *Staphylococcus aureus*.
- The most common site of formation is subcutaneous, but abscess may also occur in internal sites also.

### Mastitis

- This is an infection of mammary gland occurring only in lactating does. It is fortunately no common.
- The acute form is sometimes wrongly known as milk fever or blue breast.
- The disease is caused by various bacteria, *Staphylococci* and *Streptococci*.
- Main symptom is swollen teat, doe has little appetite but is unusually very thirsty and has high temperature.

## IMPORTANT VIRAL DISEASES

### Myxomatosis

- Myxomatosis caused by a poxvirus of the myxoma group, the disease is spread by biting insects. The most common vector infecting the wild rabbit is the rabbit flea whilst the carrier of the disease to domestic rabbit is the mosquito.
- The symptoms are swollen eye lids, eventually completely closing over the eye. Swelling may occur on other pars of body, particulary at the base of the ears. Death follows in almost all cases within at most some 12 days of infection, although ther are some few cases of recovery.

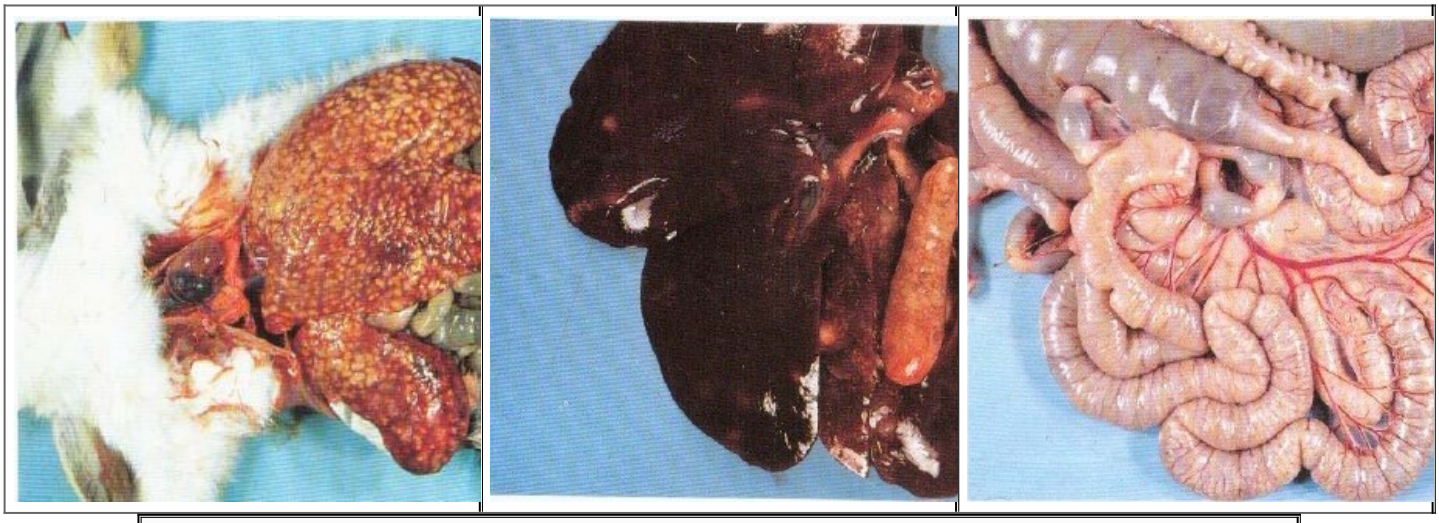
### Viral Haemorrhagic disease (VHD)

- The disease is caused by an RNA virus of the Calcivirus genus. The disease affects only the rabbit and no other birds or mammal. It affects mainly older bucks and does. In per acute form sudden death, in acute form affect all age group and the sub-acute form many animals may survive.
- Symptom includes loss of appetite, fever, apathy, dullness, prostration, paralysis, lying on side, spasms with head and lower limbs bent backwards thus arching the body with belly up, groans and cries before death.
- The only disinfectants at present, which have any effect, are a 10% solution of formalin or a 2% solution of sodium hydroxide. The viruses withstand 60°C for at least six minutes.

# IMPORTANT PARASITIC DISEASES

## Coccidiosis

- This disease was probably responsible for more loss through deaths and lowered production than any other diseases. It is caused by several species of protozoa of the genus Eimeria, one species attacking the liver, the other attacking the intestines. Very often a mixed infection occurs.
- The symptoms vary according to the form of the disease and the age and severity of attack, and also the condition of the animal. In the hepatic (liver) form of the diarrhea is only occasionally present and there may be some loss of condition. The liver, in advanced cases, shows a number of white or yellow spots or streaks and later, nodules, the contents of which vary from the thin fluid t a thick cheesy material. The bile duck become thickened and in advanced chronic cases of the liver form, the liver is greatly enlarged, giving rise to 'pot-belly' in life.
- In the intestinal form, the signs are more varied, there is usually loss of flesh, and the coat becomes harsh and staring.
- Infection arises from contaminated food and water. Green stuff, which has been overrun by wild, rabbits us a common source of infection. Adult animals act as a carrier of the disease.
- Treatment: Sulphaquinoxaline (1 gm per liter of water), Sulphadimidine, Nitrofurazone.



*Hepatic form is more common, weight loss and white spot on liver can be noticed.*

## Ear and skin mage (ear canker)

- It is a common disease of rabbit. It is caused by one of two types of mite, usually *Psoroptes cuniculi* but some times *Chorioptes cuniculi*. The adult mites are about 0.5mm long, and can be seen in scrapings from an affected ear. The mites attack the inside of the ear and cause inflammation of severe irritation, yellow or brown scab being produce. The rabbit scratches its ear and shakes its head constantly. Infestation occurs by the transmission of mites from one animal to other, and the condition is very contagious. The mites can live up to three or four weeks away from a rabbit unit. In advance stage it may affect the middle ear causing wry neck (the rabbit's head is held constantly to one side).
- Treatment can be effective if attended at an early stage. In rabbitary all the ear of rabbits should be cleaned periodically with organophosphorous compound or with butox (Deltametherin). The culling of rabbit with excessive mange is advisable.

- The bedding of affected animal should be burned and hutch carefully disinfected. The old form of treatment, which is still effective, consist in removing all crusts or scabs with cotton wool wrapped round a thin stick and dipped in hydrogen peroxide or sprit. After the removal of the scab of the proprietary ear canker preparation should be applied or liquid paraffin containing 1% phenol, or any benzyl benzoate preparation can be used.
- Modern treatment consists of the subcutaneous injection of Ivermectin at the rate of 400 micro gram per kg of live weight of the animal. One of the benefits of this treatment is that other parasites which exist are dealt with at the same time. The treatment does not kill the eggs of the mite and should therefore be repeated some three weeks later.


*Yellow or brown scab formation, irrtation and itching, treatment is effective in early stage, 400 micro gram of Ivermectin s/c is effective..*

## COMMON DISEASES OF RABBIT

| Name of disease | Cause | Important features | Treatment |
|---|---|---|---|
| Myxomatosis | Virus (spread by Rabbit fleas) and Mosquitoes. | Inflammation and oedema of eyelids, ears, anal and genital orifices. Mucopurulent blepharo conjunctiv | No effective treatment Vaccination is practiced in many advanced countries |

| | | | |
|---|---|---|---|
| | | itis, Skin haemorrhages. | |
| Pasteurellosis | Bacteria (*Pasteurella multocida* ) | Clinical forms occur are snuffles, Enzootic pneumonia, otitis media, abscess, Septicaemia, torticollis | Sulphaquinoxaline Sulphadimidine |
| Coccidiosis | Protozoa(Eimeria species) E.stiedae E.magna E.perforans | Anorexia, debilitated condition, hepatomegaly, pendulous abdomen. | Sulphaquinoxaline, Sulphadimidine, Nitrofurazone. |
| Mucoid enteritis (Mucoid enteropathy) | Unknown cause (shift from neonatal to post – weaning nutritional substrates has been proposed as having role in the pathogenesis) | Diarrhoea with clear to viscid and mucoid consistency. Dehydration | No effective treatment |
| Blue breast (Mastitis) | Streptococcus or staphylococcus species. | Seen in lactating does Bluish purple glands. | - |

| | | | |
|---|---|---|---|
| Ear canker (Ear mange)<br>  | *Psoroptes Cuniculi* | Shaking head, scratching ears with legs, Crusty exudates in ear. In advanced cases torticolis | Benzyl benzoate (Ascabiol) 2-3 daysafter removing the crusts and cleaning the ears) |
| Sorehock (Ulcerative pododermatitis) | Pressure necrosis of the skin, usually resulting from the bearing of heavy body weight on wire floors of the cages | Circumscribed areas in the skin covered by dry crustyscab on the plantar surface of the metatarsal region. Anorexia, loss of weight, humping of the back, tilted movements. | Zinc and iodine ointments and 0.2% solutions of aluminium acetate. Antibiotics parenterally to prevent secondary infections |
| Ring worm | Fungus (Trichophyton microsporon) | Falling of hairs in patches resulting in areas of baldness | Griseofulvin |
| Body mange | *Notoedres cati* | Falling of hairs from the ears | Benzyl Benzoate (external), |

| | | | |
|---|---|---|---|
| | | and nose. Scratching the ears and face with forelimbs. | Ivermectin s/c injection at dose of 0.1ml/5kg bodyweight |

## MISCELLANEOUS DISORDERS AND CONDITIONS

- Bites, injures and wounds due to fighting among animals
- Congestion of the mammary glands or caked udder (due to death of all the bunnies at early stage)
- Dissertation of young and cannibalism(first kindling, lack of maternal instinct, lack of B vitamin, lack of water, fear of doe.
- Fractures
- Fur chewing (in young rabbit due to lack of light, boredom, fungal disease, mange, magnesium and zinc deficiency)
- Heat stroke due high ambient temperature
- Over grown nails
- Moist dermatitis (slobbers)
- Pododermatitis (sore hocks)

## HYGIENE OF RABBIT HOUSE

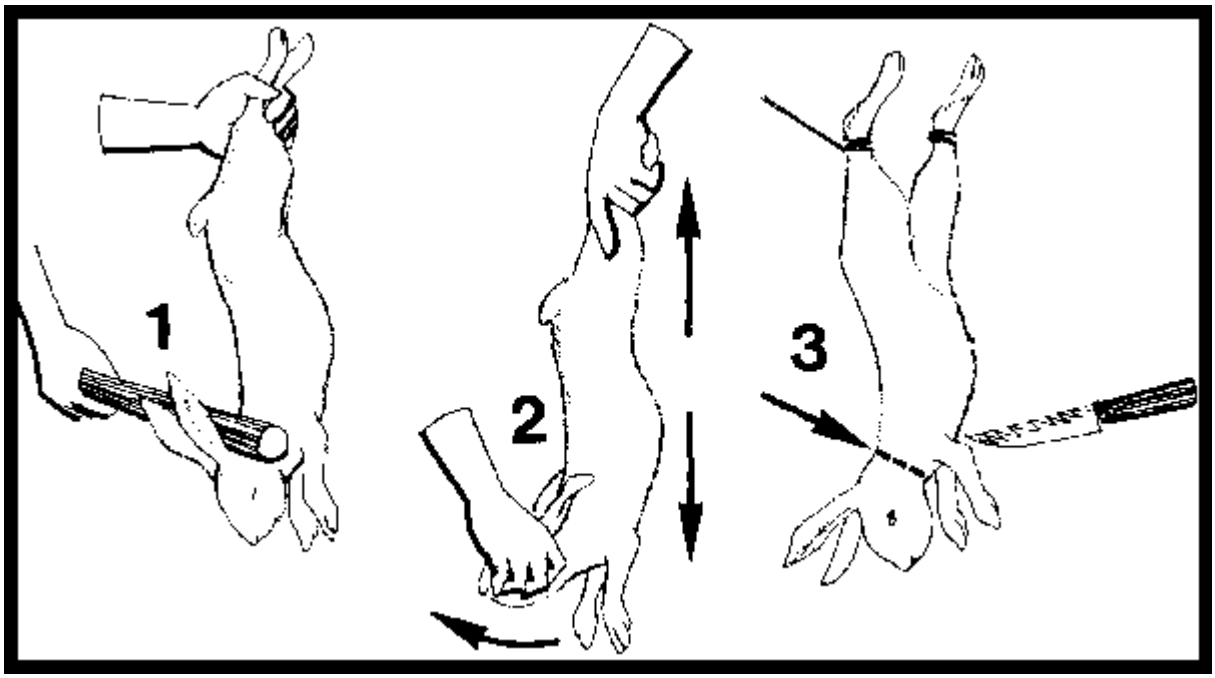
- Hygiene of rabbit house can be maintained by
    - Rabbit house should be away from noise and dust.
    - Rat proofness is essential
    - Nothing that cannot be easily cleaned and disinfected should be allowed.
    - Regular cleaning and disinfecting, drying of feeder and waterer is essential.
    - In tropical counties the building should buffer the temperature variation.
    - For easy cleaning galvanized metals should be used for rabbit equipment.
    - Man is the most dangerous permanent vector of disease. Footpath is essential at the entrance. Before handling the animal our hand should be cleaned and disinfected.
    - If the infection is more all the animals should be culled and disinfected and left free for 1 to 2 weeks before introducing new rabbit.
    - Boiled and cooled drinking water or disinfected/sterilized water should be provided to all the animals particularly to young and growing animals.

## DISPOSAL UTILIZATION OF RABBIT WASTE

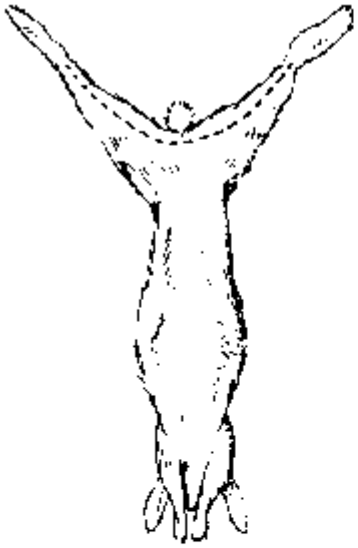
- The amount of manure produced in any rabbit farm will depend upon a number of factors such as breed, ration fed, amount of bedding used and so on. Bulky ration will produce more manure than a concentrated ration.
- The weight of rabbit manure varies between about 450 to 640 kg per cubic meter, and a large breed doe with young would produce throughout the year some 0.34 cubic meter of manure, that is to say, between 150 and 200 kg.
- On a dry matter basis the manure contains approximately 2.7% nitrogen, 1.5% phosphoric acid, and 1% potash.

# STUNNING AND SLAUGHTERING OF RABBIT

- The two most common methods are (a) dislocation of the neck and (b) stunning followed by severing the neck to ensure satisfactory bleeding. This second method may also be used in conjunction with the dislocation technique.
- For dislocation of the neck, the rabbit is grasped firmly by the hind legs just above the hock joint.
- The other hand firmly holds the rabbit's neck either in front or directly behind the ears.
- The operation is completed by pulling sharply on the neck with a downward and backward twist of the hand.
- Correct dislocation results in a small gap being left between the head and the neck.
- The spinal cord is severed and the neck dislocated. Severing the head with a sharp knife will ensure correct bleeding which results in a whiter carcass.

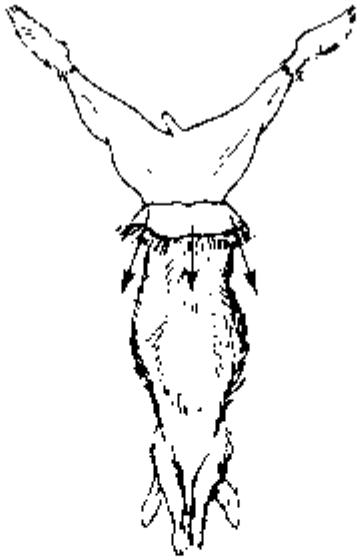



- Skinning can be done by making incision over thigh of both the hind legs and skin can be pulled off by giving slight force.



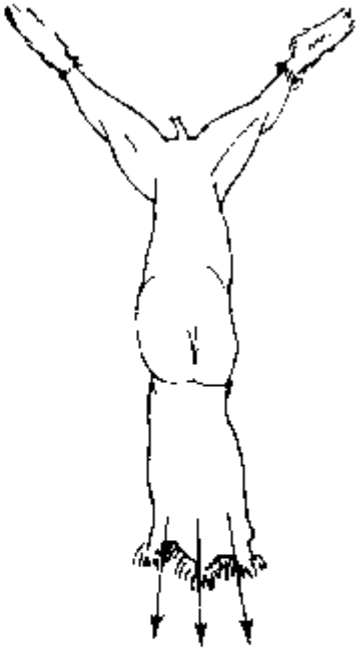
1

Skin cut between the thighs



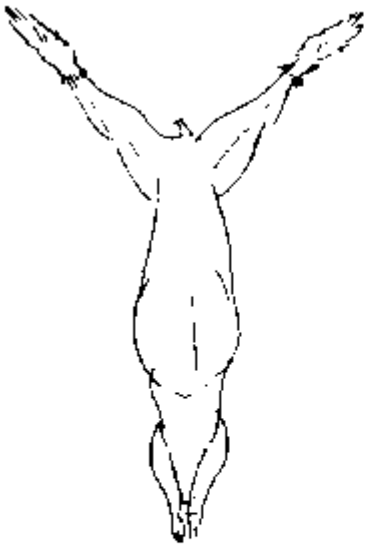
2

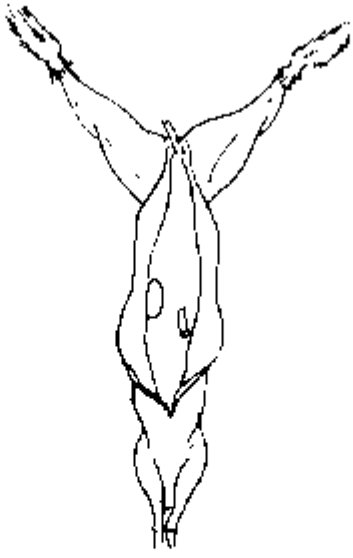
Skin pulled off the hind legs



3

Skin pulled to bare the trunk and then the fore legs





# WOOL PRODUCTION

- Angora wool is a speciality animal fibre produced by Angora rabbits.
- The other speciality fibres are:
    - lamb wool produced by sheep;
    - mohair by Angora goat;
    - cashmere/ pashmina by Pashmina goat;
    - camel wool by camel, and
    - Alpaca, Ilama and Vicuna wool by Alpaca, Ilama and Vicuna.
- These speciality fibres have a great economic value and used in the wool industry either as pure fibre or with various blends for the manufacture of specialty fabrics and yarns.

# HARVESTING OF WOOL

- Harvesting of wool is done mainly by shearing or plucking methods but there are some other methods as mentioned below which are not in practice at present.
    - Depilation. This method of removal of wool from the skin of the rabbit is done by using depilation medicines either by local application or through injections which causes the shedding of wool. This technique is not in practice these days.
    - Plucking. This method of wool harvesting is mainly adopted in China. In this method small tufts of wool at the hair tips are pulled out using the thumb and the second finger. The plucking is done 4 6 times a year depending upon loosening and moulting. The length of the wool fibre is longest in this method. But this method is somewhat painful to the animals and takes longer time than other methods. That is why this method of wool harvesting is limited to few countries.
    - Combing. This method of wool harvesting is mostly followed in France which is called "Epilation". It is accomplished by the use of short handled comb like implement which helps the operator removing patches of wool. This process is done by fixing the animal on a table by 2 4 tight straps. It is considerably more labour intensive and time consuming. This process is also painful and sometimes causes wounds in the skin.
    - Shearing. This method of wool harvesting is commonly preferred in most of the countries including India. The wool matures at approximately 14 weeks but the shearing however takes place at intervals of 12 13 weeks. In some cases shearing is done 5 times a year. This may produce wool of shorter length but a greater yield per annum.

# SHEARING METHODS

## Hand shearing

- Wool shearing is commonly done by an ordinary barber's hair cutting scissors.
- In this method, the animal is handled by the operator with the left hand and wool is clipped with right hand. First the wool from the back, shoulders, rump and neck is removed and later from the belly, legs, forehead and ears.
- The operator should secure the rabbit correctly and use the scissors properly to avoid cuts to the skin. The cuts should carefully be avoided to the teats and scrotum. Some of the wool should be left on the skin depending on the weather conditions and to provide thermo regulatory adjustments in inclement weather.

## Machine shearing

- In large commercial Angora farms and research organizations, the shearing of wool is done by electric shearing machines. In this technique the rabbit to be shorn is secured on a table.
- The animal is held by the left hand and the machine is operated by the right hand. First, the clipping of wool is done from the back and shoulders and then from the face, neck and legs.
- Lastly the shearing of wool is done at the belly, tail and around the genitalia.
- One adult Angora is clipped within 8 10 minute with this technique. But the operator should be skilled and experienced.
- Machine shearing is the best and convenient method as it is quick and does not cause any cut or wound to the rabbit. By adjusting the blades and cutters to leave 2- 3 mm wool unshorn will help the Angora to save from the cold.
- The wool clipped should be uniform. But it should be ensured that the teats of the female and the scrotum/ testicles of the male are not cut/wounded by carelessness of the shearer.
- The main advantages/ disadvantages of electric machine shearing are given below:
    - No trouble and pressure on the rabbit, shearing without pain to animal.
    - Rabbit can be saved from cold and hot weather by adjusting the wool length left.
    - Saves time and labour due to electric machine shearing.
    - Uniform and equal length of fibres at clipping.
    - Convenient at the time of grading.

## SHEARING ROOM AND STORAGE OF WOOL

- It must be ensured that any vegetable matter, burrs and other foreign matter from the body of Angora is removed before shearing.
- Angora wool being a very light material will be blown with the slightest breeze.
- To prevent this there should be a separate room set aside solely for the purpose of shearing.
- The room should be free from draughts but having light and aeration. It should be protected from rodents, and have adequate storage space for the wool after shearing.
- The wool should be stored after grading in airy wool bins preferably made of wood and chicken mesh wire with lids.
- The packing and transportation of wool from the farm to the marketing place should be done in traditional plastic bags.
- A perforated container having naptha balls should be placed in each bag to protect the wool from the insect/moth attack.

## ANGORA WOOL QUALITY

- There is no animal fibre which has the same lightness, softness and purity of fleece as Angora.
- The weight of Angora wool is 1.1g per cubic centimeter, whereas Merino sheep wool weighs approximately 1.3 g per cubic centimeter. In textile terminology, the fineness can be termed in Tex number which is 7 Tex in Angora wool meaning there by that it is possible to spin 1000 meters of yarn from 7 g of Angora wool. The Tex number of fine Merino wool would be around 20 under core spinning.
- The softness of Angora wool is produced by the extreme smoothness of the cuticle which confers the fluffiness to other fibres when blended with them. Fibre length and fibre diameter and proportion of guard hair are the main characteristics in determining the quality of wool.
- Angora wool comprises wooly fibres and guard hair. The guard hairs are of different length and thickness.
- The guard hairs may be classified in two types the finer type has uniserial type medulla of ladder shape whereas the coarser type has one or two medullary rows on the base and becomes multiserial at middle or sheath portion having largest diameter.

- The thickness is more towards head than at tail. The composition of different Angora fleece is as under:
    - Type Average length Av. Diameter (μ) % in fleece
    - (cm) Head Tail
    - Guard hairs 12 13 90 100 60 0 2
    - Guard hairs 10 11 80 90 50 60 4
    - Wool hairs 8 9 60 80 16 30 15 20
    - Wool 6 7 15 25 10 15 70 25

| Average diameter (micron) | | | | |
|---|---|---|---|---|
| Type | Average length (cm) | Head | Tail | Fleece percentage |
| Guard hairs | 12-13 | 90-100 | 60 | 0-2 |
| Guard hairs | 10-11 | 80-90 | 50-60 | 4 |
| Wool hairs | 8-9 | 60-80 | 16-30 | 15-20 |
| Wool | 6-7 | 15-25 | 10-15 | 70-25 |

- All the Angora rabbit hairs are medullated and are ladder shaped. This medullation can be seen under projection microscope as black streaks, may be uniform or in different lengths. Crimping in the wool is also an important character which is measured as crimping ratio. This is indicative of number of crimps per cm.
- The greater the number of crimps % better the wool, other characteristics of course being equal.
- The best strains of German Angoras have probably the best ratio averaging 7, French Angora 6 and British Angora 5.

## MODULE-18: ECONOMIC OF RABBIT PRODUCTION

Learning objectives

This module discuss about,

- constraints in rabbit farming and measures to improve the marketing of rabbit products,
- preparation of partial budget for small scale rabbit farms and
- economics of large scale rabbit farms.

## CONSTRAINTS IN RABBIT PRODUCTION AND MARKETING

- The major constraint is the shortage of germ plasm. The available germplasm of broiler type rabbits with the CSWRI Avikanagar and its stations at Garsa and Mannavanur falls much short of demand, Moreover, the breeders from far fetched areas have to bear high transportation cost which in turn charges a heavy price on the scale of these rabbits to new breeders.
- Lack of technical know-how, preventing the farmers to put a step forward.
- Another major constraint is non-availability of a well organized market for rabbit meat. The rabbit breeder either utilizes the product himself or sells it in the neighborhood.
- There is no clear and transparent marketing system for rabbit meat. The private rabbit breeders encourage the farmers by supplying breeding stock along with “buy back” agreement, which

results in sudden surge of market demand for breeding rabbit in the domestic market. Later due to lack of transparent marketing system and scientific knowledge results in high young stock mortality, poor weight gain in the farmers flock.

*shortage of good parent stock, lack technical support, non-availability of organized market, no clear and transparent marketing system.*

- Even though the private rabbit breeders are assuring the market for the small scale farmers, they simply transfer the breeding stock from one farm to other farm with a premium price which results in increase in the number of small farms.
- There is no organized regular slaughter of rabbit. Similarly the promoters who assured by back arrangement has failed to maintain their promise results in economic loss to the farmer. At last due to frustration the farmers are forced to close their farm.
- Constant availability of wild rabbits play a vital role in limiting the rabbit slaughter.
- Most meat consumers recognize rabbit as a pet / fancy / toy animal, which prevents their slaughter.
- Comprehensively, low consumer demand, insufficient promotion, unsteady supply, unreasonable price, competition with other meat, lack of product diversification and poorly developed market channels are the true constraints.

*Misleading private breeders, no organized slaughter, wild rabbit illegal avilability, considering rabbit as pet.*

## STRATEGIES TO IMPROVE RABBIT PRODUCTION AND MARKETING

- Through proper training, in which the nutritional value of rabbit meat to be praised, so that, farmers can recognize rabbits as a beneficially prolific meat animal species instead of as pet animals. This can be further reinforced by preparing rabbit meat dishes using local recipes.
- Serving rabbit meat on festive and community occasions, perhaps even disguising the meat for other more popular meats, is another proven means of gaining local acceptance.
- Besides such short-term approaches, providing rabbit meat in the school cafeterias and breeding stock for youth club rabbit projects are long term measures which have been successfully implemented, as observed in Africa and in Latin America.
- Moreover, in our country major agricultural farming activities are predominately performed by women, they can be further motivated to have small scale units and organizing their market.
- Rabbit projects have failed due to inadequate marketing opportunities for rabbit meat.
- The existence of viable and well established markets is always a real economic incentive.

*Proper training, conducting meat festivel, school level education, educating the women group.*

- In areas where rabbit meat is not widely consumed or marketed it is imperative to initiate a rabbit project on a small-scale, backyard family basis, since the ultimate goal of rabbit raising is to provide more meat at the family level. In time, rabbit sales to neighbors and businesses in the rural community may develop.

- If such success is met it may be possible to expand community markets to urban areas, involving marketing research and development, provided a sufficient and increasing volume of rabbit meat supplies exist. Once links between rural community and urban markets become firmly established, the development of large-scale commercial rabbit operations may be encouraged.
- In time, a more sophisticated market infrastructure may involve product diversification (eg: breeding stock, tanned skins and processed meat forms), middlemen specialization, mass-media promotions, competitive pricing and/or possibly overcoming market fragmentation.
- Through adopting such a logistic step approach to market development, greater assurance of successful marketing can often be realized. On small-scale family farms rabbits should be strongly integrated into traditional farming practices. This entails recycling of garden and/or food refuse to rabbits as feed and converting rabbit manure into compost for enhancing soil fertility. This integrated approach is an effective means by which animal feed and fertilizer costs can be minimized.
- Beneficial intermediaries (catalysts) in this integrated, cyclic scheme are earthworms as agents in finely pulverizing rabbit manure and bees as agents in boosting farm crop productivity through pollination. Alternatively, rabbits can be housed over fish ponds whereby blue- green algae production can be increased to enhance fish yield harvests.
- As a result of such applied integration each distinct farm enterprise component may demonstrate increased yields while requiring only marginal capital expenditures.
- In addition, rabbit manure can be converted into methane gas to meet household fuel needs.
- Utilization of rabbit pelts, such as tanned skins made into traditional items (drumskins, hats, rugs and toys) and foot and tail charms, should be exploited.

*initiate small scale rabbit production, integrated rabbit farming, utilization of rabbit byproducts like pelts.*

## TRAINING AND EXTENSION ACTIVITIES

- Many farmers found rabbits are not easy to raise; they require meticulous care and labor. Not every farmer possesses the human talents required. Confinement rearing has been identified as one common traditional hindrance to rabbit farming in many countries. This constraint, however, can usually be eliminated through proper approaches in screening farmers and in training, largely through effective farmer demonstration.
- Perhaps the most critical rabbit project component, which best ensures a successful program is proper farmer training and extension support. Indeed, many overseas rabbit projects have experienced technical problems or total failure attributable to inadequate education or lack of extension follow-up in appropriate methods of small-scale rabbit raising. Often this dilemma stems from the absence of a rabbit project specialist.
- The initial request to introduce a rabbit project into a rural or peri-urban area should come from the area participants themselves. From project inception the intended beneficiaries should envision the self-help rabbit project as their own. Careful selection of farmers to be involved in rabbit training is a factor of paramount importance to progressive project development.

*Rabbit farming require care and labour, need training and extension support.*

- The rabbit training course should familiarize trainees in the various applied aspects and multiple benefits of rabbit farming. On-farm demonstration activities, forage plot establishment, proper feeding, breeding and record keeping, cage construction, simple disease diagnosis, rabbit slaughter and tanning skins which complement traditionally sound farming practices and social values should be emphasized.
- As the potential rabbit farmer leader/local expert gains vital skills and confidence in rabbit production, through both training and experience, this capable farmer may later be encouraged to train other area farmers who are keenly interested in rabbit farming. This multiplier approach is essential in terms of project development and expansion.
- Well informed and enthusiastic extension agents can serve an instrumental role in complementing the above described farmer multiplication dynamic process. Village extension workers can organize farmer training and supervision activities, provide relevant technical information, promote programs, assist in the delivery of goods, etc.

*Training on applied aspects like fodder cultivation, feeding, breeding, record keeping, cage construction etc is required.*

## MAN POWER REQUIREMENT AND LABOUR MANAGEMENT

- Rabbit farming can be managed as backyard enterprise in which the farm size is small. Household labour particularly women can manage up to 20 breedable females and their followers.
- When farm size increases, accurate record maintenance and breeding skill is required. A skilled labour is highly essential for mating, pregnancy diagnosis and transferring of doe to kindling cage and care during kindly etc.
- A female labour can be able to manage 50 to 70 breedable females and their followers, if the fodder supply should be ensured constantly.
- Providing training to the labour particularly about mating, pregnancy diagnosis, kindling care is very important. Rabbits are very sensitive animals and the treatment schedules should be followed correctly. Example, monthly once anti-coccidial drugs should be added through water, correct dosing and timing is very important.
- If the farm size is large and the number of breedable females is more than 100, use of automatic watering system (nipple drinkers), foggers, chaff cutter etc. will reduce the labour requirement.

## RECORD MAINTENANCE

- Any intensive livestock rearing requires accurate record keeping to monitor the production and marketing of farm produces.
- Rabbits have short generation interval, high rate of reproduction and fecundity, prolificacy and good feed conversion efficiency.
    - These parameters should be monitored carefully to maximize profit from the enterprise.
- To achieve this objective, accurate record maintenance is important. Among different farm records following records are more important.
    - Breeding record / mating and kindling register
    - Young stock register
    - Adult stock register
    - Feed stock register
    - Mortality and disposal register
    - Daily stock register

## BREEDING RECORDS

**Breeding record / mating and kindling register**

- This is the most important register which should posses all the details related to production. This register should posses the details like sire and dam particulars; date of mating; date of pregnancy diagnosis (14th day palpation); result of pregnancy diagnosis, date of kindling, litter weight at birth; litter number at birth, litter size at weaning, litter weight and individual weight at weaning, pre-weaning mortality details at weekly intervals.

| Date of mating | Sire | Dam | Date of pregnancy verification | Result of pregnancy verification | Date of kindling | Litter at birth | | Mortality | | | | | | Date of weaning | Litter-weaning | | Dam weight at | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | Size | Weight | 1st | 2nd | 3rd | 4th | 5th | 6th | | Size | weight | Mating | Kindling |
| | | | | | | | | | | | | | | | | | | |

- This register should be printed as single sheet and kept available as field observation sheet also. This helps the farmer to know the day to day activity in the rabbit farm including, date of weaning, date of pregnancy diagnosis etc. This register also helps to eliminate unwanted or poor producing females from the farm.

## YOUNG STOCK REGISTER

- This register carries information like sire and dam particulars, litter size at birth and weaning, litter weight at birth and weaning, individual weight and three months weight/weight at market.
- This register helps to select the stock for future breeding and also for sale of breeding stock.

| Tag no. | Date of birth | Sire | Dam | Litter size at birth | Litter weight at birth | Litter size at weaning | Litter weight at weaning | Individual weight | Market weig months we |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | |

## ADULT STOCK REGISTER

- This register carries information regarding the entire stock of adult animals and also the sire and dam of the particular animal.

| Sl. no. | Tag no. | Date of birth | Sire | Dam | Date of disposal and mode of disposal |
|---|---|---|---|---|---|

## FEED STOCK REGISTER

- Another important register which gives information about the quantity of feed utilized during the period.
- Proper maintenance of this register helps the farmer to work out the feed conversion efficiency of the stock produced.
- This register can be maintained separately for growing animals and adult animals.

| Date | Opening balance | Quantity received | Total quantity | Quantity issued | Closing balance | remarks |
|---|---|---|---|---|---|---|
| | | | | | | |

## MORTALITY AND DISPOSAL REGISTER

### Mortality register

- Records the information related to death of rabbit, age, symptom, cause and postmortem findings and also the cost of the animal at the time of death. This register gives the information about the reason for death and season of death.

| Animal number | Date of death | Date of birth | Age at the time of death | History of the case | Treatment given | PM finding | Value of the animal | Re |
|---|---|---|---|---|---|---|---|---|
| | | | | | | | | |

### Disposal register

- This register records the information of sale of animal and its weight and cost. This is an important register which gives information about the farm receipts.

| Sl. no | Animal number | Date of disposal | Date of birth | Age at the time of disposal | Weight at the time of disposal | Cost received | Mode of disposal (breeding/meat/culling) | Remarks |
|---|---|---|---|---|---|---|---|---|
| 1. | | | | | | | | |

## DAILY STOCK REGISTER

- This register should be maintained in large farms where daily transaction is more. Accounting of daily stock position is very important to monitor the overall farm activity. This register gives accurate information about the movement of stock.

| | Opening balance | | | | | Addition/ birth | | | | | Internal transfer | | | | | Death | | | | | Disposal | | | | | Closing balance | | | | | Re rk |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | AM | AF | YM | YF | Tot | AM | AF | YM | YF | Tot | AM | AF | YM | YF | Tot | AM | AF | YM | YF | Tot | AM | AF | YM | YF | Tot | AM | AF | YM | YF | Tot | |
| | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |

- AM - adult male; AF - adult female; YM - young male; YF - young female; Tot - total

## WEB LINK

- NABARD provides some basic requirment for preparing project on rabbit farming
- the web link is ....http://www.nabard.org/modelbankprojects/animal_rabbit.asp
-
- Rabbit project development strategies in
- subsistence farming systems
- http://www.fao.org/docrep/u4900t/u4900t0m.htm

## BASIC ASSUMPTIONS

### Cost of animal/building/equipment

- Cost of one adult male or female rabbit is Rs. 300/-
- The rabbits are reared by cage system and cost of cage per breedable female and its followers is Rs. 1000/-
- Adult cage size 1.5' x 1.5' x 1.5'
- Kindling and growing cage size 1.5' x 1.5'x 3.0'
- Number of kindling cage/grower cage required is equal to number of breedable females
- Cost of equipments is Rs. 50 per rabbit
- Depreciation for the building is 10 per cent
- Depreciation for the equipment/cage is 15 per cent
- Building cost is Rs. 300/- per square feet
- Insurance charges @ 4% of animal value
- Bank interest @ 7%

### Production and reproduction parameters

- Sex ratio is 1: 10
- Average litter size at birth is 5
- Average litter size at weaning is 4
- Pre weaning mortality is 20%
- Number of kindling per year is 4
- Average number of bunnies produced per doe per year is 20
- Average number of bunnies weaned per doe per year is 16
- Post weaning mortality is 5 per cent
- Market age 3 months and market weight 2 kg
- Market price Rs. 300/- per breeding animal and Rs. 75/- kg live weight for meat purpouse.
- Labour cost Rs. 100/- per female labour
- Small farms with less than 100 stocks family labour is sufficient
- Cost of manure is Rs. 1000 per tonne and quantity produced 75 gm per animal per day
- Medicine cost @ Rs. 10 per adult and Rs. 5 per grower
- Electricity charges negligible for small unit of less than 100
- Larger unit Rs. 500 per month

### Feed and fodder requirement

- Concentrate requirement for growing rabbit is 75 gm/day (average requirement for 3 month)
- Concentrate requirement for adult and doe with bunnies is 150 gm /day
- Cost of concentrate feed is Rs. 14 per kg for grower and Rs. 13 per kg for adult

- Greed fodder requirement (leguminous like hedge lucerne, stylo , Lucerne etc) for growing animals 100 gm/day
- Greed fodder requirement for adult animals 200 gm/day
- Cost of leguminous green fodder is Rs. 0.50 per kg

## FIXED INVESTMENT

| Fixed investment | | | | |
|---|---|---|---|---|
| 1 | Cost of male rabbit | @Rs. 300/animal | 300.00 | |
| 2. | Cost of female rabbit (10no) | @ Rs. 300/animal | 3000.00 | 3300.00 |
| 3. | Cost of building | @Rs. 300/sq.ft | | |
| | Cage space for adult 1+10 | @ 2.25 $ft^2$/ animal total of 25 $ft^2$ | 7500.00 | |
| | Cage space for grower | @ 4.5 $ft^2$/animal total of 50 $ft^2$ | 15000.00 | |
| | Working space | @ 20 $ft^2$ | 6000.00 | 28500.00 |
| 4. | Cost of cage materials | @ Rs. 1000 per breedable female | 10000.00 | 10000.00 |
| 5. | Cost of equipment | @ Rs. 50 per breedable female | 500.00 | 500.00 |
| | Total | | | 42300.00 |

## FIXED COST

| Fixed cost | | | | |
|---|---|---|---|---|
| 1 | Interest on fixed investment | @7% x Rs.42300/- | | 2961.00 |
| 2. | Depreciation on building | @ 10% | For 28500/- | 2850.00 |
| 3. | Depreciation on equipment/cage | @ 10% | For 15000/- | 1500.00 |
| 4. | Insurance premium | @ 4% | For 3300/- | 132.00 |
| | Total | | | 7643.00 |

## VARIABLE COST

| Variable cost | | | | |
|---|---|---|---|---|
| 1 | Cost of concentrate feed | @150gm/animal/day for 365 days | 150gmx 11 animalx365 day x Rs. 13 | 7830.00 |
| 2 | Cost of | @ 75 gm/anima/day for 90 days | 75 gm x 160 bunny x | 15120.00 |

| | | | | |
|---|---|---|---|---|
| . | concentrate feed | | 90 days x Rs. 14 | |
| 3. | Green fodder | For small unit fodder from locally available sources can be exploited | | 00.00 |
| 4. | Labour | Family labour | | 0.00 |
| 5. | Veterinary aid | @ Rs. 10 per adult and 5per young | 11 x 10 = 110<br>160 x 5 = 800 | 910.00 |
| | Total | | | 23860.00 |

## TOTAL RECEIPT

| Total receipt | | | | |
|---|---|---|---|---|
| 1 | By sale of female animals for breeding | @ 300/animal | 80 female x Rs. 300 | 24000.00 |
| 2. | By sale of male animal for breeding | @ Rs. 300/ animal | 40 male x Rs. 300 | 12000.00 |
| 3. | By sale of animal for meat | @ Rs. 150/animal | 40 male x Rs. 150 | 6000.00 |
| 4. | By sale of manure | 0.75 gm x 365 x Rs. 1000 x 11 animal<br>0.75 gm x 90 days x Rs. 1000 x 160 animal | Rs. 300<br>Rs.1080.00 | 1380.00 |
| 5 | Total receipt | | | 43380.00 |

## TOTAL EXPENDITURE

| Total expenditure | | | |
|---|---|---|---|
| 1 | Fixed cost | | 7643.00 |
| 2. | Variable cost | | 23860.00 |
| | Total | | 31503.00 |
| | Net return | Total receipt – Total expenditure<br>43380 – 31503 | 11877.00 |

## RETURN

| Return | | | |
|---|---|---|---|
| 1 | Net return | Total receipt – Total expenditure<br>43380 – 31503 | 11877.00 |

| | | | |
|---|---|---|---|
| 2. | Net return per month | Net return / 12 | 989.75 |
| 3. | Net return per doe | Net return / 10 | 1187.7 |
| 4. | Cost benefit ratio | Total receipt / total expenditure | 1:1.18 |