

IVC Course Code : 110

LIVESTOCK MANAGEMENT AND DAIRYING

First Year

(w.e.f. 2018-19)

Intermediate Vocational Course

**Paper I : Ruminant LiveStock Production &
Management**

**Paper II : Non-Ruminant Livestock Production &
Management**

Paper III : Feeds & Feeding of LiveStock



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**ANNUAL SCHEME OF INSTRUCTION AND EXAMINATION FOR
1ST YEAR LIVESTOCK MANAGEMENT & DAIRYING**

Part-A		Theory		Practicals		Total	
		Periods	Marks	Periods	Marks	Periods	Marks
1.	General Foundation course	150	50	-	-	150	50
2.	English	150	50	-	-	150	50
Part-B							
3.	Paper-I Ruminant Livestock Production Management	135	50	135	50	270	100
4.	Paper-II Non Ruminant Livestock Production Management	135	50	135	50	270	100
5.	Paper-III Feeds and Feeding of Livestock	135	50	135	50	270	100
6.	OJT	-	-	365	100	365	100
7.	Total	705	250	770	250	1475	500

II. On the Job Training for 1st year from 1st August to 30 January at Livestock farms, feed plants and fodder farms. by 9.00AM to 12.00 NOON

EVALUATION OF ON THE JOB TRAINING:

The “On the Job Training” shall carry 100 marks for each year and pass marks is 50. During on the job training the candidate shall put in a minimum of 90 % of attendance.

The evaluation shall be done in the last week of January.

Marks allotted for evaluation:

S.No	Name of the activity	Max. Marks allotted for each activity
1	Attendance and punctuality	30
2	Familiarity with technical terms	05
3	Familiarity with tools and material	05
4	Manual skills	05
5	Application of knowledge	10
6	Problem solving skills	10
7	Comprehension and observation	10
8	Human relations	05
9	Ability to communicate	10
10	Maintenance of dairy	10
	Total	100

NOTE: The On the Job Training mentioned is tentative. The spirit of On the Job training is to be maintained. The colleges are at liberty to conduct on the job training according to their local feasibility of institutions & industries. They may conduct the entire on the job training periods of I year and (450) II year either by conducting classes in morning session and send the students for OJT in afternoon session or two days in week or weekly or monthly or by any mode which is feasible for both the college and the institution. However, the total assigned periods for on the job training should be completed. The institutions are at liberty to conduct On the Job training during summer also, however there will not be any financial commitment to the department.

DAIRYING

Paper - I

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UNIT-1**Introduction-Confirmation Points of Different Ruminants****Structure**

1.1 Live stock Statistics – Dairy animals, Sheep and Goat

1.2 Role of Live stock in Indian Economy

1.3 Common terms used in Farm Animal Management

1.4 External body parts of Dairy Animal, Sheep and Goat

1.1 Live Stock Statistics – Dairy animals, sheep, goat and pigs (2012 census)

S.No	Type of livestock	Population in India(millions)	Population in A.P(millions)	Position of A.P in the country
1.	Cattle	190.90	4.71	15
2.	Buffalo	108.70	6.46	6
3.	Sheep	65.06	13.56	1
4.	Goat	135.17	4.49	14
5.	Pigs	10.29	0.15	20
6.	Poultry	729.20	80.58	3

- India contributes about 15% of world cattle population and 56.6 % of world buffalo population. India stands first in buffalo population, second in cattle population, third in goat and fourth in sheep population in the world. India contributes nearly 20% of the world bovine population and stands first in bovine population in the world.
- India stands first in the world milk production with an estimated milk production during 2016-17 was 165.4million tones. Buffaloes contribute nearly 51%, cows contribute nearly 45% and goats contribute nearly 4%of the total milk production in India. The per capital

availability of milk in India (2014-15) is 310 grams per day / per person. I.C.M.R. has recommended a minimum of 280 grams per day / per person.

- Andhra Pradesh stands fifth place in milk production, fourth place in meat production and second place in egg production in India.

1.2 Role of Livestock in Indian/ Rural Economy

Livestock sector is an integral part of agriculture. Agriculture is the foundation of Indian economy and animal husbandry forms the back bone of the agriculture. Livestock sector provides supplementary income to over 75% of all rural and a few urban households. Traditionally animal husbandry is complementary and supplementary to agriculture in strengthening the rural economy. Livestock wealth is more equitably distributed than the land among various classes of society and more favorably to the weaker sections of society. Mixed farming / Diversified farming / Integrated farming is the combination of crop production with livestock rearing. It is the most suitable farming system in India particularly for the marginal and small farmers. It provides income and employment throughout the year particularly during failure of crops due to failure of monsoon and pests and diseases. Livestock provides stability to agriculture and drought proof mechanism to the rain fed areas.

- Livestock sector plays an important role in the national economy and in the socio-economic development of the country. It also plays important role in the rural economy as supplementing family income and generating employment in the rural sector, particularly among the landless laborers, small and marginal farmers.
- Livestock is providing nutritious food i.e milk, meat and eggs by utilizing the various agricultural by products.
- It is an important source of draught power and organic manure for crop production.
- Dried dung of cattle and buffaloes is utilized as source of energy for domestic cooking in some of the rural areas. Biogas can be produced with dung and it can be used for cooking, lighting lamps and running diesel motors. Slurry can be used as a good organic manure. Cattle and buffalo dung, sheep and goat manure and poultry manure improves soil fertility.
- About 70% of livestock in India is owned by majority of small and marginal farmers and the land less people. Livestock is providing higher degree of livelihood and security to the livestock keepers in comparison to farmers depending on only agriculture.
- The contribution of livestock to the agriculture sector in India has increased from 13.88% (1980-81) to 25.85% (2011-12).

- Buffalo meat, sheep and goat meat swine meat and poultry meat improves the protein value of human diet.
- Livestock also provides raw material/by products such as hides and skins, blood, bone, fat etc.
- Livestock provides subsidiary occupation to a large section of the society particularly to the people living in the rain fed, drought prone, hilly, tribal and other remote areas where crop production is limited to 7 to 8 months in a year.
- In the adverse climatic conditions and national calamities like drought, flood etc., animal husbandry practices shall be proved to be boon for sustaining the livelihood of the landless and marginal farmers in the state.
- Livestock also provide indirect employment through feed, pharmaceutical, dairy plant. meat, wool and poultry industry.

1.3 Common Terms used in Livestock management

Calf: Young one of cow or buffalo below one year of age.

Heifer calf: Female calf

Bull calf :Male calf

Heifer: Adult female from the age of puberty to calving is known as Heifer.

Bull or sire: Un castrated adult male fit for servicing/breeding.

Bullock: A castrated adult male used for work or ploughing

Teaser Bull : A Vasectomised bull which is used to detect the animals in heat in the herd.

Cow: Adult female after first calving.

NOTE: The same terms are applied to the buffaloes with prefix of Buffalo.

Gestation period: The duration of pregnancy

Servicing: Act of breeding in cattle/ buffalo

Calving: Act of Parturition in cattle/ buffalo

Freemartin: When twin calves of opposite sexes are born to a cow, the female twin born usually sterile is known as freemartin.

Veal: The meat of calf is known as veal.

Ewe: Adult female sheep

Ram: Un castrated adult male sheep

Doe: Adult female goat

Buck: Un castrated adult male goat

Lamb: Young sheep of less than one year

Kid: Young goat of less than one year

Tupping: Act of breeding in sheep

Lambing: Act of parturition in sheep

Mating: Act of breeding in goat

Kidding: Act of parturition in goat

Wedder: Castrated male sheep

Byre : House/ Place of living of cattle

Pen : House/ Place of living of sheep and goat

Herd : A group of cattle

Flock : A group of sheep

Band : A group of goat

1.4 External Body Parts of Dairy Animal, Sheep and Goat:

Body Parts of Cattle

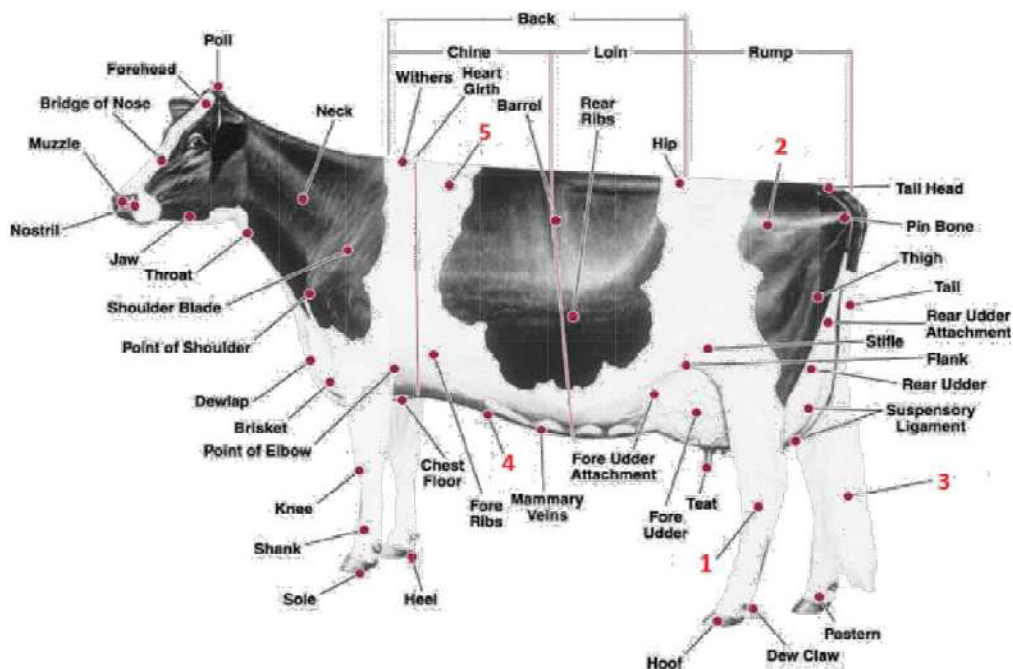
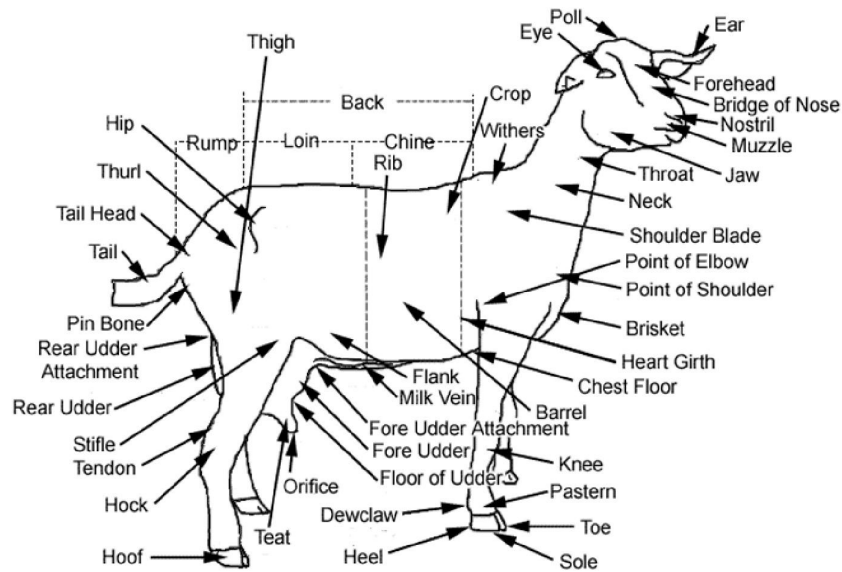


Fig 1.1: External Body Parts of Dairy Animal

Body Parts of Sheep

Fig. 1.2 Body Parts of Sheep



Body Parts of Goat

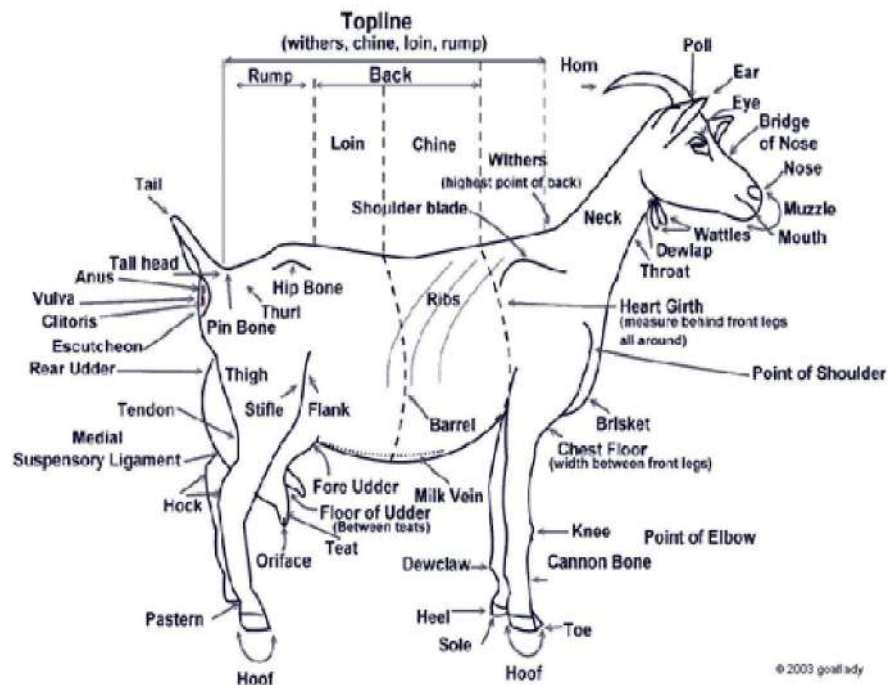


Fig. 1.3 Body Parts of Goat

Short Answer Type Questions

- 1) What is the meaning of bull, bullock, heifer and ewe
- 2) What is the meaning of servicing, tupping, lambing and kidding
- 3) What is the meaning of ram, buck, doe and kid
- 4) What is the meaning of byre, pen, herd, flock and band
- 5) Name the parts of in the head portion of the Cattle
- 6) What is freemartin

Long Answer Type Questions

- 1) Describe in detail about the role of live stock in Indian Rural Economy
- 2) Write the external body parts of Cattle
- 3) Write the external body parts of sheep
- 4) Draw a diagram of goat and label the external body parts
- 5) What are the common terms used in cattle, sheep and goat

UNIT- 2**Breeds of Dairy Cattle, Buffaloes, Sheep and Goats****Structure**

2.1 Definition of breed - Classification of Indian Cattle Breeds

2.2 Important Indian Breeds of Dairy Cattle

2.3 Important Exotic Dairy Breeds

2.4 Important Indian Buffalo Breeds

2.5 Classification of Indian Sheep Breeds – Important Breeds

2.6 Important Exotic Sheep Breeds

2.7 Classification of Indian Goat Breeds – Important Goat breeds

2.8 Important Exotic Goat Breeds

2.1 Definition of Breed-Classification of Indian Cattle Breeds

A breed is a large group of animals having similar morphological, physiological and economic characters like general appearance, size, and configuration etc. that are inherited more or less firmly. The Indian cattle belong to the species *Bos indicus*.

Indian cattle breeds are broadly classified into three types according to their utility:

- a) Milch / Dairy breeds: The cows of these breeds are high milk yielders, but the bullocks have poor draft quality. They can produce more than 1500 litres of milk per lactation.
Eg. Sahiwal, Red Sindhi, Tharparkar and Gir
- b) Dual Purpose breeds: The cows are fairly good milk yielders and the bullocks are good draft animals. Eg. Ongole, Deoni, Kankrej and Hariyana
- c) Draught breeds: The cows are poor milk yielders and the bullocks are good draft animals.
Eg. Amritmahal, Hallikar, Kangyam, Dangi, Malvi, Khillari, Malvi and Punganur etc.

2.2 Important Indian Breeds of Dairy Cattle

Milch Purpose Breeds

1. Sahiwal (Montgomery): The home tract of the breed is Montgomery district in Pakistan, but sufficient number of animals of this breed are found in Punjab, Haryana, Delhi, U.P and Bihar.

- The body colour is reddish brown with or without white splashes
- It is a medium sized breed, broad fore head, thick short horns and fine loose skin and loose dewlap.
- Legs proportionate to size with good feet. In the male the sheath is pendulous.
- The tails is long with a black switch. Udder is large, broad and fine. Teats are good, uniform in size and squarely placed. Milk veins are large and prominent.
- It is the highest milk yielding Indian cattle breed. Milk yield ranged from 2000 to 2500 kgs.
- Age at first calving is 37 to 48 months; Calving interval – 430 to 580 days
- A new breed called Jamica Hope has been evolved out of Sahiwal and Jersey crossbreeds in Latin America and West Indies.



Fig. 2.1 Sahiwal Cow

2. Red Sindhi : The home tract of this breed is the Sindh province in Pakistan but sufficient number of animals of this breed are found in Punjab, Haryana, Delhi, U.P and Bihar.

- The body colour of the breed is deep dark red. The bulls are much darker than cows. A white marking on the forehead is common.

- The animals are medium sized, compact and symmetrical. The head is of moderate size, forehead is broad and poll is prominent in between horns.
- The horns are short and thick.
- Dewlap is abundant in both males and females and hangs in folds. Legs are medium in size. Tail is slender with black switch.
- The udder is large size with medium sized teats .
- Average weight of the male is 420 kg and the average weight of the female is 341 kg. Milk yield of well bred herds is 1800-2000 kg in lactation.



Fig.2.2 Red Sindhi Cow

3. Gir: The home tract of this breed is Gir forest of Gujarat state. Animals of this breed are also found in Punjab, Haryana and some parts of Maharashtra.

- The body colour is different shades of red and white to black and white.
- The animals are medium sized with proportionate body. It has prominent broad fore head with curved horns turning back at the tip.
- Ears are large and pendulous with a typical curled-leaf appearance.
- Dewlap is thin and hanging, not pendulous. Legs are well proportionate and muscular. The hump is medium sized and markedly developed. The tail is long touching the ground.
- The udder is of medium size. Average weight of the male is 545 kg and that of the female is 390 kg.
- The lactation milk yield is 1500-2000 kg. The bullocks are heavy and good for work.



Fig. 2.3 Gir Cow

4. Tharparkar (Thari or white Sindhi): The home tract of this breed is from Sindh in Pakistan. This breed is also found in Rajasthan and Haryana.

- The body coat colour of the cattle is white or gray. In males, the gray color may deepen, particularly on the fore and hind quarters. The color of the cattle deepens during the winter months and also when the cows are pregnant.
- The head is of medium size, the forehead is broad and flat or slightly convex above eyes
- Horns are set well apart curving gradually upwards. A small portion of the skin with hairs extends over the base of the horns.
- The dewlap is of medium size and the skin is fine and mellow. The navel flap in the females is prominent.
- Lactation milk yield ranged from 1500 to 2000 kgs



Fig. 2.4 Tharparkar cow

Dual Purpose Breeds

1. Kankrej: The home tract of this breed is Gujarat and distributed in Bombay and kutch.

- The body coat colour of the female is silver gray, iron or black. The males are darker than the females.
- The forehead is broad slightly dished in the centre. The horns are thick, strong and curved and slightly symmetrical. They have lyre shaped horns.
- The body is powerful, with broad chest. Straight back, well developed hump, pendulous sheath in males and the tail is of moderate length with black switch extending below the hock.
- Dewlap is thin and pendulous and hump is large and prominent.
- It is the heaviest cattle breed in India. The average weight of the male is 455 to 682 kg and of the female is 409 to 455 kg. The average milk yield is 1360 kg. in a lactation.



Fig. 2.5 Kankrej bull

2. Hariana: The home tract of this breed is Haryana state and distributed in Punjab, Rajasthan and U.P.

- The colour of the breed is white or light grey.
- The horns are short and fine or moderately long. A prominent bony prominence at the center of the poll is a typical characteristic of the breed.
- Dewlap is small without flashy folds and hump is well developed in the males.
- Udder is well developed. Teats are medium sized and proportionate.
- The average weight of males is 500 kgs and that of the females is 375 kg.

- The average milk yield of cows is 1000 to 1360 kg. The bullocks are good for ploughing and road transport.



Fig. 2.6 Hariyana Bull and Cow

3.Ongole: The home tract of this breed is Prakasam, Guntur, Nellore and Kurnool districts of A.P. They are also distributed in Krishna, west and east Godavari districts of A.P

- The body coat colour of the animal is white. Black Kazal marking around the eyes is common. Black muzzle, black knees, fetlock, pastern, horns and switch of the tail are present
- The horns are short and stumpy. Loose horns are common in this breed.
- Hump is well developed and erect in bulls, dewlap is well developed and folds extending to navel flap. The tail is long with black switch reaching below the hocks.
- The udder is broad with moderate even sized quarters. Teats are average size.
- Ongole is one of the heaviest breeds in India. The weight of the male ranged from 500 kg to 650 kg. and that of the female is 400 to 450 kg. Lactation milk yield ranged from 1000to 1600 kgs. The males are for good for draft power and road transport.



Fig. 2.7 Ongole Bull and Cow

Draught Purpose Breeds

1.Amritmahal: The home tract of this breed is Karnataka state.

- The body coat colour of the animal is White and Grey.
- The barrel is long and well rounded and the navel flap is tacked up.
- The forehead is deeply furrowed.
- The legs are well proportioned and medium in length.
- The hooves are hard, black with narrow clefts. The tail is moderate in length. The udder is small with small hard teats.
- This is the best breed in India for draught purpose. The bullocks are suited for quick transport and the cows are poor milkers.



Fig No.2.8 Amrithmahal cow**Amrithmahal Bull**

2. Hallikar: The home tract of this breed is Mysore and Tumkur districts of Karnataka State, but the breed is widely distributed in South India.

- The body coat colour of the animal is dark or light grey with white patches round the face and dewlap.
- The head is long with bulging forehead furrowed in the middle.
- Horns are close together and sprung perpendicularly from the head, carried backward with a graceful sweep on each side of the neck and curving upwards and terminate in sharp point. The body is long and compact with long and slender legs. The navel flap is tucked up and tail is thin.

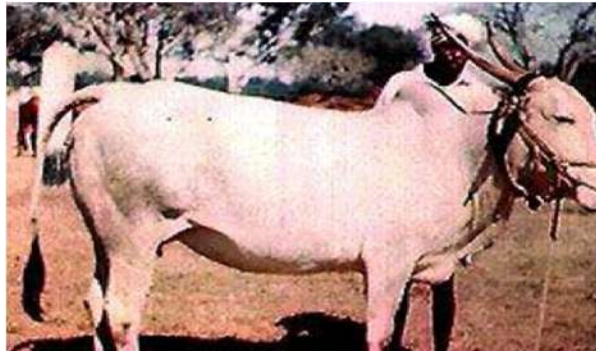


Fig. 2.9 Hallikar Cow

3. Punganur: The Punganur cattle originated from the Chittoor district of Andhra Pradesh. The breed is one of the smallest Indian cattle breeds.

- Punganur cattle are small sized animals and body coat colour is white and light grey. Sometimes they can also be light brown to dark brown or red in color.
- They have a broad forehead and short horns.
- Average height of the Punganur cattle is about 70-90 cm.
- Average weight of the bulls is around 225 kg. and average body weight of the cows is around 115 kg. The lactation milk yield is 500to 600kg.



Fig: 2.10 Punganur Bull

2.3 Important Exotic Dairy Breeds

The European breeds of dairy cattle belong to the species of *Bos Taurus*. They are less heat tolerant and less disease resistant when compared to Indian cattle, but are superior in milk production. Hence, exotic breeds of cattle have been used for cross breeding purpose in India on a fairly extensive scale with a view to improve the milk yielding capacity of the indigenous cows. The important European breeds of dairy cattle are Holstein Friesian, Brown Swiss, Jersey Guernsey and Ayrshire. Out of the above breeds there is greater demand and use of H.F and Jersey breeds for crossing with the indigenous cows in India.

1.Holstein Friesian: The home of this breed is Holland and it is distributed in cold climatic countries.

- The body colour of the animal is black and white markings and the switch of the tail is always white. Some pure bred animals may be solid black.
- The animals are the largest with large barrel and udders.
- The ideal body weight of a cow is 682 kg and that of bull is 800to 1000 kg.
- This is the world's highest milk yielding breed though the fat percentage of milk is very low. The cows are heavy milkers and the average lactation yield is 4295 kg, with milk fat

of 3.5 per cent. Individual animals touched 19,995 kg of milk in a lactation period of 365 days.

- The milk of these animals are used for cheese making as the fat percentage is low.

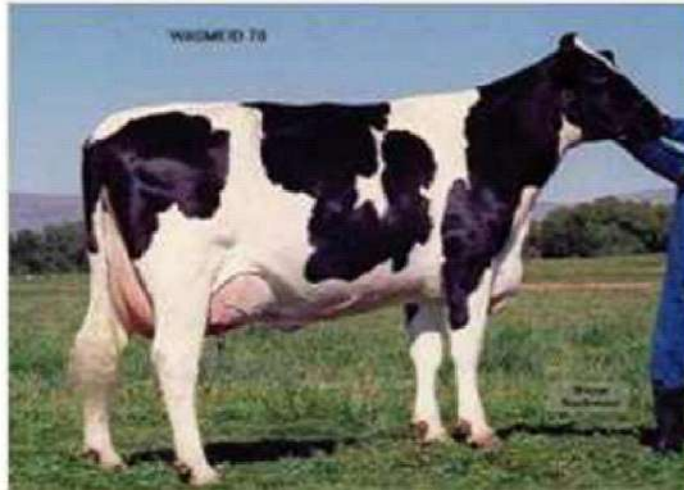


Fig. 2.11 Holstein Friesian

2. Jersey: The home of this breed is Jersey Island in the Channel Islands. This breed is popular and widely distributed all over the world. Jersey is the smallest of the European dairy breeds and the earlier maturing among them.

- The colour of the animals is brown with variation of brown to black and vary from white spotted to solid in marking.
- The switch of the tail is black. The animal is small in size, with a good capacity for milk production.
- Jersey animals are extensively used for cross breeding programme in India.
- The average milk yield of the cow is 2727 kg in lactation. Individual yielded 13,296 kg in 365 days. The milk fat is high i.e. 5.3% and milk solids are 15 %. Jersey milk is yellow in colour due to high carotene and is good for butter making.



Fig. 2.12 Jersey Cow

3. Brown Swiss: These cattle were developed in mountains area of Switzerland.

- Body colour varies from light brown to almost black. The muzzle is of light colour and along the back bone a light coloured stripe is present.
- It is the second-heaviest to the Holstein Friesian breed.
- Brown Swiss animals are large in body size and produce calves with good birth weight.
- The heifers mature and reach peak production at a later age than other dairy breeds.
- Average lactation milk yield is around 3000kgs with 4% fat.



Fig. 2.13 Brown Swiss

2.4 Important Indian Buffalo Breeds: The Indian buffalo is known as Water buffalo (*Bubalis bubalis*). There are 14 buffalo breeds present in India. But the most important breeds are Murrah, Jaffrabadi, Nili,-Ravi, Mehsana.

1. Murrah: The home tract of this breed is Rhotak, Hissar and Jind districts of Hariyana State, Punjab and Delhi. This breed is distributed throughout India and some of the south Asian countries.

- The body colour of the animal is jet black with white switch of the tail which is long and reaching the fetlock. The skin is soft and smooth. The horns are short and tightly curled.
- The she buffalo had a deep massive frame with a comparatively light neck and head.
- The udder is well developed with prominent milk veins and good sized teats.
- Average weight of the buffalo is around 500 kg and that of a buffalo bull is 545 kg to 682 kg.
- The animals are noted for good milk yield and fat per cent. It is the highest milk producing buffalo breed in the world.
- The lactation milk yield is 2500 to 3000 kg with 7- 8 fat per cent.



Fig. 2.14 Murrah Bull and Buffalo

2. Nili Ravi: The animals of this breed are found in the tract of Montgomery district of Pakistan and Ferozpur district of Punjab state. Animals of this breed are distributed all over India and Pakistan.

- The body colour of the animals is black with white markings on the forehead, face muzzle and legs.
- Wall eyes and white switch of the tail are the important physical characteristics of this breed.

- The animal is large sized like Murrah and the udder is well developed.
- The average milk yield of the she buffaloes is 1600-2000 kg in a lactation period
- The buffaloes are heavy milkers and the male animals are used for heavy road works.



Fig. 2.15 Nili rahi Bull and Buffalo

3. Jaffrabadi: The home tract of this breed is Gir forest of Kathiawar in Gujarat state.

- The body colour of the animals is black, with white patches on face and legs.
- The forehead is prominent with heavy drooping horns on each side of the neck.
- Head and neck are more massive and the body is longer but not so compact, udder is well developed and the body frame is loose.
- They are very massive animals with large body size. On an average the females weigh 464 to 555 kg and the male weigh 545 to 750 kgs. Average milk yield of she buffalo is 1820 kg to 2275 kg per lactation with high fat %.



Fig. 2.16 Jaffrabadi

4.Surti: The home tract of this breed is Kaira and Baroda districts of Gujarat State.

- The body colour of the animals is black to brown with two white collars – one around the jowl and another around the brisket. The eyes are round and bulging. Horns are of medium length and sickle shaped. The udder and teats are moderate in size.
- Average milk yield of well breed animals is about 1800 to 2500 kg with 7.5% fat.
- It is a medium size breed. Females weight is 365 kg to 455 kg and male weight is about 540kg



Fig. 2.17 Surti buffalo

5. Mehsana: The home tract of this breed is Gujarat state.

- The body colour is black with some white markings on the face, legs and tip of the tail.
 - The breed is considered to be a cross between Surti and Murrah breeds and they have characteristics of both the breeds.
 - The animal is of medium size, with long face, long wedge shaped body.
 - The udder is well developed with well placed teats.
 - The tail is long with black switch. The milk has high fat percentage.
 - Average weight of the female is about 455 kg and that of male is about 545 kg to 682 kg.
 - She buffaloes are good milk producers with long lactation lengths, and shorter dry periods
- The average milk yield of the she buffaloes is about 1820 kg in lactation.



Fig. 2.18 Mehsana buffalo

6. Nagpuri (Elitchpuri): The home tract of this breed is Maharashtra. It is also distributed in some parts of Telangana state.

- The body coat colour is black with some white patches on face, legs and tip of the tail. The head is long with a broad forehead, and the horns are long, curved back on each side of neck behind the shoulders (sword like horns).
- Barrel is long and deep with light limbs. The tail is short reaching just below hock
- The bull is comparatively short. The males are largely used for draft purpose and the females are fair milkers and the lactation milk yield is 900 to 1500 kg.



Fig. 2.19 Nagapuri Bull and Buffalo

The other buffalo breeds are Bhadawari, Panntharpuri, Tarai, Sambalpuri, Parlakhemundi, Kalahandi, Toda and South Canara.

2.5 Classification of Sheep Breeds: Sheep belonged to the species *Ovis aries*. India has about 46 breeds of sheep .

Indian breeds of sheep are classified into the following groups according to utility:

I. Apparel wool breeds: Kashmir Merino, Bharat Merino, Hissardale, Nilgiri and Avivastra. These are crossbreds of native sheep with exotic fine wool/ dual-purpose/mutton breeds.

II. Carpet wool breeds: Chokla, Nali, Magra, Jaisalmeri, Pugal, Patanwadi, Tibetan, Bonpala, Gaddi, Rampur Bushair, Poonchi, Karnah, Gurez, Changthangi, Avikalin.

III. Meat and carpet wool breeds: Malpura, Sonadi, Muzaffaranagari, Jalauni, Deccani, Bellary, Coimbatore, Chhotanagpuri, Balangiri, Ganjam, Bhakarwal, Shahabadi

IV. Meat breeds: Nellore, Mandya, Hassan, Mecheri, Kilakarsal, Vembur, Ramnad White, Madras Red, Tiruchi Black, Kenguri. These sheep are maintained for meat almost in south India

1.Nellore : There are three varieties/strains i.e Nellore Palla which is completely white in colour ; Nellore Jodipi - white with black spots particularly around the lips, eyes and lower jaw, on belly and legs; and Nellore brown(Dora), completely brown in colour.

- Nellore Jodipi breed is mostly found in Nellore and chittoor districts of A.P. Nellore brown(Dora) breed is mostly found in Rayalaseema districts of A.P. Nellore Palla is mostly found in very few areas Nellore district of A.P and its population is very less.
- These are tall animals with little hair, rams are horned and ewes are polled.
- The body weight of mature ewes is 30-35 kg and mature males average weight is 40-45kg. The body weight is higher in Nellore palla followed by Nellore Jodipi and Nellore brown(Dora).Nellore brown(Dora) can withstand poor pasture conditions as compared to Nellore Palla and Nellore Jodipi.



Fig. 2.20 Nellore-Jodipi

2.Deccani : The home tract of the breed is Maharashtra , Telangana and Karnataka. It can withstand poor pasture conditions. There are different strains in Deccani breed in Maharashtra.

- The body coat colour is black or black with white markings. Rams are horned /ewes polled
- Ears are medium long, flat and slightly drooping and tail is short and thin.
- Wool is extremely coarse and hairy. Belly and legs are devoid of wool.
- Wool yield is about 450gm. It is used for blanket manufacture.
- Body weight of male is 38 kg and female is 25kg.



Fig.2.21 Deccani

3.Mandya (Bannur/ Bandur) : The home tract of the breed is Mandya and Mysore districts of Karnataka. There is good demand for the mutton of this breed because of good quality.

- Body coat color is white but sometimes face is light brown. Both sexes are polled.
- These are smaller animals. They have compact body with typical reversed U shape conformation from rear.
- Ears are long, leafy and drooping. often wattles are present
- Coat is extremely coarse & hairy
- Male – 34 kg, female – 27 kg

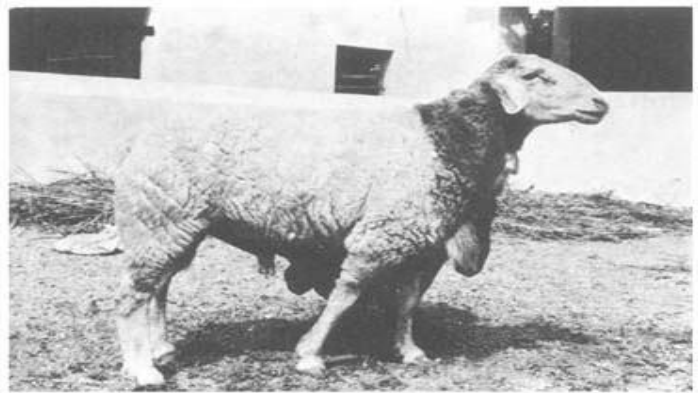


Fig. 2.22 Mandya (Bannur / Bandur)

4.Bellary : The home tract of the breed is Bellary district of Karnataka.

- Medium-sized animals, with body colour ranging from white through various combinations of white and black to black
- Males are horned; females are generally polled. Ears are medium long, flat and drooping

- Male – 35kg; female; 27kg



Fig.2.23 Bellary

5.Muzaffarnagari : It is also known as Bulandshahri. The home tract of the breed is Muzaffarnagar, Bulandshaher, Saharanpur, Meerut and the Bijnor districts of Western Uttar Pradesh. Muzaffarnagri is the largest and heaviest sheep breed in India.

- Body coat colour is white with occasional patches of brown or black. The ears and face are rarely black.
- Both sexes are polled. Rams sometimes show rudimentary horns. The ears are long and drooping.
- The tail is extremely long and reaches the fetlock.
- The fleece is white, coarse and open. The belly and legs are devoid of wool.
- Age at first lambing is between 16 to 18 months; lambing percentage ranges from 60 to 95%.
- Daily milk yield ranges from 300 to 500 ml with a lactation period of 120 to 180 days.
- Average body weight of adult male is 50kg, adult female is 40kg.



Fig.2.24. Muzaffarnagari

6.Malpura: The home tract of the breed is Jaipur, Tonk, and adjacent areas of Ajmer in Rajasthan. It is fairly well-built animals with long legs. Face is light brown. Ears are short and tubular and both sexes are polled. White fleece, extremely coarse and hairy. Belly and legs are devoid of wool.



Fig. 2.25 Malpura

7.Kashmir Merino : This breed originated from crosses of different Merino types (at first Delaine Merinos, and subsequently Rambouillet and Soviet Merinos) with predominantly migratory native sheep breeds, such as Gaddi, Bhakarwal and Poonchi.



Fig. 2.26 Kashmir Merino

2.6. Important Exotic Sheep Breeds: Merino, Rambouillet, Dorset, Suffolk and Corridale breeds are used for crossbreeding of Indian sheep for increasing the quantity and quality of wool and meat production under good feeding and management conditions.

1. Merino:

- It was developed in Spain. Body coat color is white. Skin is pink. Head and legs are covered with wool. Larger skin folds, large quantity of wool on face.
- Rams have spiral horns and ewes are generally polled
- Body weight is 60-70 kg. Fine quality wool yield is 4-7kg per year. It is popular for very fine quality of wool.
- Australian merino have small skin folds and small quantity wool on face.



Fig. 2.27 Merino

2. Rambouillet : It is originated in France(Descendent of Spanish merino)

- Body coat color is white . Face and legs are white and skin is pink and free from skin folds.
- Excellent fine wool producer of long staple.
- Rams: horned spiral/polled.
- Ewes are polled ,White hair around eyes and nose
- Average weight of ram is 100-125kg, Ewes- 60-90kg.
- Good quality wool yield is 4to5 kg per year.
- Prolific breeders



Fig. 2.28 Rambouillet

3.Dorset : It is originated in England.

- Medium size , medium size head, polled and horned strains available
- Face, ear, legs are white in color free of wool
- Superior meat quality.
- Average weight of ram is 80-110kg, Ewe:50-80kg



Fig. 2.29 Dorset

3. Suffolk : It is originated in Britan.

- Body coat colour is white with black face, ears and legs. Wool is white or black
- Legs are short and straight and Wool is absent below knees& hock
- Rams and Ewes are polled.
- Prolific breeder and best milkers
- Average weight of ram is 100-135Kg, ewe-70-100kg.
- Wool is white or black

**Fig.2.30 Suffolk**

5.Corridale : It is originated in Newzealand. It is a cross between Lincoln & Leicester rams X Merino ewes.

- Dual purpose breed for mutton and wool. Body coat colour is white. It is generally polled.
- It is prolific and hardy. Adult weight is 55to80kg. Average quality wool yield is 5-7Kg.

**Fig. 2.31 Corridale**

2.7 Classification of Goat Breeds: Goat belonged to the species *Capra hircus*. Goat Breeds are classified according to utility/major functions as given below.

I. Milch and meat breeds : Jamnapari, Barbari, Beetal, Surti and Jhakrana

II. Meat breeds : Bengal, Osmanabadi, Ganjam, Sangmneri, Malabari, Sirohi, Mehasana etc.

III. Fibre and meat breeds : Chegu, Changathangi, Gaddi and Marwari

1. Jamnapari: The home tract of the breed is west U.P

- Large sized animals, body coat colour is white with tan or black markings at neck and ears and long pendulous ears. The typical character of the breed is a highly convex nose line (Roman nose) with a tuft of hair and giving a parrot mouth appearance. The udder is well developed with large conical teats.
- Average adult weight is 55to75kg.
- Average lactation milk yield is 575 kg / 6-7 months lactation period with 4 % fat.



Fig. 2.32 Jamnapari

2.Barbari: The home tract of the breed is west U.P and it can produce twins and triplets (Prolific breeder)

Small sized animals with white colour and brown spots.

Short and erect ears, short legs.,both sexes have twisted horns.

Average adult weight is 25to40kg.

Daily milk yield is about 1kg per day.

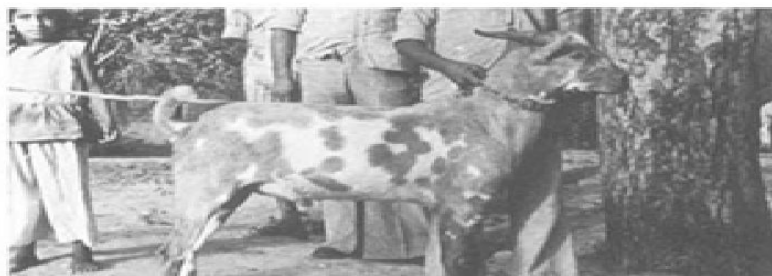


Fig. 2.33 Barbari

3.Beetal: The home tract of the breed is Punjab and Haryana.

Large sized animals and body coat colour is black with white spots.

Long pendulous ears with roman nose, horns are spirally twisted. Males are beaded.

Daily milk yield is about 1-1.5kg per day.



Fig.2.34 Beetal

4.Sirohi : The home tract of the breed is Rajasthan.

- Medium-sized animals with long lope ears.
- Coat colour is brown with light or dark brown patches
- Both sexes have small horns, curved upward and backward
- Meat purpose animal



Fig. 2.35 Sirohi

5.Osmanabadi : The home tract of the breed is South Maharashtra

- Body coat colour is black , black with white or dark brown patches.
- Most males (89.5%) are horned; females may be horned or polled, in almost equal proportions
- The udder is small and round with small teats. Meat purpose animal

**Fig. 2.36 Osmanabadi goat**

6.Black Bengal: The home tract of the breed is west Bengal and distributed in some parts of Bihar, Assam and northeastern states. It is a meat type of animal and prolific(Triplets) animal. Body coat colour is black, Small sized animals, the hair coat is short and lustrous. Both sexes have small to medium horns. Meat and skins are of excellent quality and highly prized.

**Fig. 2.37 Bengal Goat**

2.8. Exotic Goat Breeds: Saanen and Alpine breeds are used for crossbreeding of Indian goat for increasing the milk production in goats in research institutes.

1.Alpine : The home tract of the breed is France.

- Body coat colour is white to black with white spots with short pointed ears.
- Adult body weight is around 60-80kg. Daily milk yield is 1.0-1.5kg.



Fig. 9.33 Alpine Goat

2.Saanen: The home tract of the breed is Saanen valley of Switzerland. It is called as milk queen of goats.

- Body coat color is dull white to light cream. Large and pendulous udder.
- Upright erect ears, males are horned and females are horn less.
- Adult body weight is around 65-70kg. Daily milk yield is 2.0- 3.0kg.



Fig. 2.38 Saanen Goat

3.Toggenberg : The home tract of the breed is Toggenberg valley in Switzerland.

- Body coat color varies from light brown with white stripes on each side of the face, ear , Legs below knee and hock joint. Ears are erect carried forward.
- Male: 80Kg Female: 65 kg
- Males having longer hair than
- Female giving it rugged appearance
- Adult body weight is around 55-60kg. Daily milk yield is 2.0- 3.0kg with 3-4% fat.



Fig. 9.32 Toggenberg Goat

Short Answer Type Questions

1. Define breed.
2. Write the names of milch and dual purpose breeds of Indian cattle
3. Write the names of important exotic breeds of cattle
4. Write the names of important buffalo breeds
5. Write the scientific name (Species) of Indian cattle, Exotic cattle, sheep and goat
6. Write the names of important meat type of Indian breeds of sheep
7. Write the names of important exotic breeds of sheep
8. Write the names of important milk and meat type of Indian breeds of goat
9. Name important exotic Goat breeds
10. Name any four important draft breeds of Indian cattle

Long Answer Type Questions

1. Classify Indian breeds of cattle and write about Sahiwal, Gir and Ongole.
2. Briefly write about any three of the buffalo breeds.
3. Briefly write about any three of the exotic cattle breeds
4. Briefly write about any three of the Indian sheep breeds
5. Briefly write about any three of the Indian goat breeds
6. Briefly write about any three of the exotic sheep breeds.

UNIT-3**Selection and Breeding of Ruminant Livestock****Structure**

- 3.1 Selection of Dairy animals, Sheep and Goat for Breeding
 - 3.2 Selection of Sheep and Goat for Mutton purpose
 - 3.3 Culling of Ruminant animals
 - 3.4 Systems of Breeding – Inbreeding, Cross Breeding and Gradingup
 - 3.5 State and National Breeding Policies for enhancing Lvestock production
-

3.1 Selection of Dairy animals, Sheep and Goat for Breeding**3.1 a. Selection of Dairy Animals for Breeding:**

Selection is a process in which certain individuals in a population are preferred to others for the production of next generation. There are different methods of selection being used for dairy animals.

1.Individual Selection : Selection is based on the individuals own milk yield and physical characters. This is ideal for characters with high heritability. In dairy cattle most of the economic traits have low to moderate heritabilities. Hence, the individual selection is of little use for selecting the animals for milk production.

2.Family Selection : Whole families are selected or rejected as units according to the mean breeding value of the family. The families may be full sibs or half sibs. The method is useful when the character for which selection is made has low heritability.

3. Progeny Testing : The criterion of selection is the mean value of an individual's progeny which comes closest to the breeding value. The value of an individual is judged by the mean value of its progeny known as breeding value. It is equal to the sum of average effects of genes the individual carries. Progeny testing prolongs the generation interval. The bull has to wait its progeny test result before its use. A higher intensity of selection is also possible by employing artificial insemination with pedigree semen.

3.1 b. Selection of Breeding sheep and goat

1. Selection of breeding ram or buck : It is said that “The ram or buck is half of the flock.”

- Ram or buck should be pure bred
- Age should be 2 years for breeding purpose
- Ram or buck should have bold masculine characters
- Ram or buck should have good general conformation

Good conformation is vital for sheep to achieve maximum efficiency in meat production.

- A wide, straight back; Smooth shoulders; Fullness through the heart area;
- A good spring of ribs; A long, well balanced body, with adequate skeletal size.

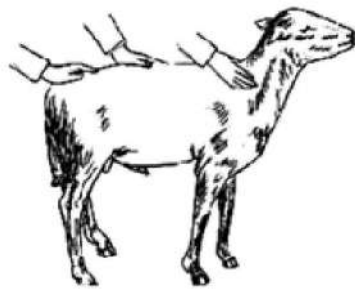


Fig. 3.1

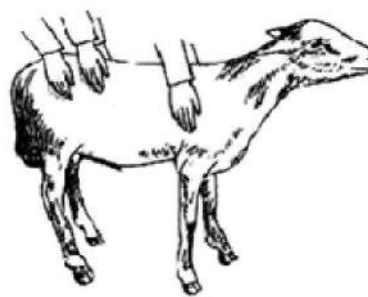


Fig. 3.2

- The legs should be straight and set squarely under the corners of the body. The legs should not be very close at the hocks or very widely apart or bowed. Strong feet and pasterns are essential for proper mounting.
- Testicles should be larger in size. The testicles should also be firm when palpated and of equal size. There should not be any cryptorchidism condition.
- The ram or buck should be healthy and free from brucellosis.

2. Selection of Breeding Ewes or does : The following characters are important while selecting the ewes or does for breeding purpose.

- Ewe or does should be pure bred
- Age should be 1 year for breeding purpose
- Ewe or doe should have feminine characters

- It should have good general conformation. The ewes or does should have bright eyes, smooth and shiny hair cover.
- A breeding ewe or doe should have a good sized normal udder. There should not be abnormalities such as swellings and lumps in the udder. Such abnormalities indicate a previous history of udder infections. The teats should be normal, free from injury and not blind.
- Ewes or does should have good mothering ability so that it will suckle their lambs readily and try to protect their offspring. Poor mothers take little interest in their lambs and sometimes they even abandon them.
- Ewes or does must be healthy and free from Brucellosis and other reproductive problems. It is better to purchase ewe with lamb or pregnant ewe

3.2 Selection of sheep and goat for mutton purpose

Selection of Sheep for Mutton Purpose:

The mutton type is characterized by a deep, wide, blocky body with symmetry, balance, breed character, thick fleshing, a strong constitution and quality. A good mutton type of breed should be selected. It should have strong back and loin, and by all four evenly placed legs. A lamb should have a deep covering of natural fleshing and fat which spreads firmly and fully over the shoulder, ribs, back, loin, rump and legs.

Selection of Goat for Mutton Purpose:

Growth rate and meat quality are two of the more important considerations in a meat goat selection program. In selecting goats for meat production, it is to consider the adaptability to environmental and production conditions, reproductive rate and growth rate. The best way to increase adaptability is to select breeding stock from animals maintained under the same natural conditions in which their offspring will be raised. For example, heat-tolerant goats are best selected for production in hot climates.

Reproductive efficiency is a major factor contributing to efficient and profitable meat production, but it is relatively difficult to select for because of low heritability. Manage the breeding herd to increase reproductive efficiency. Select for twinning rate, and cull nonproducing does for best results. Cull animals that do not meet reproductive performance criteria. Selecting goats for growth rate should be relatively easy because of the fairly high

heritability of growth traits. Base growth rate selection on higher post weaning gains or yearling weights.

Goats selected for their increased growth rate will typically also produce increased lean muscle yield. Selecting for growth rate, reproductive efficiency, and environmental adaptability will greatly improve production efficiency (pounds of production per doe bred) and the likelihood of making a profit. Improvement of meat-type goats based on production alone can easily be achieved if good records are maintained. Progressive producers will select replacements based upon records using these guidelines.

3.3 Culling of Ruminant Animals

Culling is elimination or removing undesirable and un- economical animals from the herd or flock. The unwanted or culled animals must be disposed at the earliest to control the wastage of fodder, feed, labour and other facilities in the farm. Culling is practiced once in six months in the farms depending on the herd size. The available feed and fodder resources, labour, housing and other farm facilities can be better utilized for superior animals by removing the un-economical livestock from the farm. It improves the productivity and profitability of the farm.

Reasons for culling

- The animals having undesirable breed characters are removed from the herd/flock in the breeding farms.
- Stunted growth in calves, lambs and kids
- Old aged animals
- Animals suffering from chronic diseases which are not responding to the treatment.
- Disabled animals due to injury or loss of organ, extreme lameness leading to un maintainable conditions, un healed fractured animals etc.,
- Animals suffering from serious infectious diseases like Tuberculosis, Johnes disease, Brucellosis, lost one or more quarters and teats of the under due to chronic mastitis resulting in marked reduction in milk production.
- Low milk yielding animals and sterile animals.
- Animals having bad vices like kicking, butting ,fighting with other animals

- Surplus animals than the farm carrying capacity.

3.4 Systems of Breeding : Breeding is defined as the crossing of the male and the female parents to get the off spring for the characters desired. The main breeding methods are In Breeding and Out Breeding.

In-Breeding : Inbreeding is the mating of closely related individuals, whose relationship is more than the average relationship of the population. The individuals to be mated having one or more common ancestors or relatives. The measures of inbreeding are the coefficient of inbreeding.

Advantage of Inbreeding

- Undesirable recessive genes may be discovered and eliminated by further testing in this line.
- It increases homozygosity and decreases genetic variance in the population resulting the progeny are more uniform.
- Breaking down of population into different inbred lines.

Disadvantages:

- The progeny becomes more susceptible to diseases.
- Breeding problems and reproductive failure usually increases.
- It is difficult to find out the stage of breeding at which it should be discontinued in order to avoid the bad effects of the system.
- It depresses vitality in early life than in later life.
- In breeding appears to have little value in dairy cattle breeding programmes, because of its numerous detrimental effects.

In breeding may be close breeding and line breeding.

Close breeding: It is mating between very closely related individuals such as full brothers crossed with full sisters, or off springs are crossed with parents.

Line Breeding:

- It is repeated back crossing to one outstanding ancestor, so that its contribution to the progeny is more. In this type of breeding mating is made to concentrate the inheritance of desired characters of some favoured individuals.
- It brings about the uniformity of the required type.
- The dangers involves in case of in breeding can be reduced.

In breeding is mostly used for the production of inbred lines.

Out Breeding methods: Out Breeding is mating of un related animals.

1. **Out Crossing:** It is the mating of unrelated pure bred animals of the same breed. The animals do not have common ancestors on either side of their pedigree up to 4 to 6 generations and the offspring of such a mating is known as out cross. It is an effective system for genetic improvement if it is carefully combined with selection. It is also called as pure breeding.

2. Cross Breeding: It is the mating of animals among different breeds.

Cross breeding is an important tool for breeding animals for high milk and meat production. In India, indigenous breeds of cows and nondescript cows are crossed with exotic breeds like Holstein Friesian, Brown Swiss and Jersey bulls or inseminated with their semen to increase the milk production potential of the progeny. Holstein Friesian is the best suited for the temperate or sub-tropical areas and where higher feed inputs can be provided. Jersey crosses are ideal where feed inputs are limited and the climate is tropical.

Advantages

- The desirable characters of the exotic parent like milk production and growth rate are transmitted to the progeny.
- In India, cross-breeding of cows is done by using the exotic bulls and the progeny inherit the desirable characters of the parent like high milk yield, early maturity, higher birth weight of calves, better growth rates, better reproductive efficiency and indigenous parents characters like heat tolerance, disease resistance, ability to thrive on scanty feeding and coarse fodder etc.
- This method is useful to evolve new breeds with desirable characters.
- Results are seen more quickly in characters like milk yield in the cross bred progeny.

Disadvantages

- Adaptability of the crossbred under tropical climate of India is poor when the exotic inheritance exceeds more than 50 – 62.5 %
- Cross breeding requires maintenance of two or more pure breeds in order to produce the crossbreds.

3. Grading Up: It is the practice of breeding in which the sires of the superior breed are mated with the non-descript females and their off-spring from generation to generation. After 7 or 8 generations of grading up, the non- descript population will be improved and resemble the superior breed. This is the breeding policy for buffaloes of non descript in India and AP.

Females of less developed breeds or nondescript buffaloes are continuously breed by Murrah bulls.

Advantages:

- Grades resemble pure bred animals in physical appearance and milk production after 7 or 8 generations.
- Grading up avoids the expenditure of purchasing the high producing pure animals as grading up is carried with a few superior pure bred bulls on the non descript indigenous female animals.

Disadvantages: The genetic improvement is very slow and the graded males are not useful for breeding purpose

3.5 State and National Breeding policies for enhancing Milk Production

Cattle breeding policy at national level

- Improvement of recognized Indian cattle breeds like Sahiwal, Sindhi, Tharparkar, Rathi, Gir, Kankrej, Deoni, Ongole, Amritmahal, Hallikar etc. through selective breeding.
- Crossbreeding of non-descript cattle with exotic milch breeds like H.F, Jersey and Brown swiss breeds.
- Upgrading of non-descript cattle with superior Indian cattle breeds like Sahiwal, Sindhi and Gir etc.

Buffalo breeding policy at national level

- Improvement of recognized Indian buffalo breeds like Murrah, Nili-Ravi, Surti, Jaffrabadi and Nagpuri etc. through selective breeding.
- Upgrading of non-descript buffaloes with superior Indian buffalo breeds like Murrah, Nili-Ravi and Surti etc.

Sheep breeding policy at national level

- Improvement of recognized Indian sheep breeds through selective breeding.
- Upgrading of non-descript sheep with superior Indian sheep breeds.
- Crossbreeding of Indian sheep breeds with exotic sheep breeds like Merino, Rambouillet , Corridale etc in temperate region.

Goat breeding policy at national level

- Improvement of recognized Indian goat breeds through selective breeding.
- Upgrading of non-descript goat with superior Indian goat breeds.
- Crossbreeding of Indian goat breeds with exotic goat breeds like Alpine and Saanen and Angora breeds in some organized farms.

Breeding policy in A.P**Coastal Andhra (North)**

- Jersey bulls mated to non-descript cows.
- Jersey cross breed bull (50% exotic) mated to jersey cross-bred cows.

Coastal Andhra (Delta and South)

- Jersey bulls mated to indigenous non descript cows in upland areas.
- Jersey cross breed bulls mated to jersey cross breed cows.
- Ongole bulls mated to Ongole cows in Ongole breeding tract.

Rayalaseema

- Jersey bulls mated to non-descript cows.
- Jersey cross-breed bulls (50%) mated to Jersey cross bred cows.
- Ongole bulls mated to Ongole cows in parts of Kurnool and Anantapuramu.

Tribal Areas

- Jersey cross bred bulls (50% exotic) for natural service on non descript cows.

Areas with Better Management Levels

- Jersey cross bred bulls (75% exotic) mated to Jersey cross bred cows (50%)
- Holstein Fresian cross-bred bulls (75% exotic) mated to HF crossbred cows (50%)

The State Breeding Policy for Buffaloes

- Pure bred Murrah bulls mated continuously to non-descript and graded she buffaloes (up grading).
- Graded Murrah bulls mated to non-descript and graded she buffaloes in dry and drought prone areas with limited fodder resources.

Short Answer Type Questions

1. Explain selection.
2. Explain culling
3. Explain Line breeding
4. What is grading up
5. What is cross breeding

Long Answer Type Questions

1. Write about various types of selection of dairy cattle.
2. Explain about systems of breeding
3. Write about culling of ruminant animals.
4. Explain briefly the national breeding policies of dairy animals, sheep and goat

UNIT- 4

Housing of Ruminant Livestock**Structure**

4.1 Selection of Site for Livestock Farms

4.2 Systems of Housing for cattle - Loose Housing system - Conventional dairy barn

4.3 Floor space requirements and various buildings required for dairy sheep and goat farms

4.4 Cleaning and Sanitation in Livestock farms

4.5 Bio – Gas plant

4.6 Vermi Culture

A good housing is required to protect the livestock from extreme climatic conditions like high atmospheric temperature, radiation, severe cold and high rainfall and wild animals. It is also required to provide comfort to the animals, effective feeding, good health of animals, optimum labour efficiency. The major function of live stock housing are given below.

- It should buffer the extremes of climatic conditions and provide comfortable micro environment inside the shed to reduce stress on the animals housed.
- It should permit a dry and comfortable surface for the animals to rest and provide sustainable health.
- It should provide desirable working conditions for labour and supervisory staff on the farm.
- It should be integrated with feeding, watering, and manure handling systems.
- It should protect the animals from predators and it should be economical.

4.1 Selection of Site for Livestock Farms

The following factors should be considered before the starting of live stock farm buildings.

1. Topography: Live stock farm building should be located at a higher elevation than the surrounding ground to provide a good slope for rain water and drainage for the wastes of the livestock to avoid water stagnation around the buildings . Leveled area requires less site preparation and less cost of construction cost of building.

2. Soil Type: Fertile soil should be allotted for fodder cultivation. Sufficient land should be available for fodder cultivation and construction of farm buildings. Hard soil is preferable for construction of buildings.
3. Exposure to the sun and protection from wind: Live stock farm buildings should be located to a maximum exposure to the sun in the north and minimum exposure to the sun in the south and protection from prevailing strong wind currents whether hot or cold. The long axis of the animal sheds should be set in north - south direction to minimize the heat stress in hot and humid regions.
4. Accessibility: Easy accessibility to the buildings is always essential. Situation of a animal sheds by the side of the main road preferably a distance of about 100 meters should be maintained.
5. Water Supply: It is very essential for fodder production and daily livestock maintenance.
6. Surroundings: Areas infested with wild animals should be avoided.
7. Labour: Honest and hard working labour should be available.
8. Marketing: There should be assured market and remunerative price for the farm produce.
9. Electricity: Electricity is important for lighting and to operate chaff cutter, feed mill and other electrical based equipment in a livestock farm.
10. Arrangement of farmstead buildings: Farmer's house should be located nearer to road and farm buildings. Farm buildings should be near enough to one another for effective labour efficiency. The animal sheds and other ancillary buildings like stores, hospital, vehicle and equipment sheds should be located around a central court for effective supervision of various farm activities within a short time.

4.2 Systems of Housing for cattle

The housing systems of cattle are of two types i.e Loose housing and conventional barn.

Loose Housing System: In this system, a open paddock is provided with shelter along one side. The animals can retire under the shelter when it is very hot or cold or during rains. The animals are not secured or tied in the shed. They can move freely in the shelter (covered area) and open paddock which is enclosed by means of half walls or plain chain linked fence/ GI pipes of convenient height depending on the size of the animals. Animals are kept loose except at the time of milking and treatment. A common continuous feed manger is arranged under the shelter. A common continuous water trough is arranged in the paddock. All types of live stock can be housed under loose housing System.

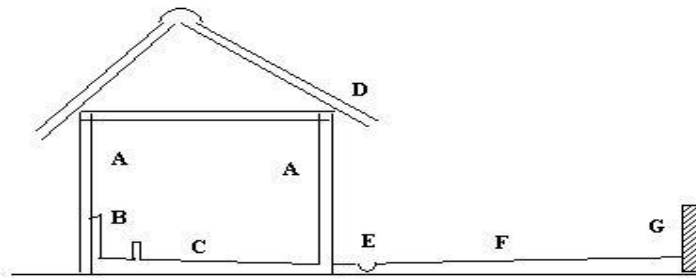


Fig. 4.1 Loose Housing System

Section of loose house showing internal details: A. Roof supporting structures , B. Manager
C. Covered Area , D. Roof, E. Gutter, F. Open area and G. Compound Wall

Advantages of loose housing system

- It is a suitable housing system for all livestock in the hot and humid climatic conditions. Animals overcome heat stress better by voluntary movement and are more comfortable in the loose house
- It is cheaper to construct and easier to expand
- It is possible to make further expansion without change
- Easy detection of animals in heat.
- Animals get optimum exercise which is extremely important for better health and production.
- 10-15% more stock than standard can be accommodated in each loose house without affecting their performance for a shorter period.
- Clean milk production is possible as the animals are milked in a separate milking shed.

De merits of loose housing system

- It is not a suitable housing system for all livestock in the temperate Himalayan region and very high rainfall climatic conditions.
- It requires more land for construction of shed.
- Individual attention may not be paid on each animal
- Bossy and strong animals may not allow the docile and weak animals to take fodder and feed from common manger. It can be controlled by providing more feeding space and sufficient fodder throughout the day.

Conventional Barn or Stanchion barn: Animals are confined on a platform and secured at neck by neck chains. The barns are completely roofed and the walls are also complete with windows / ventilators located at suitable places. Animals are fed and milked in the same place.

Merits

- Conventional barns are suitable for Temperate Himalayan region and very high rainfall areas.

- It requires less land for construction of shed.
- Individual attention can be paid on each animal and individual feeding is possible

Demerits

- Cost of construction is more
- It is not suitable for hot and humid climatic conditions
- Animals will not get sufficient exercise as they are tied in the shed throughout the day.
- Clean milk production is not possible as the animals are fed with roughages and concentrates in the same shed. It is difficult to maintain hygienic conditions in this system
- Additional number of animals cannot be accommodated.

There shall be individual standings of stalls for stanchions in one or two rows. Double rows of stanchions can be arranged either tail to tail or head to head. Length and width of standing is 1.5 to 1.7 and 1.05 and 1.20 meters respectively. The width of standing is 80% of length. Width of central passage is 1.5 to 1.8 m and shall have a gentle slope of 1 in 40 from centre towards the drain. Two continuous mangers one on each side along the head side of the standing rows and 0.75m wide feed alley beyond each manger present. “U” shaped drain of 30cm on either side of the central passage is present. The eaves of the roof shall project 90cm beyond the side walls.

4.3 Floor space requirements and various buildings required for dairy, sheep, and goat farms

4.3 a. Floor space requirements required for dairy animals, sheep and goat.

Type of animal	Floor space Covered area(Sq.m)	Floor space Open area(Sq.m)	Maximum number of animals per pen	Height of shed (cm) at eaves
Cattle and Buffaloes				
Cows	3.5	7.0	50	180 cm in medium and heavy rainfall areas and 240 in semi-arid and
Buffaloes	4.0	8.0	50	
Advance Pregnant	12.0	12.0	1.0	
Young calves	1.0	2.0	30	
Older calves	2.0	4.0	30	

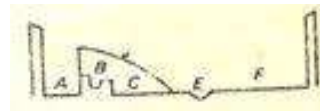
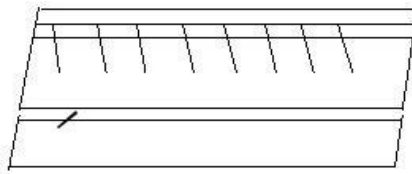
Bulls	12.0	120.0	1.0	aried areas.
Sheep and Goats				
Ewe/ doe	1.0	2.0	50	220 in heavy rainfall areas. 300in dry areas.
Lamb/kid	0.4	1.0	50	
Ram/Buck	3.5	7.0	1.0	
Milch doe	1.4mx1.2m	--	One stall for each doe	

Feeding and Watering space requirements for dairy animals, sheep and goat.

Type of animal	Feeding space per animal(cm)	Watering space per animal(cm)	Width of manger/water trough (cm)	Depth of manger/water trough (cm)	Height of inner wall of manger/water trough (cm)
Adult cattle	60-75	6.0-7.5	60	40	50
calves	40-50	4.0-5.0	40	15	20
Adult sheep and goat	40-50	4.0-5.0	50	30	35
Lambs and kids	30-35	3.0-5.0	50	20	25

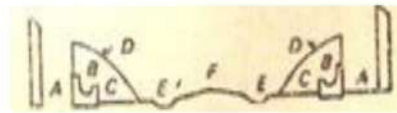
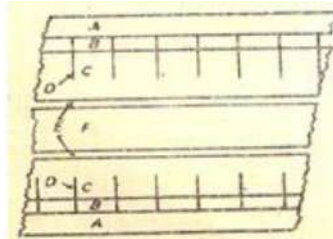
4.3b. Various buildings required for a large dairy farm

1. Milking barn/ parlour: It should be located at a central place with all other buildings arranged around it. The milch animals are fed with concentrates and milked in this shed. Depending on the number of milch animals, there are two types of milking barns i.e single row milking barn and double row milking barn. Single row milking barn is practiced when the number of lactating animals are less than ten. There should be individual standings in the milking barns. The number of standings required should be 25% of the number of total milch animals. Double row milking barn is again classified into tail to tail (Facing out) system and head to head system (Facing in) system.



Single row barn

A. Feed Alley, B. Manger C. Standing D. Standing partition E. Gutter and F. Passage



Double row tail to tail milking barn. Legend same

Advantages of tail to tail milking barn

- Milking supervision is easy and cleaning and milking operation is easy.
- It is more suitable for machine milking
- Less danger of spread of respiratory diseases from one animal to another animal

Advantages of head to head milking bar

- Feeding of animals is easy and animals are better exhibited to visitors
- Disinfection of gutter is possible with direct fall of sunrays

Tail to tail milking barn is advisable than head to head system. Length and width of standing is 1.5 to 1.7 and 1.05 and 1.20 meters respectively. The width of standing is 80% of length. Two continuous mangers one on each side along the head side of the standing rows and 0.75m wide feed alley beyond each manger present. Width of central passage is 1.5 to 1.8 m and shall have a gentle slope of 1 in 40 from centre towards the drain. "U" shaped drain of 30cm on either side of the central passage is present. The eaves of the roof shall project 90cm beyond the side walls.

2. Shed for milch/ Dry animals : Loose housing system sheds are required for milch and dry animals separately. The floor in the covered and open areas should be cement concrete to maintain cleanliness and hygiene in the sheds.
3. Maternity pen: These are located nearer to the farmers quarter for better supervision. Pregnant animals are transferred to maternity pen 2-3 weeks before expected date of calving. The number of calving pens are required at 10% of the number of total breedable female stock on the farm. The dimensions of each calving pen shall be about 3mx4m for covered area and 3x4 meters for the paddock.
4. Calf pens: These are located nearer to the milking barn. Calves are housed separately in individual calf pens with good ventilation.
5. Young stock sheds : Heifer calves are housed separately from 6 months to breeding age.
6. Bull shed: It is located at one end of the farm. Each breeding bull requires a separate shed. The dimensions of each bull shed shall be about 3mx4m for covered area and 3x8 meters for the paddock.

Other structures required in a dairy farm are stores, milk house, hay/straw sheds, silo pits, animal handling cum weighing yard and manure pits which should be located far away from the animal sheds to control flies.

4.3.c. Various buildings required for a large sheep and goat farms: The type of sheds are mostly similar for sheep and goat. They are constructed as per the floor space requirements for different age groups.

General flock Shed: Ewes/does are housed in this shed. Each shed accommodate about 50-60 Ewes/does. Measurements of shed is 15 x 4 x 3 m. It should have moorum or brick on edge floor. Slatted flooring is advisable in temperate Himalayan regions and high rainfall areas.

Ram/Buck Shed: Measurements of the shed is 4 x 2.5 x 3 m for eight animals. Individual partitions are required for breeding animals.

Lamb/kid Shed: Lambs are housed in two groups as un-weaned (0-3months), weaned (4-6 months) and un-matured animals. It is better to group the lambs as per their body weights.

- Measurements: 7.5 x 4 x 3
- un-weaned animals : 5 x 4 m

- weaned but un-matured animals: 2.5 x 4 m
- Capacity : 60-75 lambs per shed.

Lambing/kidding Shed: Measurements: 1.5x 1.2 x 3m for one pregnant animal.

Sick Animal Shed: It is for segregating sick and disabled animals ·

Shearing Room:

- The room should be well lit by having large glass windows all around
- Floor: Cement-paved with smooth surface

Wool Storage Room:

- Should have clean smooth floors & walls lined with glazed tiles upto 1.5 m height
- Should be made dust and damp-proof
- Three windows on three sides

Foot Bath

- A shallow tank made of cement concrete at the entrance of the farm
- The tank is filled with germicidal solution to protect animals from diseases and pests.

General specifications of sheep/ goat pen: It depends on the agro- climatic conditions and flock size. The shed are to be constructed as per the floor space and feeding and watering space requirement with little modifications as per the local climatic conditions.

- The shed should be located in an elevated and well drained place. Roof is preferred either thatched or corrugated asbestos sheet with sufficient slope to drain rain water.
- The shed should be constructed N – S length wise in case of moorum or brick on edge floor to enable the shed dry and clean by entry of sun rays during morning and evening. Walls may be constructed completely on North and South. A 4 feet height wall with a diamond mesh on the wall up to the roof level may be laid on East and West.
- The height of the shed may be restricted up to 10 ft
- Covered area of the shed: 1600sft (length 80 ft X 20 ft width X 10 ft height) with 5 ft collapsible gate, centrally located
- Feed Troughs Movable RCC feed troughs in the paddock: 10 Nos . Size of each trough: 10 ft Length X 18 inches width X 18 inches depth).
- The feed trough should be located 6"- 9" above the ground level
- Water trough in the paddock: 50 ft length X 4 ft width X 2 ft dept (made up of brick & smooth finished with cement)

4.4 Cleaning and sanitation in Livestock Farms

Cleaning of Animal Sheds: The easy and quick method of cleaning animal house is with liberal use of tap water, proper lifting and disposal of dung and used straw bedding, providing drainage to the animal house for complete removal of liquid waste and urine. The daily removal of feed and fodder left over in the manger reduces the fly problem. Periodical cleaning of water trough eliminates the growth of algae, bacterial and viral contamination and thus keeps the animal healthy.

Sanitation in Dairy Farm: Sanitation is necessary in the dairy farm houses for control of all micro organisms causing diseases in the animals. Milk produced in an unclean environment is likely to transmit diseases which affect human health. Proper cleaning and sanitation of animal sheds control flies, ticks and fleas etc.

The following practices are followed for cleaning and sanitation of animal sheds.

- Remove the dung from the floor and urine channel with the help of a shovel and basket (iron) and transfer it to the wheel barrow. Remove the used bedding and leftovers from the mangers in a similar way.
- Empty the water trough and scrape its sides and bottom with the help of a floor brush.
- Wash the water trough with clean water and white wash it with the help of lime mixture once a week.
- Scrape the floor with a brush and broom and wash with water.
- Clean and disinfect the splashes of dung on the side walls, railing and stanchions.
- Remove the cobwebs periodically with the help of a wall brush. Sprinkle one of the available disinfecting agents in the following concentration.
- Bleaching powder should have more than 30% available chlorine.
- Phenol 1-2% solution.
- Washing Soda (4% solution).
- Allow adequate sunlight to enter in to the shed.
- Spray insecticides at regular intervals especially during the rainy season (Fly season).
- Whitewash the walls periodically by mixing insecticides in it to eliminate ticks and mites living in cracks and crevices.

Commonly used Sanitizers: Disinfection of animal sheds means making them free from disease producing bacteria and is mainly carried out by sprinkling chemical agents such as bleaching powder, Iodine and Iodophor, sodium carbonate, Washing soda, Slaked Lime (Calcium

hydroxide), Quick Lime (Calcium oxide) and phenol. Sunlight is the most potent and powerful sanitizer which destroy most of the disease producing organisms.

Bleaching Powder: This is also called calcium hypo chloride. It contains up to 39 % available chlorine which has high disinfecting activity.

Iodine and Iodophor: This is commercially available as Iodophores and contains between 1 and 2 % available Iodine which is an effective germicide.

Sodium Carbonate: A hot 4 % solution of washing soda is a powerful disinfectant against many viruses and certain bacteria.

Slaked Lime and Quick Lime: White washing with these agents makes the walls of the sheds and the water troughs free from bacteria.

Phenol: Phenol or carbolic acid is very powerful disinfectant which destroys bacteria as well as fungus.

Commonly used Insecticides: Insecticides are used for control of ecto- parasites and insects.

Liquid insecticides can be applied with a powerful sprayer, hand sprayer, a sponge or brush.

Commonly used insecticides are malathion, sumithion , deltamethrin and cypermethrin etc.

These are highly poisonous and need to be handled carefully and should not come in contact with food material, drinking, water, milk etc.

Precautions while using disinfectants and Insecticides.

- Remove dung and used bedding completely.
- Avoid spilling of dung and used bedding while carrying it out.
- Avoid the use of dirty water in cleaning the sheds.
- Never put the fresh fodder over the previous day's left over fodder in the manger.
- Prevent algae to grow in the water troughs
- Use proper concentration of disinfectant / insecticide solutions to avoid any toxic effects.
- Avoid the use of disinfectant solution at the milking time as milk absorbs these quickly.

Procedure

4.5 Bio – Gas Plants

Bio-gas can be produced from raw materials such as agricultural waste, manure, municipal waste, plant material, green waste or food waste. It is a renewable energy source. It can be produced by anaerobic digestion with anaerobic organisms, which digest material inside a closed system, or fermentation of biodegradable materials. This energy release allows biogas to be used as a fuel.

Uses of biogas: It can be used as domestic fuel, street lighting and generation of electricity .

Advantages of biogas plants

- Reduces burden on forests and fossil fuels
- Produces a clean fuel - helps in controlling air pollution
- Provides nutrient rich (N & P) manure for plants
- Controls water pollution by decomposing sewage, animal dung and human excreta.

Limitations of biogas plants

- Initial cost of installation of the plant is high and service centers are not available.
- Number of cattle owned by an average family of farmers is inadequate to feed a biogas plant.

There are two types of biogas plants in usage for the production of biogas.

A. The fixed- dome type of biogas plant

B. The floating gas holder type of biogas plant

A. Fixed dome type of biogas plant:

Raw materials required : Forms of biomass listed below may be used along with water.

- Animal dung
- Poultry wastes
- Plant wastes (Husk, grass, weeds etc.)
- Human excreta
- Industrial wastes(Saw dust, wastes from food processing industries)
- Domestic wastes (Vegetable peels, waste food materials)

Biogas is produced as a result of anaerobic fermentation of biomass in the presence of water.

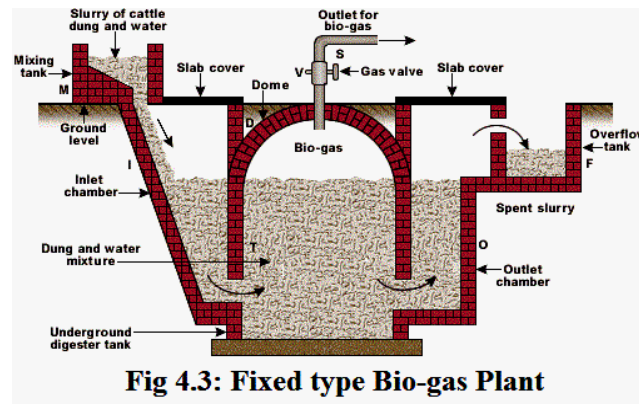
Working of fixed dome type Biogas Plant:

- The various forms of biomass are mixed with an equal quantity of water in the mixing tank. This forms the slurry. The slurry is fed into the digester through the inlet chamber.
- When the digester is partially filled with the slurry, the introduction of slurry is stopped and the plant is left unused for about two months. During these two months, anaerobic bacteria present in the slurry decomposes or ferments the Biomass in the presence of water.
- As a result of anaerobic fermentation, biogas is produced and collected in the dome of the digester. As more and more biogas starts collecting, the pressure exerted by the biogas forces the spent slurry into the outlet chamber.

- From the outlet chamber, the spent slurry overflows into the overflow tank. The spent slurry is manually removed from the overflow tank and used as manure for plants.
- The gas valve connected to a system of pipelines is opened when a supply of biogas is required.

To obtain a continuous supply of biogas, a functioning plant can be fed continuously with the prepared slurry.

- **Advantages of fixed dome type of biogas plant:** It requires only locally and easily available materials for construction, inexpensive and easy to construct.



B. Floating gas holder type of biogas plant

Working of floating dome type Biogas Plant :

- Slurry (mixture of equal quantities of biomass and water) is prepared in the mixing tank. The prepared slurry is fed into the inlet chamber of the digester through the inlet pipe.
- The plant is left unused for about two months and introduction of more slurry is stopped. During this period, anaerobic fermentation of biomass takes place in the presence of water and produces biogas in the digester.
- Biogas being lighter rises up and starts collecting in the gas holder. The gas holder now starts moving up. The gas holder cannot rise up beyond a certain level. As more and more gas starts collecting, more pressure begins to be exerted on the slurry.
- The spent slurry is now forced into the outlet chamber from the top of the inlet chamber.
- When the outlet chamber gets filled with the spent slurry, the excess is forced out through the outlet pipe into the overflow tank. This is later used as manure for plants.
- The gas valve of the gas outlet is opened to get a supply of biogas. Once the production of biogas begins, a continuous supply of gas can be ensured by regular removal of spent slurry and introduction of fresh slurry.

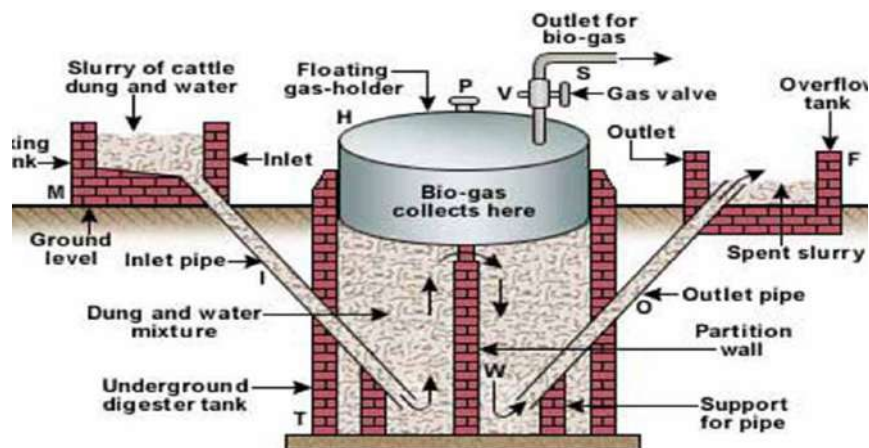


Fig 4.4: Floating Dome type Biogas Plant

Disadvantages of floating gas holder type biogas plant: It is expensive, steel drum may rust and requires regular maintenance.

4.6 Vermicompost

Vermicompost (or vermi-compost) is the product of the composting process using various species of worms, usually red wigglers, white worms, and other earthworms, to create a mixture of decomposing vegetable or food waste, bedding materials, and vermicast.

- Vermicast (also called worm castings, worm humus, worm manure, or worm feces) is the end-product of the breakdown of organic matter by earthworms.
- These castings have been shown to contain reduced levels of contaminants and a higher saturation of nutrients than the organic materials before vermicomposting.
- Vermicompost contains water-soluble nutrients and is an excellent, nutrient-rich organic fertilizer and soil conditioner.
- It is used in farming and small scale sustainable, organic farming. Vermicomposting can also be applied for treatment of sewage sludge.
- Furthermore, a variation of the process is vermifiltration (or vermidigestion) which is used to remove organic matter, pathogens and oxygen demand from wastewater or directly from black water of flush toilets.

Short Answer Type Questions

1. Explain loose housing system
2. Explain conventional Livestock barn
3. What is maternity pen in dairy farm
4. Write the advantages of tail to tail milking barn
5. Write the advantages of head to head milking barn
6. List out the sheds required in a sheep farm
7. Give four sanitizers used in livestock sheds.
8. Explain Bio-Gas
9. What is Vermi Culture?

Long Answer Type Questions

1. What are the points to be considered while selection of site for livestock farm.
2. Write in detail about loose housing and conventional housing system and merits of the systems.
3. Write about various buildings required in a large dairy farm.
4. Briefly write about the housing of sheep and goat.
5. Write about floor space requirements and feeding space requirements for cattle, buffaloes, sheep and goat.
6. Briefly write about cleaning and sanitation in a livestock farm

UNIT-5

Care and Management of Ruminant Livestock

Structure

- 5.1 Starting of new dairy sheep and goat farms
 - 5.2 Care and management of calf, heifer, milch, dry and pregnant cattle
 - 5.3 Care and management of bulls and bullocks
 - 5.4 Care and management of kids and lambs
 - 5.5 Care and management of young sheep and goat
 - 5.6 Care and management of pregnant ewe and doe
 - 5.7 Care and management of ram and buck
 - 5.8 Management of animals during transport
-

5.1 Starting of new dairy sheep and goat farms

5.1a. Starting of new dairy farm

Most of the dairy farmers are rearing animals in small scale traditional methods. They are not aware about the modern farming techniques for dairy farming. As a result, some farmers are loosing their investment instead of being benefited. Several important steps for setting up dairy farming are to be considered.

1. Market for milk: There should be assured market and remunerative price for milk in the proposed area for starting the farm. Milk can be sold directly to consumers, milk cooperative societies and private dairies. There should be assured market as milk is highly perishable item. Remunerative price for milk is also very important as the profitability of dairying is mainly decided by the price.
2. Availability of land and water: Sufficient land is required for construction of animal sheds and cultivation of fodder. A ten animal unit requires about one hectare of land for fodder production and 0.1 ha for animal sheds. Sufficient water is required for cultivation of fodder and day to day

use of water for animals and cleaning of animal sheds. There should be assured source of water like bore wells and irrigation canals in the farm.

3. Breeding and health cover facilities: A.I and hospital facilities should be available within the reach of the farmers. It is also very important for optimum breeding efficiency and good health of the animals.

4. Availability of labour: Skilled and hard working persons should be available in the near by area.

5. Availability of dry fodder and crop residues is required to reduce the transport cost of dry fodders from long distance.

6. Transport and communication facilities are also required.

7. Training and experience: The farmer should have basic knowledge about breeding, feeding, management and health care of animals. Visit some commercial dairy farms and observe the day to day farm operations and discuss with the experienced farm owners about their experience in dairy farming. Information regarding dairy farming can also be obtained from farm magazines, books, radio and T.V.

8. Fodder production, construction of sheds, procurement of equipment, feed and dry fodder should be taken up before the purchase of animals.

9. Start the farm with high yielding dairy animals like Murrah, H.F, jersey crossbreds and graded murrah buffaloes depending on local market demand for milk, feed and fodder resources and housing facilities.

5.1 b. Starting of new sheep and goat farm: The following important steps for setting up Sheep and goat farming are to be considered.

1. Market demand for meat: There should be assured market and remunerative price for meat animals in the proposed area for starting the farm. When there is a good demand for sheep meat, the farm should be started with good meat type of sheep breeds. When there is a good demand for goat meat, the farm should be started with good meat type of goat breeds.

2. Availability of land and water: Sufficient land is required for construction of animal sheds and cultivation of fodder and development of pasture lands. 100 sheep and goat unit requires about one hectare of land for fodder production and 0.1 ha for animal sheds. Sufficient water is required for cultivation of fodder and day to day use of water for animals and cleaning of animal sheds. There should be assured source of water like bore wells and irrigation canals in the farm.

3. Health cover facilities: Veterinary hospital facilities should be available within the reach of the farmers for prevention and control of diseases and treatment of sick animals.

4. Availability of labour: Skilled and hard working persons should be available in the near by area.
5. Availability of crop residues is required to reduce the transport cost of dry fodders from long distance.
6. Transport and communication facilities are also required.
7. Training and experience: The farmer should have basic knowledge about breeding, feeding, management and health care of animals. Visit some commercial sheep and goat farms and observe the day to day farm operations and discuss with the experienced farm owners about their experience in sheep and goat farming. Information regarding sheep and goat farming can also be obtained from farm magazines, books, radio and T.V.
8. Fodder production, construction of sheds , procurement of equipment, feed and dry fodder should be taken up before the purchase of sheep and goat.
9. Start the farm with good meat breeds of sheep and goat depending on local market demand for the breeds of sheep and goat, feed and fodder resources, pasture land and housing facilities.

5.2 Care and Management of Calf, Heifer, Milch, Dry and Pregnant Cattle

5.2a. Care and Management of Calf

Good feeding and management are essential for the calves for higher growth rate, so that they can attain mature body weight earlier and mortality rate can be minimized particularly in buffalo calves. Calves are the future replacement stock. The feeding and care of the calf begins before its birth. The dam should be dried two months before expected date of calving and should be fed well. Underfed pregnant animals will give calves with low birth weight.

Care and management of new born calf

- Immediately after birth remove any mucous or phlegm from those nose and mouth. Normally the cow licks the calf immediately after birth. This helps in dry off the calf and also stimulates breathing and circulation. When the cow doesn't lick the calf or in cold climate, dry the calf with a dry cloth or gunny bag. Provide artificial respiration by compression and relaxing the chest with hands.
- The naval cord should be tied about 2-4 cms away from the body and cut 1 cm below the ligature and apply Tr. Iodine to prevent naval ill or naval abscess.
- The birth weight of the calf should be recorded. It may be ranged from 25 to 30kg depending on the breed. The birth weight is higher in male calves than female calves.
- Wash the cow's udder and teats preferably with clean water and dry off with a clean cloth. Allow the calf to suckle the first milk of the mother i.e. Colostrum.

- Normally the calf will be standing and attempts to nurse within one hour. Otherwise help the calve to take colostrum.

Feeding of Calves

- Feed colostrum i.e. the first milk of the cow for the first 3 days. The colostrum is thick and viscous. It contains higher proportions of Vit A and proteins. The proteins are immune globulin which gives protection against many diseases. Whole milk should be given after 3 days. It is better to teach the calf to drink milk from the pail or bucket. Feed the calves twice a day. For weak calves, feed thrice a day.
- The limit of liquid milk feeding is 10 % of its body weight feeding. It may be 2-3 litres per day and continue liquid milk feeding for 6-10 weeks.
- The milk replacers can be given to the calves after 2 weeks to replace whole milk which reduces the cost of feeding. Calf starter can be given from third week of age.
- Provide good quality green fodder and hay from one month afterwards for the early development of the rumen.
- Feeding of antibiotics to calves through milk or calf starter during early life improves appetite, increases growth rate and prevents calf scours. E.g. aureomycin, Terramycin etc.

Other management practices

- The calves are identified by tattooing on inside of the ear after birth and tagging or branding after one year.
- Dehorn the calf within 7-10 days after birth with red hot Iron or caustic potash stick or with electric dehorner.
- De worm the calf regularly to eliminate internal parasites using appropriate deworming drugs. Deworming should be done at 7 days after birth, and later every 30 days interval up to 3 months and for every month up to 6 months and for every 3 months up to 1 year.
- Fresh water should be given from 2nd week onwards.
- House the calves in individual calf pens up to 3 months and afterwards in groups. After six months males and females calves should be housed separately.
- Weigh the calves at weekly interval up to 6 months and at monthly interval afterwards to know the growth rate.
- Mortality in calves is more during first month due to worms (Ascariasis), Diarrhea (calf scours) and pneumonia. Proper deworming and housing under clean conditions is important to prevent mortality in the calves.

- Wetness should be avoided in the calf pen to prevent bloody diarrhoea (coccidiosis).
- Extra teats beyond 4 should be removed at 1-2 months of age in the female calves.
- All the surplus male calves which are not used for breeding purpose should be castrated at 8-10 weeks of age.
- Mineral-block licks should be provided to the calves to prevent mineral deficiency.
- Wean the crossbred calf from the mother 3 days after birth and feed them through pail feeding.

5.2b. Care and Management of Heifer

Better care and management of heifer will give high quality replacement stock to the dairy farm. The following care and management practices are recommended for a heifer.

- 1 -2 kg concentrate feed supplementation is required apart from green fodder and dry fodder.
- A loose housing system with a shelter open to one side is sufficient. They should be protected from summer stress by following the summer management practices.
- Heifer should be bred between 250 to 275kg. Attaining body weight is important than breeding age. Breeding under sized animals is not advisable. Small sized heifer is more likely to have difficulty in calving.
- Usually the heifer is bred when they attain 60% of its mature body weight.
- Place the heifer in a separate shed/maternity pen about 6-8 weeks before the expected date of calving. Provide 2-3 kgs of concentrate daily along with adlibitum forage.
- The heifer should be habituated to handling and milking routine along with other milch animals before calving .
- Maintenance of health among heifers is very important for proper growth. The health among the heifers is maintained by hygiene housing, watering balanced feeding and taking necessary preventive steps against common diseases.
- Periodically the heifers in the herd should be checked for their proper growth and other progress. Animals lagging behind below the required standards should be removed from the herd.

- For the heifer that is calving first time may have difficulty in calving. So take extra care should be taken during calving.

5.2.c. Care and Management of milch animals

The milch animal should be properly fed and necessary care and management practices should be followed to get higher milk production during lactation. The following feeding and management practices should be followed for higher milk production in milch animals.

- Sufficient green succulent forage together with leguminous hay or straw should be provided to meet its maintenance requirements. Extra concentrate at the rate of 1 kg for every 2 litres of buffalo milk and 2.5 liters of cow milk should be provided. Salt and mineral supplements should be given to maintain the lactation.
- A milch animal will come to heat within 60 days after calving with good feeding and management after calving. Do not withhold service unnecessarily after the signs of heat are noticed in a milch animal. Early service of the milch animal reduces the calving interval.
- Maintaining proper records of breeding and feeding of the animals will ensure a continuous milk production throughout the year in the farm.
- Each animal is fed according to its milk production. Drinking water should be available within the reach of the animals at all times. High milk yielding animals require more water for milk synthesis in the udder.
- Concentrate mixture is fed before or during milking, whereas roughages after milking. This practice will avoid dust in the shed. Sudden change of regular feeding will decrease the milk production.
- Regularity in milking is essential. Increase of milk in the udder will reduce further secretion of milk. Milking thrice is better than twice since 10 -15 % more milk can be produced in high milk producing animals.
- Quick, continuous, dry hand milking should be practiced. Milking should be done with full hand milking method, but not with stripping and knuckling.
- Cows should be trained to let down milk without calf suckling. This will help to wean the calves early.
- Loose housing with shelter during hot part of the day should be provided. The animals will get maximum exercise in loose housing system.

- Grooming of the cows and washing of the buffaloes before milking help in clean milk production. Daily brushing will remove loose hair and dirt from the coat. Grooming will also keep the animal hide pliable.
- Wallowing of buffaloes or water spraying on their bodies will keep the buffaloes comfortable especially in summer.
- Common vices should be properly detected and care should be taken. Eg. Kicking, licking, suckling etc.
- Provide at least 60 days dry period before calving. When the dry period is not sufficient, the milk yield in subsequent lactation will be reduced.
- Vaccinate the cows against important diseases and also guard against insects and pests.
- Check for mastitis regularly by conducting strip cup test and clean milk production practices should be followed in the farm.

5.2d.Care and Management of dry and Pregnant Animal

The good care and managerial practices given to pregnant animal will give good calf and also high milk yield during the successive lactation.

- Extra concentrate mix of 1to 2kgs should be provided for pregnant animal as pregnancy allowance. Feed good quality of leguminous fodder. The animal should not be lean or fat condition.
- Provide clean drinking water and protection from thermal stress.
- Do not allow them to mix with other animals that have aborted or that are suffering from or carriers of diseases like brucellosis.
- Allow moderate exercise, which helps in calving normally. Do not tire them by making long distances especially on uneven surfaces.
- Do not allow them to fight with other animals and take care that they are not chased by dogs and other animals.
- Avoid slippery conditions, which causes the animal to fall receiving fractures, dislocation etc.
- If accurate breeding records are available, calculate the expected date of calving. Separate it one or 2 weeks before and shifted to individual parturition pens. These pens are thoroughly cleaned and fresh bedding may be provided.

- Feed one kg extra concentrates during last 8 weeks of gestation. Feed laxative diet about 3 - 5 days before and after calving (Wheat bran 3 kg + 0.5 kg of Groundnut cake + 100 g of mineral mixture and salt).
- Symptoms of delivery may be observed i.e. swelling of external genitalia, swelling of udder, usually majority of animals will deliver without any help. If there is any difficulty, provide veterinary help.
- After parturition external genitalia, flank should be cleaned and protect the animal from chill and give warm wafer.
- Placenta will normally shed by the cow within 2- 4 hours after calving. If it fails to shed even after 12 hours, take the help of a veterinarian
- Take care of the animal before calving from milk fever. Give calcium supplement.
- Sometimes the udder will be swollen just before calving. Remove the milk partially.
- Take care, of the animal, if at all any abortion.
- Provide always free access to drinking water.

5.3 Care and Management of Bulls and Bullocks

5.3.a. Care and Management of Bull

- The maintenance of breeding bulls in good condition and suitable for breeding is highly essential requirement for the success of breeding programmes.
- A rising condition is better for reproduction than a falling one.
- Fat males may produce semen of inferior quality or they may be slow or fail at service. Breeding bull should receive plenty of exercise will usually produce large ejaculation containing more sperms of higher activity.
- A breeding bull should be housed separately in a bull shed with sufficient area of floor and proper covering.
- It is sound practice to provide cool conditions and adequate drinking water.
- A balanced ration should be fed containing adequate energy, proteins, minerals, and vitamins. Green fodder must be available both before and during breeding season.
- Most of the bulls are ferocious and so control them properly using nose rings etc.
- It is of great importance that males should be fed regularly and not too much at one time and too little at another.
- For bulls two matings a day has been found to be optimum.
- Moderate exercise should be provided to keep the breeding bull in active and non fatty conditions.

- Regular grooming of the breeding bull should be practiced.
- In buffalo bulls regular shaving may be practiced around prepuse.

5.3.b Care and Management of Bullocks

Bullocks are normally used for agricultural operations and transport purpose. Some bullocks are ferocious and so control them properly with nose rope or nose rings. The hooves of the bullocks should be provided with metal shoes to protect the hooves from wear and tear.

- The working hours for bullocks are recommended as follows
- Normal Work - 6 hours of carting or 4 hours of ploughing.
- Heavy Work - 8 hours of carting or 6 hours of ploughing.
- Sufficient roughages and 1-2 kg of concentrates may be provided for feeding of bullocks. During break period in works, the animal may be left for free grazing.
- The bullocks are housed in separate sheds with sufficient space and protection from hot and cool conditions. Free access to drinking water is essential. Regular grooming of animals should be practiced.

5.4 Care and Management of Kids and Lambs

Good feeding and management is essential to increase the growth rate and to decrease the mortality in lambs and kids.

- The ewe/doe should give birth in a clean environment either on a well-rotated pasture or stall bedded with straw or other absorbent material.
- Remove the excess mucus in the nasal passages and mouth.
- Disinfect the navel by dipping the cord in a mild solution of tincture of iodine to prevent entry of disease causing organisms into navel.
- The lamb/kid should consume enough colostrum of about 10% of their body weight .One of the most important functions of colostrum (first milk) is to provide lambs/kids with immunoglobulins that provide immunity for the first couple of months of life. Colostrum is also a highly concentrated source of energy, acts as a laxative and is an essential feed within one hour of birth.
- Colostrum enables the newborn to follow its mother and protects it from over cooling (chilling) which is the single most important cause of death. Moreover, allowing the lamb/kid to suckle colostrum is an important part of the maternal bonding process.

5.5 Management of Ewes / Does

Flushing: It is the practice of providing a high energy/protein diet prior to and during breeding season. It is practiced 2 to 3 weeks before and after breeding season. Flushed ewes/does respond to the increased level of nutrient intake by increased ovulation rate which leads to improved prolificacy. Daily feeding of 250g of concentrate/grains during breeding season take care of the flushing in ewes and does.

Other management Practices

- Screen the ewe/doe flock and cull ewes/does with bad udders and any other physical deformities.
- Ewes/does with a history of poor mothering ability, low milk production or had lambing/kidding difficulties would be strong candidates for culling.
- Lambing/kidding season is one of the factors that affect the survival of lambs/kids, it is advisable to consider adjusting the breeding/mating time so that lambing/kidding could occur at a favorable time for survival.

5.5 Care and Management of Pregnant Ewes/Does

Ewes/does must have enough body reserves at lambing/kidding to produce lambs/kids with adequate birth weight and produce sufficient colostrum and maintain milk yield in early

lactation. Most foetal growth, along with mammary gland development, occurs during the last 2 months of pregnancy. Good feeding is very important during this time. Ewes/does should consume drymatter about 3% of their bodyweight daily. Insufficient feed intake, particularly energy, will result the birth of weak lambs/kids and produce inadequate colostrum, reduced milk production throughout lactation. It leads to increased lamb/kid mortality. All ewes/does should be routinely vaccinated against endemic diseases like E.T, pasteurellosis etc. Ewes/does should be de wormed 3 to 4 weeks before lambing/kidding.

5.7 Care of the Breeding Ram and Buck: Proper feeding of rams during this period is important to maintain proper body condition. Good quality forages either as pasture or hay along with 500g of concentrate feed is sufficient during breeding season so as to breed more number of ewes/does. Rams/Bucks should also have a mineral and vitamin mix manufactured specifically for sheep available. Internal and external parasite control program, proper vaccinations, hoof maintenance, should be done.

The use of a marking harness, rotating colors every 17 days, is an excellent management tool for this purpose. The breeding season should be kept to a maximum of 60 days for young rams. This will prevent over-use, severe weight loss and reduced libido. Severe weight loss may impair future growth and development of the young ram, and reduce his lifetime usefulness. Supplementing young rams with 500gms concentrates during the breeding season will reduce excessive weight loss.

5.8 Management of animals during transport

The most common mode of transport of animals used is by foot and road (truck). Occasionally, the animals are transported by rail from very long distance in India. Important factors to be considered during the transportation of animals to minimize the transport stress and injuries to the animals.

- The size and design of the transport vehicle should be compatible with the number of stock and type of live stock being transported.
- The transport vehicle should be in good condition to ensure the livestock arrive at their destination with least injury and in the shortest possible time.
- The stock crate should be well designed so as to minimise bruising. A well designed stock crate will have a large smooth contact surface without projections on which animals can bruise. Pens should be approximately 3 metres in length (pens should not be longer than 4 metres) to provide more support to animals during travel and thus reduce stress and allow them to adapt to transport more readily.
- It is recommended that the following classes be transported or penned separately: polled & dehorned cattle; young calves, a cow with a suckling calf; adult bulls; cattle greatly different in size and females in advanced stages of pregnancy.
- A good floor either sand or straw bedding should be provided in the transporting vehicle.
- It is necessary to carry the local feed and utensils for feeding, watering and milking of animals during the journey. Experienced attendants should accompany a truck or wagon load to take care of the feeding, watering and cleaning.
- First aid medicines for bloat, diarrhea and injury should be carried.
- The live stock should be watered every 12 hours i.e once in the morning and once in the evening.
- Animals by truck should not be transported for a distance more than 600-700km. Instruct the driver not to drive fast to avoid sudden stoppages. Sudden and sharp turn must be avoided.

- Ramp should be used during loading and unloading time. Ordinary goods truck can take 5 to 6 cattle depending upon their age and condition.

It is important to make sure you have adequate facilities to unload the cattle when you get them back to your place. A set of yards or a small paddock to confine the cattle for the first couple of days is essential. Holding the cattle in a small paddock or set of yards for the first couple of days will help to settle and calm them. It may also help to prevent the spread of diseases to the existing animals.

The holding paddock or yard must have a supply of water that is accessible to all animals. It would also be a good place to introduce your cattle to some hay, in order to settle them after the transport.

When pasture is short or of low quality (such as summer pasture), supplementation is necessary to maintain desired weight or condition and support growth, pregnancy and lactation. Hand feeding is often needed during autumn, winter and summer depending on seasonal conditions and during late pregnancy and lactation.

Short Answer Type Questions

1. What is the method of identification for calves
2. Explain sealing of naval vessels
3. Write the importance of colostrum
4. Explain importance of deworming
5. Write the importance of calf starter
6. What is flushing
7. Explain about creep feeding of Lambs
8. Explain the care of pregnant ewe

Long Answer Type Questions

1. Explain about the starting of new Dairy farm
2. Describe in detail about the care and management practices of calf.
3. Explain the management of pregnant animals.
4. Write in detail about the care and management of Kids and Lambs.
5. Briefly write about the management of animals during transport.

UNIT- 6**Activities in Ruminant Livestock Farms****Structure**

- 6.1. Dairy farm, Sheep and Goat Farm daily routine activities
- 6.2. Restraining methods of dairy cattle, Sheep and Goat
- 6.3. Dentition and ageing of animals
- 6.4. Methods of identification in dairy cattle, Sheep and Goat
- 6.5. Records to be maintained in a dairy cattle, Sheep and Goat farms
- 6.6. Common vices of dairy animals, Sheep and Goat
- 6.7. Weaning of calf, Lamb and Kid
- 6.8 Grooming, disbudding, hoof trimming, castration and de – ticking
- 6.9. Dipping, Clipping and Shearing Operations.

6.1 Dairy farm, Sheep and Goat Farm daily routine activities**6.1a. Dairy Farm Routine Activities**

The various practices to be carried out on the dairy farm daily or periodically should be well planned and carried out punctually in the following manner.

TIME	FARM OPERATION
4:00 A.M to 4:30 A.M	<ul style="list-style-type: none"> • Cleaning Milch animals • Offering half of the daily concentrate Feed • Morning milk • Milk disposal • Washing and disinfection of the milking barn • Heat Detection with teaser bull/ observation.
4:30 A.M to 5:30 A.M	
5:30A.M to 6:30 A.M	

6:30 A.M to 8:00 A.M	<ul style="list-style-type: none"> • Cleaning of the milch cow sheds • Feeding of dry/green fodder to the milch stock • Isolation of the sick animals • Offering concentrate to calves and pregnant animals
8:00 A.M to 12:00 Noon	<ul style="list-style-type: none"> • Cleaning other age group Animals • Treating of ailing animals • Artificial insemination • Vaccination / Deworming • Harvesting green fodder • Transportation of fodder • Fodder chaffing • Feeding green fodder to live stock • Cleaning of entire premises and sheds • Disposal of dung to vermi compost / bio gas • Spraying disinfectant • Spraying insecticides • Vermi composting • Lunch cum rest period for labourers
12:00 P.M to 1:00 P.M	
1:00 P.M to 2:00 P.M	<ul style="list-style-type: none"> • Miscellaneous jobs: Identification, preparation of concentrate feed, repair of farm equipment weekly scrubbing and white washing of feed mangers and water troughs, halter making etc.
3:30 P.M to 4:30PM	<ul style="list-style-type: none"> • Cleaning of milch animals • Offering concentrate feed to milch animals • Offering green fodder to other age groups
4.30 P.M to 5:30 P.M	<ul style="list-style-type: none"> • Evening milking
5.30 P.M to 6:30 P.M	<ul style="list-style-type: none"> • Disposal of milk • Washing of the milking barn • Feeding dry fodder to all animals
6.30 P.M to 7:30 P.M	<ul style="list-style-type: none"> • Record keeping • Accounting

7.30 P.M to 4:00 A.M	<ul style="list-style-type: none"> • Night watchman comes on duty
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6.1.b. Routine operations in sheep and goat farms

The study of farm routines enables proper scheduling of various farm activities on a sheep and goat farm. It also helps in the optimum utilization of labor and resources, and higher returns through efficient management practices.

Daily Schedule of Activities on a Sheep / Goat Farm

Approx. Time	Farm Operations
07.00	<ol style="list-style-type: none"> 1. Turning out the animals for grazing. This can be delayed during the winter months. 2. Observe and isolate sick animals
08.00	<ol style="list-style-type: none"> 1. Feed half of the daily concentrate ration to nursing females and fattening lambs/kids. 2. Watering of the animals on the grazing lands
08.30	<ol style="list-style-type: none"> 1. Feed chopped green and dry fodder to penned sheep/goats. 2. Cleaning of all the sheds and disposal of manure
09.00 to 15.00	<ol style="list-style-type: none"> 1. Special activities like record keeping, weighing and marketing of lambs and kids, shearing, vaccination and preventive health care, disbudding; grading, sorting, storage and marketing of wool etc.
16.00	<ol style="list-style-type: none"> 1. Return of sheep and goats to their pens 2. Feeding the other half of the daily concentrate ration to nursing females and fattening lambs/ kids. 3. Feeding chopped green and dry fodder to all the animals.

Note : On a goat farm, the milch does should be milked twice a day at convenient timings.

Monthly Schedule of Sheep Farm Operations

The monthly schedule of various sheep farm operations with twice a year lambing or shearing pattern under semi-arid conditions on an organized farm is given below.

Month	Farm Operations
January	Stock verification, protection against cold weather; care, management and supplementary feeding of advanced pregnant ewes; preparation of lambing pens, care at lambing, docking, identification of newborn lambs; supplementary feeding of breeding rams for spring mating; vaccination against clostridial infections
February	Lambing continues, care and supplementary feeding of lactating ewes; creep feeding, ear-tagging, tail docking and growth recording of lambs; flushing of breeding ewes for spring mating, tupping (in later part of February), vaccination against sheep pox.
March	Lambing continues, care and supplementary feeding of lactating ewes; creep feeding, ear-tagging, tail docking and growth recording of lambs; washing of sheep, wool sampling, shearing, dipping, vaccination against sheep pox.
April	Wool sampling, shearing and dipping continues, creep feeding, growth recording and weaning of lambs; culling of old, infertile and weak animals; deworming, vaccination against FMD
May	Weaning and supplementary feeding of lambs, drenching of weaners, grazing during cooler hours, tree lopping, proper shelter and adequate drinking water.
June	Care, management and supplementary feeding of advanced pregnant ewes; supplementary feeding, culling of undesired ram lambs, preparation of lambing pens, vaccination against tetanus, ET & HS.
July	Washing, shearing, dipping, drenching, care of advanced pregnant ewes, autumn lambing starts, care at lambing, flushing of ewes for autumn mating.
August	Lambing continues, flushing of ewes for autumn mating continues, supplementary feeding of breeding rams, de worming.
September	Selection of breeding rams, autumn breeding starts, creep feeding and management of lambs; drenching.
October	Autumn breeding continues, creep feeding of lambs and supplementary feeding, care of weaners, culling of underweight & deformed lambs, vaccination against ET drenching.
November	Winter grazing, de worming continues depending on worm load, penning at night.
December	Protection against cold and chilly weather, disposal of surplus lambs, supplementary feeding of advanced pregnant ewes.

6.2 Restraining Methods of Dairy Cattle

Handling cattle and buffalo is required when they are vaccinated, examined or undergo other treatments. It may lead to stress and injuries especially if the animals are not properly handled and the handler is not experienced.

There are different techniques used to restrain and cast (throw) these large ruminants.

6.2.a. Methods of Restraining (controlling) cattle and buffalo

Trevis: Made of wood or metal used for restraining cattle and buffaloes for a brief period of time. It is commonly used for controlling the cattle and buffalo for examining the animals in veterinary hospital.

Restraining of Head

Halter: The primary method of restraint used in dairy cattle is the halter. The halter can be made of cotton, nylon, twine, etc. It is mainly used to control the head and once the head is controlled, the animal can be handled with relative ease. The proper placement of the halter is important and it begins with making sure the lead is placed on the left side of the animals head.

Correctly place the halter on the head i.e. “the part that draws goes under the jaws.” This leaves the top part of the halter to go over the poll and behind the ears.

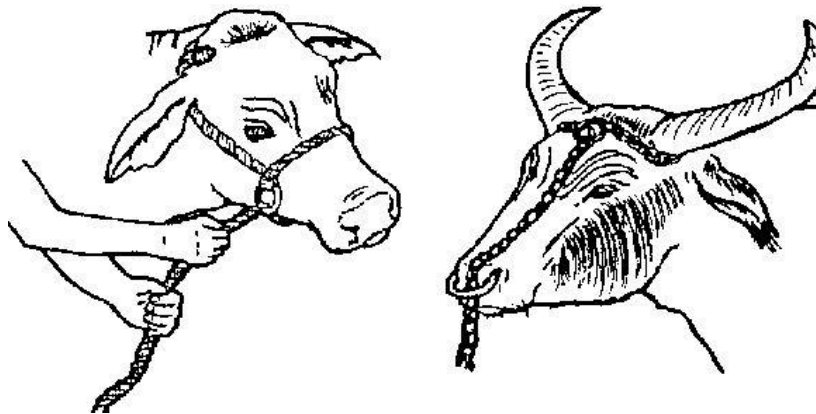


Fig. 6.1 Haltering Large Ruminants (Cattle and Buffalo)

In the absence of the halter or nose holder, the cattle can be handled by take a firm grip of the nostril using the thumb and forefinger of one hand while holding the horn or the ear with the other hand.

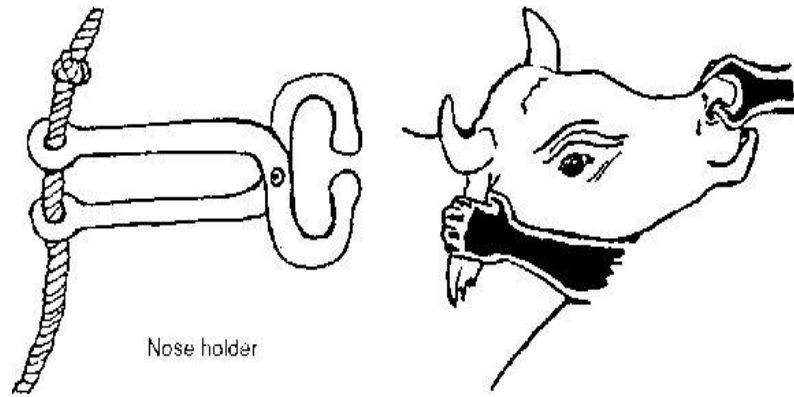


Fig. 6.2 Nose Holder

Handling of Tail: The purpose of this restraint is to keep the cow's tail out of the way when a placenta is being removed or the udder is being treated or while handling the hind part of the animal

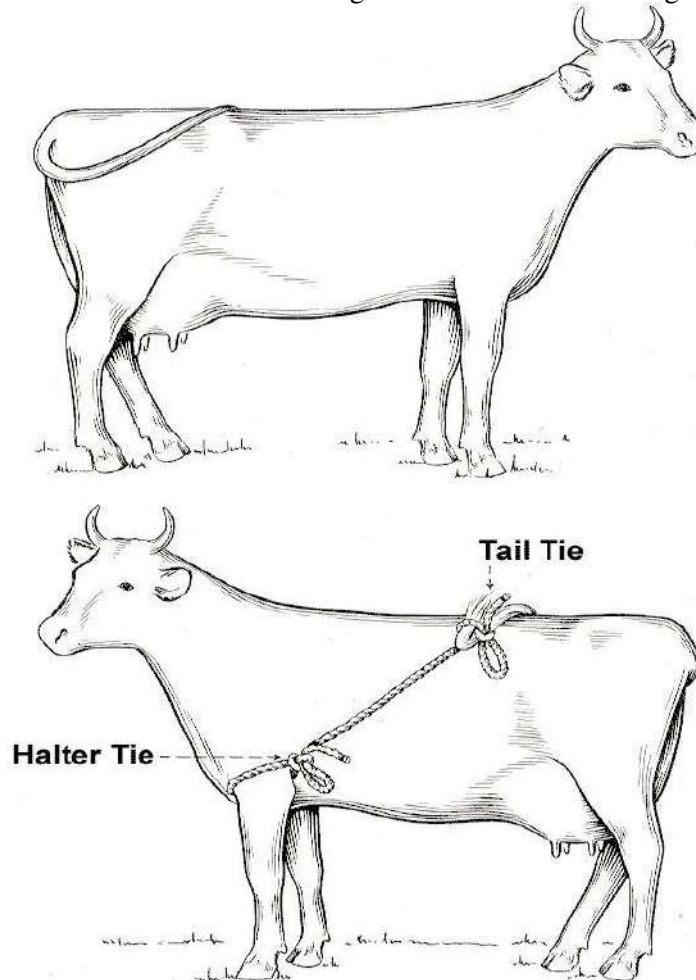
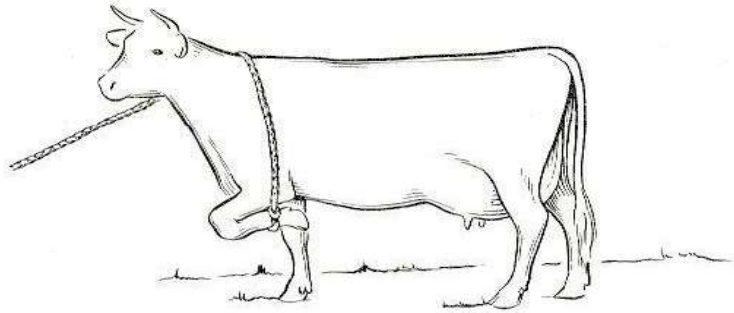


Fig. 6.3 Handling of Tail

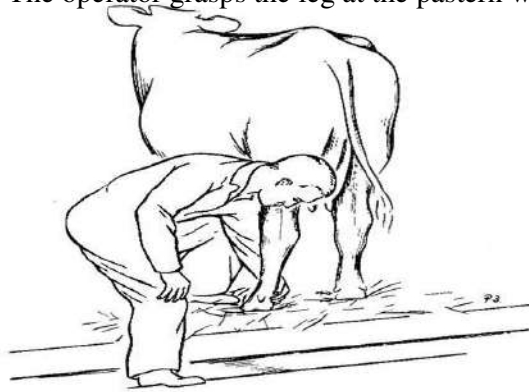
Front Leg : This restraint can also be used to make a cow stand still and to keep her from kicking with a hind leg. A rope with an eye in one end is used to form a loop around the pastern. The other end of the rope passes over the withers where it should be held by an assistant so that it can be released quickly if the cow starts to go down.

Fig. 6.4 Lifting of front leg

Rear leg :

(B) Manual rising

In using this simple method one is less likely to injure the cow than in using the beam hook or a more elaborate method. A nose lead is used and the cow's head pulled to the side opposite that of the foot to be lifted. The operator grasps the leg at the pastern with his left hand.

**Fig. 6.5 Lifting of hind leg**

With his left shoulder he pushes the cow's flank so that her weight will be shifted to the other rear leg and at the same time he raises her rear leg.

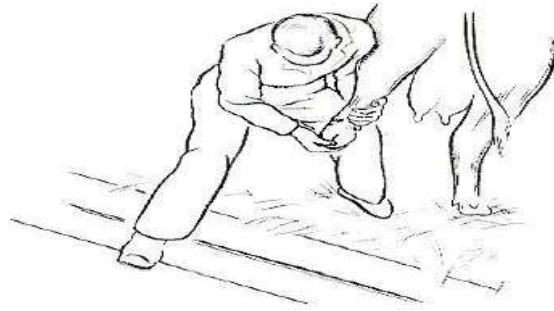


Fig. 6.6 Lifting of hind leg

He adjusts the position of the cow's leg so that his own leg is holding the weight of it and his left hand is only needed to hold it steady. His right hand is then free to work.

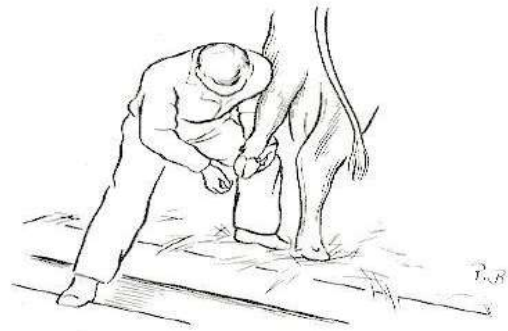


Fig. 6.7 Lifting and flexing of hind leg

(C) Beam Hook Method

- This is a method of raising a cow's foot off the ground and holding it in a position which will permit one to examine it or to treat it.
- It is particularly useful for the treatment of hoof rot in dairy herds as it can be applied to animals in stanchions.
- By means of a nose lead the cow's head is pulled to the side opposite the leg which is to be lifted and made fast to a stanchion.
- A set of beam hooks is fastened to a beam above and somewhat behind the cow.

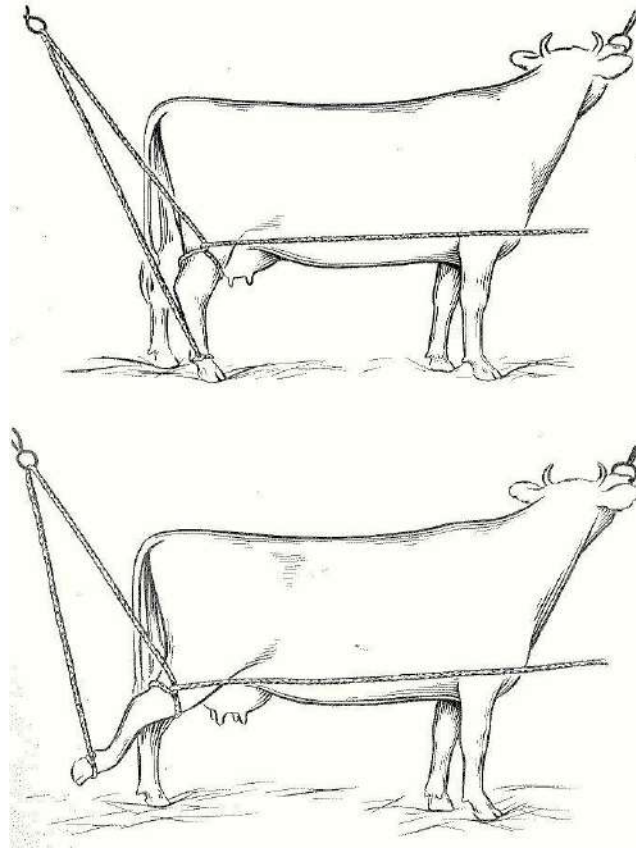


Fig. 6.8 Lifting of hind leg by beam hook method

A 30 foot piece of rope with an eye or a quick-release honda is used to make a loop around the cow's leg below the fetlock. The free end of the rope is passed upward through the ring of the beam hook so that it goes in a direction toward the head of the cow. Passing down from the beam hook, the end is brought around the leg above the hock, going from the inner to the outer side and back around the standing part of the rope to form a half hitch. It is then carried forward and wrapped once around a part of the stanchion. The cow's foot is lifted off the ground and the slack in the rope taken up. The animal may struggle; but if her foot is lifted and the rope tightened simultaneously, the foot can be raised high enough to permit one to work on it. The end of the rope is then made fast with a halter tie to hold the foot at the desired height.

Examination of Mouth

- For any thorough examination of a cow's mouth one should use a mouth gag and have a good strong light.
- The mouth gag with its two arms together is slid into the mouth and then fastened by a strap around the neck. It may be opened to the desired width by a ratchet on the side. This mouth gag has a wide space between its arms so that even the corners of the mouth can be seen easily and the teeth can be approached from any direction.

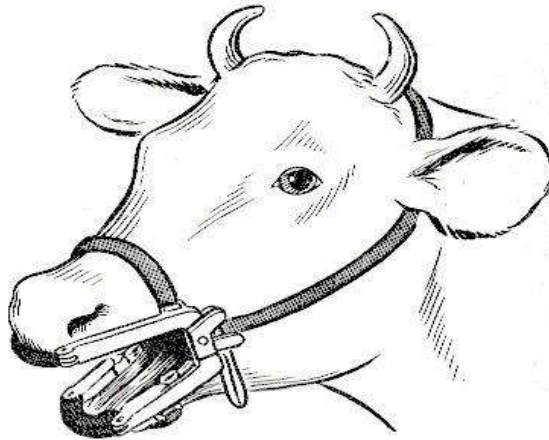


Fig. 6.9 Application of mouth gag

- To hold the mouth open in a case of bloat or to pass a stomach tube, a probang gag may be used. The wooden block is placed in the mouth and the strap fastened behind the horns.

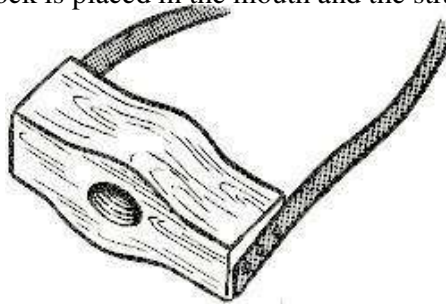


Fig. 6.10 Probang gag

Casting the Cattle and Buffaloes**(A) Burley Method**

This method of casting cattle, devised by Dr. D. R. Burley of Georgia, has many advantages over the other casting methods. .

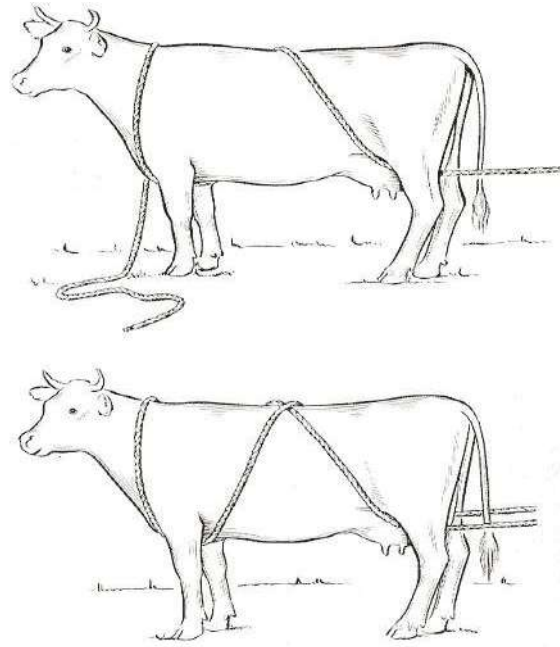


Fig. 6.11 Casting the Cattle and Buffaloes by Burley method

While the cow is being held by a strong halter or by a nose lead a forty foot piece of rope is placed over her back with its centre at the withers. The ends are carried between the forelegs and crossed at the sternum. One end is carried up each side of the animal's body and the two are crossed again over the back. Each end passes downward between the rear legs going between the inner surface of the legs and under the udder or scrotum, as the case may be.

When the ends of the rope are pulled, the cow will fall. The operator may control the direction of the fall by pulling the casting ropes so that the animal is forced to one side or the other.

To tie the rear leg the operator keeps both ropes taut and slides the uppermost one along the under surface of the rear leg to the fetlock. He flexes the leg and makes a half hitch around the fetlock.

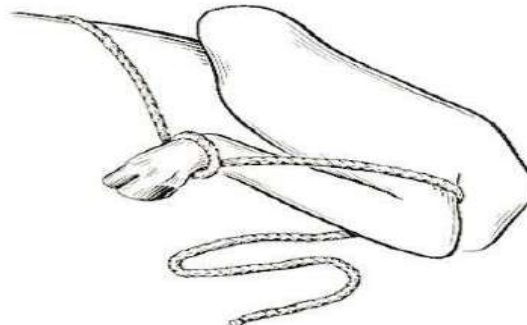


Fig. 6.12 Fixing the hind leg

The end is then carried around the leg above the hock, across the cannon bone, and back around the fetlock. The leg is secured by several such “figure 8’s”.

To tie the front leg a short heavy cord or rope about six feet long is needed. One end of it is fastened around the pastern with a clove hitch leaving a free end about eight inches long. The front leg is flexed and the long end of the cord carried forward and passed under the main casting rope descending from the withers.

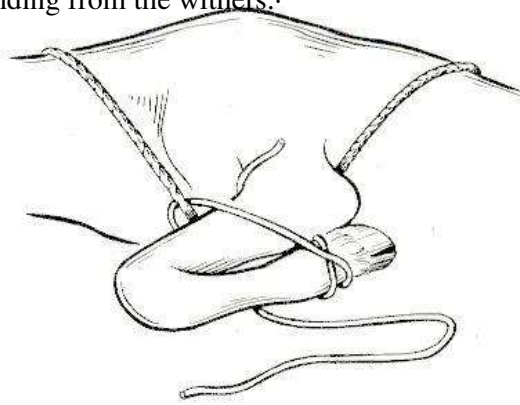


Fig. 6.13 Fixing the hind leg with rope

The cord is passed around the flexed front leg several times and tied in a reefer’s knot to the short free end at the pastern.

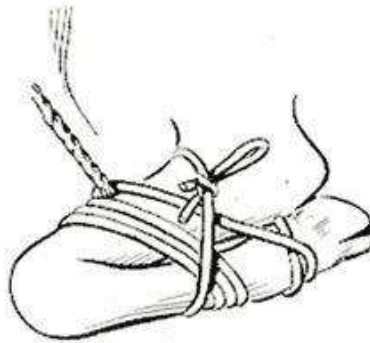


Fig. 6.14 Tying the hind leg with rope

The animal is rolled over and the rear leg of the other side is tied with the other end of the casting rope. With another six foot cord, the other front leg is tied, and the animal is then completely restrained.

Rope squeeze method

- This is a standard method of casting a cow.
- The rope for this restraint may be arranged on a cow while she is in the stanchion.
- She may then be led to the place where it is desired that she lie down and tension applied to the end of the rope.
- Make a loop around the cow's neck using a bowline knot placed as indicated in the drawing.

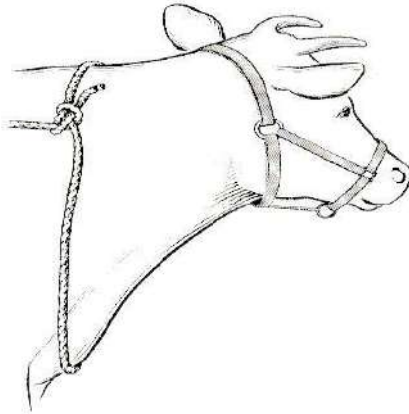


Fig. 6.15 Application of loop at the neck

Throw the end of the rope over her back to the opposite side.

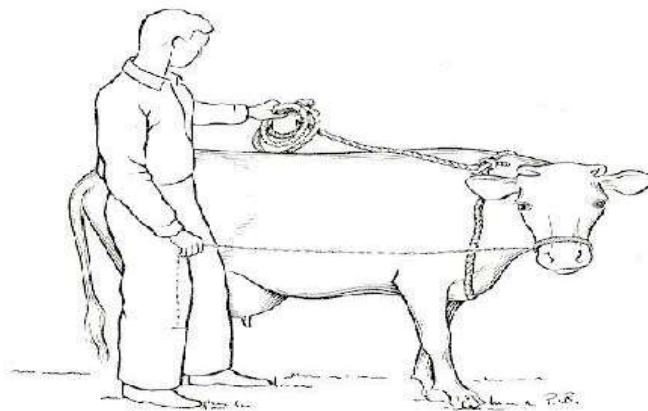


Fig. 6.16 Application of loop on the body

Reaching under the cow, pick it up and bring it around her body and under the standing part of the rope near the bowline to form a half hitch just behind the shoulder.

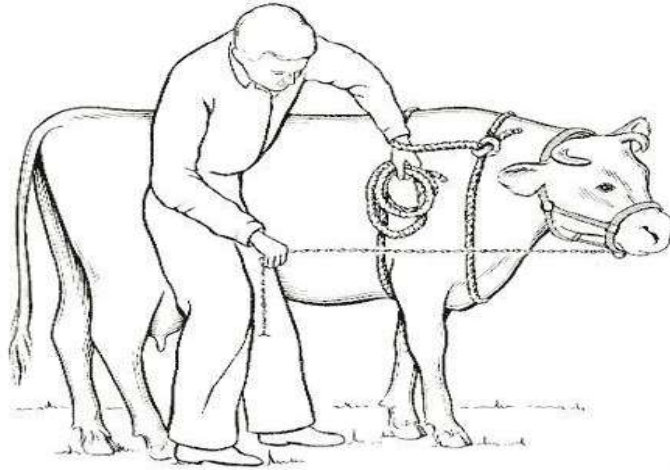


Fig. 6.17 Application of loop on the body

By tossing the end over the cow's back again, make another half hitch just in front of the udder. Pulling the rope will force the cow to lie down.

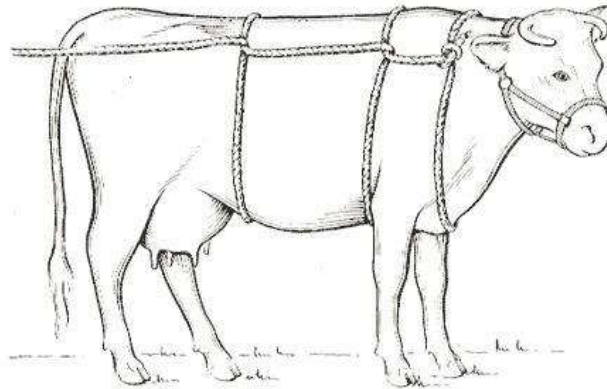


Fig. 6.18 Pulling the animal

6.2.2 Restraining methods of Sheep and Goat

Restraining devices make it easier and quicker to handle sheep. One of the many ways to do this, is by using a gambrel. A gambrel is ideal for foot trimming, lambing, transportation,

and any holding job. This restrainer goes over the neck of the sheep and has slots on both sides where the animal's front legs are placed.

- Hold the sheep on its side
- Hook the restrainer on to one front leg
- Pull the restrainer over the nape of the neck
- Hook in the other leg.

Halters are also used for restraining. They are ropes that can slip over the head of the animal and two methods are available to restrain a sheep. You can place the sheep on its side by tying one stretched front leg with the other two hind legs. This method is simple and easy but attracts crows if the sheep is not attended as it appears to be "dead".

In addition, if the tied front leg is freed, the sheep will run away with two front legs. Therefore it is advisable to place the sheep's stomach on the ground. The rope is looped around the hind legs (as a "band"), above the knee. You pull the bottom part of the rope upwards and wrap it around the head, then place one front leg into the loop. The restrained sheep can now lie down in normal resting position. It is less stressful for the sheep and is also safer as it's less likely to attract predators or scavengers.

6.3 Dentition and Ageing of Animals

6.3.a. Dentition and Ageing in Dairy Animal

Teeth Eruption

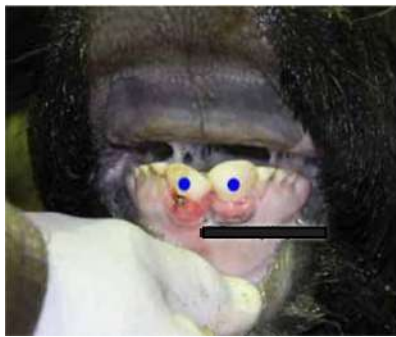
A calf is born with 8 temporary milk incisors in the bottom jaw. These teeth grow in size and last until the animal is yearling, as in the teeth below.



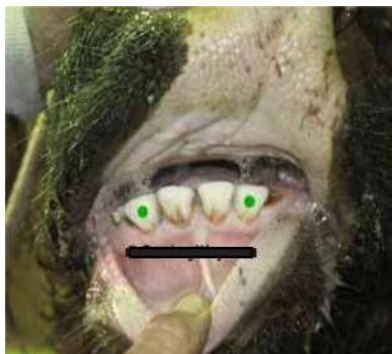
Fig. 6.19 A calf with temporary teeth**Age: Two years**

The first permanent incisors (dots) come in from about the time a cow is 1/2 years old to two years. By approximately age two years they are typically fully developed. They often come in at an angle and then straighten.

NOTE: Smaller teeth visible to the left and right of the first permanent incisors are “milk” or “baby” teeth.

**Fig. 6.20 Age : Unknown****Estimated Age : 2 years****Fig. 6.21 24-26 months****Estimated Age : 2 years****Age: Three years**

The second pair of permanent incisors (dots) appear somewhere around age 2 1/2 years, and are typically fully developed by age three years.

**Fig. 6.22 Actual Age : Unknown****Estimated Age : 3 Years****Fig. 6.23 Actual Age : 3 Years****Estimated Age : 3 Years**

Age: Four years

At approximately age 3 1/2 years the third pair of permanent incisors (dots) are cut and are typically fully developed by age four years.



Fig. 6.24 Actual Age : Four years Fig. 6.25 Actual Age : 3 1/2 years

Estimated Age : 4 Years

Estimated Age : 4 Years

Age: Five years

At approximately age 4 1/2 years the last of the cow's permanent incisor teeth (the "corner" incisors; dots) are cut, and are typically fully developed by age five years. Therefore, at age five years, cows typically have all eight of their permanent incisors erupted and in use. At this age the incisors are tall, relatively flat across the front (when compared to older ages), sharp at the top, and close together.



Fig. 6.26 Actual Age : Unknown

Fig. 6.27 Actual Age : 5 Years

Estimated Age : 5 Years

Estimated Age : 5 Years

Age : Six years

From age six, estimating cattle age by their teeth is based on the degree of wear of the teeth. Estimating the age of cattle from this point forward becomes more difficult.

At age six years the cow's eight permanent incisor teeth will begin to show various degrees of wear.

The tops of the teeth will still be comparatively sharp but will have begun to dull slightly, and the teeth will begin to take on a slightly rounded appearance from side-to-side (as opposed to appearing more flat from side-to-side as seen in younger ages).



Fig. 6.28 Actual Age : Years, Estimated Age : 6 years

Age: Seven years

At age seven years the cow's eight permanent incisor teeth will continue to show various degrees of wear. The tops of the teeth will show additional loss of sharpness, and the teeth will continue to appear slightly more rounded from side-to-side (as opposed to appearing more flat from side-to-side as seen in younger ages). At age seven there is commonly a separation, from subtle to definitely noticeable, between at least some of the teeth from top to bottom. The roots of the teeth may begin to be visible at the gum line.

NOTE: In the photos below all eight incisors were present in the cow, but sometimes cannot be seen in the photos.



Fig. 6.29 Actual Age : 7 Years
Estimated Age : 7 Years



Fig. 6.30 Actual Age : 7
Estimated Age :7 Years

Age: Broken Mouth

A broken mouth cow is a cow that has lost one tooth due to age. In some areas, a cow is not a “broken mouth” until she has lost two teeth due to age.

NOTE : In the photo below the corner tooth on the left-hand side of the photo was present, but cannot be seen in the photo.



Fig. 6.31 Actual Age: Unknown

Estimated Age: Broken mouth.

The blue arrow is pointing to a gap where a tooth is missing.

Age: Gummer

A “gummer” is often the oldest age description given to a cow. A gummer has lost several teeth due to age, or has worn them down until they are of little or no practical use.



Fig. 6.32 Actual age : Unknown Estimated Age : Gummer

6.3.2 Dentition and aging of Sheep and Goat

Aging Sheep and Goats By Their Teeth Introduction: Both sheep and goats have a total of 32 teeth. They do not have any upper incisors. The dental formula for sheep and goats is as follows:

0/4 incisors, 3/3 pre-molars, 3/3 molars. The first number in each formula represents how many sets of teeth are on the upper jaw; the second number indicates how many sets of teeth are on the lower jaw. For example, the 0/4 means that sheep/goats have no upper incisors, but have 4 sets of lower incisors (8 lower incisors in all). Most of the time the dental formula looks like this 2 (0/4 incisors, 3/3 pre-molars, 3/3 molars) = 32.

All baby sheep and goats are born with deciduous teeth (teeth that will fall out). Deciduous teeth are much smaller than permanent teeth. The deciduous teeth are replaced with permanent teeth as the animal ages. The following table outlines when the permanent teeth will appear or erupt:

Permanent Tooth Eruption in Sheep and Goats

Permanent tooth Age at Eruption

Incisor (I1) 1-1.5 years

Incisor (I2) 1.5-2 years

Incisor (I3) 2.5-3 years

Incisor (I4) 3.5-4 years

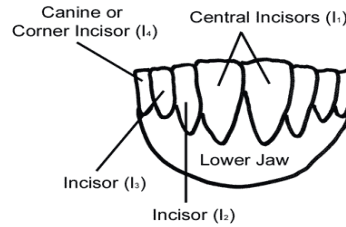
Premolars 1.5-2 years

Molar (M1) 3 months

Molar (M2) 9-12 months

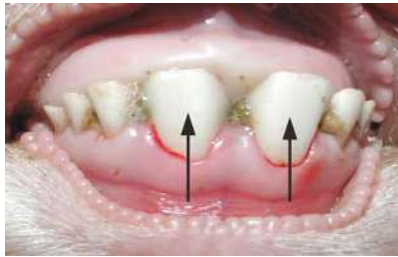
Molar (M3) 1.5-2 years

This is a diagram of the lower jaw. These incisors are used to age an animal. In this diagram, all the incisors are permanent teeth.

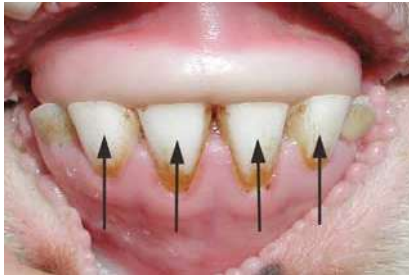


incisors associated with the teeth that can easily be used to age an animal. In this diagram, all the incisors are permanent teeth.

Common Dentition of Sheep:



Dentition of a yearling sheep. Two incisors are permanent (black arrows).



Dentition of a 2 year old sheep. Four incisors are permanent (black arrows).



Dentition of a 4 year old sheep or "full mouth." All incisors are permanent.



Dentition of a 6-8 year old sheep. Notice the wide spacing between the teeth.



Dentition of an extremely aged sheep (from 8-12 years of age), frequently referred to as a "broken mouth." Notice how this ewe has severely worn or missing teeth, with receding gum lines.

Common Dentition of Goats:



Dentition of a goat 2 weeks of age. All the teeth are baby or deciduous teeth.



Dentition of a goat 10 months of age. All the teeth are still baby or deciduous teeth.



Dentition at 1.5-2 years of age. Four incisors are permanent (black arrows).



Dentition of a 3 year old goat. Six incisors are permanent (black arrows).



Dentition of an aged goat (about 10 years old). All the incisors are permanent and worn. The black arrow shows where this goat is missing an incisor tooth.

6.4 Methods of Identification in Dairy Cattle, Sheep and Goat

The purpose of livestock identification is for maintaining the breeding, feeding and health records of the herd/flock. It is also important for identification of progeny in farms and AI centers, scientific selection, culling and breeding of livestock. It is required to issue health, insurance and postmortem certificates of live stock. Identification is also important to indicate ownership of a particular animal, or to indicate the herd/flock of origin. A successful identification system makes able to quickly identify an animal.

The identification systems of the animal classified in to two types

1. Temporary
2. Permanent

Temporary Method: Used to identify the animals for only short period of time. These include

- Putting neck straps with number,
- Painting the numbers on animal body, Painting the horns,
- Cutting off the brush of the tail.

Permanent methods of Identification Includes : Tattooing, Tagging, Branding and Electronic identification.

6.4.a. Methods of Identification in Dairy Cattle:

1.Tattooing :Tattoo is a method of identification that is permanent if properly done. This method is mostly used for identification of young calves and lambs.

Required equipment : Tattooing letters/symbols, Tattooing ink/paste, Tattooing forceps
Sprit/alcohol and Clean cloth

Procedure



Fig. 6.44 Step 1. Clean the inside of the ear with sprit



Fig. 6.45 Step 2. Apply tattooing Ink



Fig. 6.46 Step 3. Pressing the tattooing forceps after fixing the desired number/letter



Fig. 6.47 Step 4. Reapply the tattooing ink and rub in firmly.

**Fig. 6.48 Step 5 Tattoo letters
on the animal ear**



Tagging: It is important method of identification of cattle in India. It is easy and quick to carry out. The equipment required are ear tags made of plastic/brass, tag applicator .

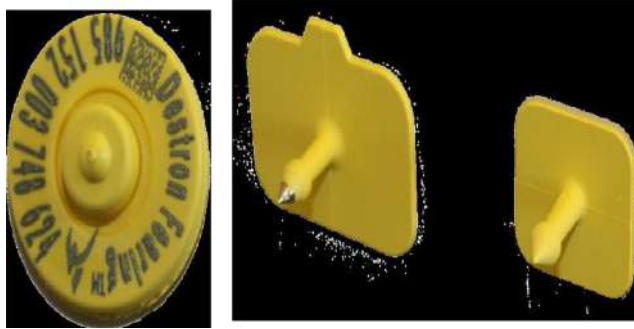


Fig. 6.49 Tagging equipments

Steps of tagging:

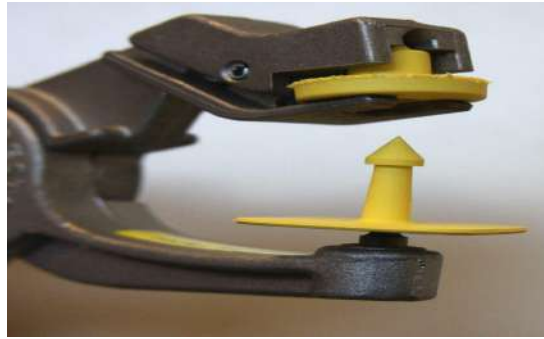
- Properly secure the animal to apply tag
- Identify the tagging site on the animal's ear.
- Place each half of the tag onto the applicator.

Fig. 6.50 Tags in Applicator



Before tagging the animal, check alignment of the tagger by closing the jaw of the applicator to the point where the two halves meet; the stud should be centered with the hole.

Fig. 6.51 Alignment of Tags



Position the applicator in the identified tagging site on the animal's ear firmly and close the applicator in a fast manner and release.



Fig. 6.52 Position of Tags

Examine the tag to verify whether it is correctly placed or not.

Branding: Branding is a process of searing a number, letters, designs or a combination of these on the skin of the animal using heat, chemical or cold which causes cauterisation of the skin, killing the hair follicles and leaving a scar. Branding allows identifying the animal from a distance without necessary restraining.

Branding is of 3 types

- Hot iron branding
- Chemical branding
- Freeze branding

Hot-Iron Branding : Good hot iron brands are permanent and legible from a distance. Sets of branding irons are available in the market. Same branding irons can be used for hot and chemical branding.



Fig. 6.53 Hot Iron Branding

In hot iron branding, the desired iron is heated to bright red and applied to the skin on the sides of the thighs with light pressure for not more than three seconds. Apply a little mustard oil with zinc oxide/ any antiseptic over the burns for ready healing.

Chemical Branding: The iron should be dipped in the branding chemical. The extra chemical drained off the iron and the wet iron applied on the skin.

Freeze Branding can be a relatively painless and very effective form of permanent animal identification. Freeze branding is more comfortable to cattle than is hot iron branding. While hot iron branding makes a neat, legible scar on the surface of the hide, freeze branding changes hair colour to white. Freeze branding works by destroying the pigment-producing cells in hair follicles, resulting in white hair growth. Freeze brands typically become readable about 6 to 8 weeks after branding. Liquid nitrogen or a combination of denatured alcohol and dry ice are effective methods for cooling freeze branding irons. Irons suitable for freeze branding are often made of copper alloy. Copper irons tend to work better than stainless steel and aluminium irons because they transfer cold well.

Steps of Freeze branding

The irons should cool for 20 minutes in liquid nitrogen before first use.

**Fig. 6.54 Iron Cooling in liquid Nitrogen**

- Properly restrain the animal and clip the area to be branded.
- Brush or wipe the area clean and spray a liberal coat of alcohol on the clipped surface.

**Fig. 6.55 Cleaning the rump
and thigh area**



Apply the branding iron for the predetermined amount of time. If the iron moves, reapply it to the depressed area and add a few seconds to the application period.



Fig. 6.56 Branding iron in operation

Electronic Identification

Electronic Identification (EID) is the latest method used to identify livestock and is based on electronic devices and readers. The device used is a micro-chip in either an ear tag or a ceramic bolus.

Fig. 6.57 Electronic Identification



The bolus is swallowed by the animal and remains in the animals' stomach for its lifetime. The reader records the individual number on the device and this data is recorded and locked to the visual ear tag.



Fig. 6.58 Electronic Reader

Advantages: Animals can automatically be identified without handling the animal. Treatments, weights etc can be recorded against the individual animal with minimum human intervention, especially when using a race reader.

6.4b. Methods of Identification in Sheep and Goat

Animal Identification: Record keeping begins with individual animal identification. The ideal sheep identification is permanent, resistant to loss or tearing, easy to read from a distance, easy to apply, and gives all of the information about the animal from a glance.

Ear tags: It is a common method of identification in sheep and goat in India. There are many methods to identify sheep and goat, with ear tags being the most common. Ear tags come in many different sizes, designs, and brands. There are brass, aluminum, and plastic tags; button tags, rotary tags, swivel tags, and looping tags; DNA tags, and RFID (electronic tags).

Brass tags are ideal for tagging small or newborn lambs. They are light, so they will not pull down on the ear. However, the lamb must be caught in order to read its tag. Metal tags are the cheapest and easiest to apply, but they are more likely to be ripped out and cause a reaction in the ear.

Ear tags should be placed between the middle and lower cartilage ribs in the ear and far enough out on the ear to allow for later wool growth. In addition to identifying an individual animal, ear tags can contain other useful information about the animal. The first number on an ear tag can be used to denote the animal's birth year.

Different colored tags can be used for different birth years, breed types, sires, or

owners. The name or registration prefix of the producer or farm can be written or imprinted on the tag. Ear tags can be inserted in different ears (right or left) to denote birth type, sex of the lamb, breed type, or sire.

Tattoos: It is not commonly practiced in India. They also do not harm the animal's appearance or reduce its value in any way. The numbers and letters are made of needles that place small holes in the ears in their shape and the ink is applied to the holes so that the number is readable. The biggest disadvantage to tattooing is that tattoos are difficult to read from a distance. It is usually necessary to catch the animal to determine its number.

Neck chains or straps : Neck chains or straps are the least used form of identification in sheep. They are most common with dairy animals. Neck chains have a numbered tag that corresponds to that animal's identification number.

Electronic ID

The number of animals being identified with radio frequency identification (RFID) technology is rapidly growing. Electronic ear tags are the most common form of electronic ID. A microchip and coiled copper antenna is encapsulated in a standard plastic ear tag. A rumen bolus is administered using a balling gun and resides in the reticulum of the animal. It is easily removed by the packer and can be recycled.

Microchips are a form of identification that involves the implanting of an electronic chip with a miniature radio transponder and antenna, under the skin of an animal. The most common implant site is between the shoulder blades or near the base of the ear. The transponder can also come in a form that can be ingested by the animal.

6.5 Records to be Maintained in a Dairy, Sheep and Goat farms

Maintenance of farm records is important for

- Scientific breeding, feeding, reproduction and health care of live stock
- Selection and culling of live stock for implementation of different breeding programmes
- Milk recording of individual animals, growth rate in meat animals
- Estimation of the economics of different live stock farms.
- Production of action lists for management

6.5.a. Records to be maintained in a Dairy farm:

1. History and pedigree sheet
2. Reproduction records
3. Breeding registers
4. Calving register
5. Calf register
6. Adult stock register
7. Fodder production register
8. Feed stock register
9. Animal weighing register
10. A.I register
11. Health registers
12. Case sheets
13. Vaccination register
14. Deworming register
15. P.M register
16. Daily milk production register
17. Milk production and Disposal register
18. Dung register
19. Registers related to tractor and other farm equipment
20. Financial registers

Formats of some registers**Calving register**

Animal Number	Due date of calving	Date of calving	Calf Number	Sex of the Calf	Birth Weight of Calf

Calf Register

Calf Number	Date of Birth	Sex of the Calf	Sire Number	Dam Number	Disposable

Growth record of the young Stock

Calf Number	Birth Weight	Fort Nightly Weight	Weght of the 1 st Service	Weght of the 1 st Calving	Remarks

Breeding Records

Animal Number	Date of Calving	Service Date time bull number	PDDate	Result of PD	Expected date of Calving

Daily Feeding Register

Date	No.of Aniimals	Concentrate			Green Folder	Others
		Received	Issued	Balanced	R I B	R I B

Daily milk record

Animal Number	Date of Calving	01		02		03	
		AM	PM	AM	PM	AM	PM

Health Register

Animal Number	History and Symptoms	Diagnosis	Treatment	Remarks

Deworming and Vaccination Register

Animal No	Deworming Date	Next Due Date	Vaccination for	Date of Vaccination	Next Due Date

Daily Livestock Register

Date	Cows		Calves		Heifers	Breeding Bulls
	Males	Females	M	F		

6.5.b. Records to be Maintained in Sheep and Goat farms**Record Keeping In Sheep And Goat Farms**

Purpose : Farm records are essential for ascertaining the pedigree, implementing the breeding programme for improvement of the herd, keeping track of various farm efficiency indicators, economical feeding of animals, culling of under-productive animals, stocking and sale of products, and computation of financial data.

1. Individual ewe/ doe history sheet

ID No	Flock no	Date of Birth	Purchase	Single	Twin	Description	Sire no	Dam no	Disposal	Growth data	Date	Reasons	Remarks	Date	Age	Weight	Remarks

2. Ewe record

Ewe No	Sire No	Dam No	Date of Birth	Birth Weight	Type of Birth	Type of rearing	Age and weight at weaning	Shorn fleece weight	Lamb details	remarks

--	--	--	--	--	--	--	--	--	--	--

3. Ram / Buck Record

Ram No	Sire No	Dam no	Date of Birth	Birth Weight	Type of Birth	Type of rearing	Age and Weight at weaning	Shorn fleece weight	Progeny Performance	Remarks

4. Lamb/ Kid crop register

Year	Season	Date ram turned in	Date ram turned out	Ram used	Ewe no	Date of lambing	Lamb no	Sex	Birth weight	Type of birth	Nursed by	Date weaned	Date castrated	120 days weight	Market weight	Disposal mode	Disposal date	remarks

5. Wool Production Register

Year	Season	Date	Sheep No	Days of Growth	Sides	Shoulder	Belly	Thigh	Total staple yield	length	Grade	Remarks	Fitness

					Fitness	Yield	Fitness	Yield	Fitness	Yield	Fitness	Yield				
--	--	--	--	--	---------	-------	---------	-------	---------	-------	---------	-------	--	--	--	--

6. Health Register

Date	Animal no	Complaint	Treatment	Remarks

7. Roll call register

Date	Rams	Ewes	Ram Lambs	Ewe Lambs	Total reason for variation	Remarks

Other registers in sheep and goat farms

- | | |
|---------------------------------------|---------------------------------------|
| 1. Adult sheep or goat stock register | 2. Young stock register |
| 3. Lambing/Kidding register | 4. Feed stock register |
| 5. Fodder production register | 6. Medicines and vaccination register |
| 7. Weighing register | 8. Mortality register |
| 9. Sheep and goat disposal register | 10. P.M register |

Other financial and farm equipment registers are similar to dairy farm registers

6.6 Common Vices of Dairy Animals, Sheep and Goats

6.6.a. Common Vices of Dairy Animals

Certain bad habits are prevalent among the cattle which leads to economic loss to the dairy farmer. These habits are

- Suckling another cow or herself
- Licking other animal
- Kicking during milking

- Fence and rope breaking
- Buller steer syndrome
- Tongue rolling/playing
- Eye rolling
- Head shaking/nodding
- Feed related vices
- Rubbing
- Barbiting
- Butting other animals and men
- Chewing objects etc.

Unless they are properly treated from the first observation, it becomes a difficult problem to get rid of such practices in later stages. Some of the common bad habits are discussed below:

1. Suckling

- Some cows that suck themselves or other cows, thus causing losses of milk, contamination of the udder and sometimes indigestion of the animal concerned.
- The reason for this vice is not clearly known
- To prevent this, the cow should be separated from the rest of the herd.
- A cradle or a bull ring is put in the cow's nose and then two or three other rings are attached to it. A special ring that has some sharp prongs soldered on to it, is very effective. This system does not interfere with the animal's normal eating.

2. Licking

Some animals, especially calves, get into the habit of licking other calves during the milk feeding period. This ultimately leads to the indigestion of hair which gets entangled with the curdled milk in the stomach and forms hair balls. On further accumulation of such hairs, balls continue to grow in size and lead to serious disorders which may be transmitted to other calves.

One of the precautionary methods is to rub a pinch of salt or mineral mixture on the tongue of the calf after each feeding.

Repetition of this system will enable the calf to forget this habit. Some use rope-net or wire gauze muzzle to control this vice.

Young calves of this nature can best be kept in individual pens or tied so that they cannot reach others.

3. Kicking

- Many heifers or cows kick when they are milked.
- It may be due to handling by an unskilled milker or may be by nature vicious.
- Before applying any remedial measure, it will be wise to search for the reasons of such habit.
- It may be possible that the cow is suffering from some disease of the udder or teats.
- Sometimes bad milking method may compel the animal to do so. In such cases proper treatment will bring the cow in order.
- But when the cow by nature is vicious, in that case one method is to tie the head high. Another is to tie a rope around the body of the cow just in front of the udder. In severe cases, anti-linking chains can be used. A clamp fits over each hock and a chain fastens them together. Sometimes a piece of rope is used to tie the hocks by making a loop like the figure “8”. Unless crossed between the two hocks, the strap will slip down when the cow struggles.

4. Fence Breaking

- Some animals have the habit breaking their fence of the enclosure in which they are grazed on jumping over the fences.
- The habit is formed due to the feeling that on the other side of the fence the grasses are more green or plenty.
- There is little that will stop a roughish cow except proper hitching arrangement and good fences.

5. Buller Steer Syndrome

- In this type of vice the young male calves (Rider) mount their herd mates willing to be mounted (Buller).
- There is no intromission attempt made by rider, although sometimes there may be partial penile erection.
- Young male calves weaned early in life as well as kept in intensive housing system are prone to development of this type of behavioral problem.
- Addition of new steer to a well-established group of male calves result in an increased incidence of buller steer syndrome.

- In order to reduce the incidence of buller steer syndrome close watch should be kept over the steers at least once a day, for identification of buller.
- The bullers are separated from the lot and kept with fewer animal groups.
- Newborn male calves should be kept with their mother for some time, which will inhibit the confined indoors.

6. Tongue Rolling or Playing

- The animals extrude their tongue from the mouth and moved by curling and uncurling outside or inside of the mouth. After that partial swallowing of the tongue and gulping of the air take place.
- It is perform by cows and buffaloes to satisfy their instinct of prehension of forage plants during grazing.
- Tongue rolling is seen most frequently immediately before and after feeding.
- It has been observed that hereditary factor and early weaning of calves can increase the incidence of this behaviour.
- Animal should be left for grazing or they should be given the freedom of movement by keeping them untied for few hours. Visual separation of affected animal is required to prevent the spread of this behavioural abnormality to other animals and they should be given some unchaffed fodder for chewing. Animals having the habit of tongue playing should not be kept as breeding stock.

7. Eye Rolling

- This is condition in which eyes are moved in orbit at a time when there are no visible objects present in surroundings of the animal.
- Affected calves stand immobile for extended period of time, head is held motionless along with rolling of the eyes and it is repeated frequently.
- This behaviour has been found to be more in those calves that are kept in confinement in individual calf box and lack the access to loafing area.
- Calves should be given some loafing area for walking and exercise and if this is not possible then they should be kept loose for some period of time.

8. Head Shaking or Nodding

Head shaking has been observed mostly in the adult animals that are being kept in confined housing environment for all the time.

Animal while shaking the head they hit their head with manger, wall of the house, peg etc. and they keep it up for a long time if not being interrupted.

They start doing this activity at any time whenever they become free after taking their feed, but the maximum incidence has been observed during night hours. Such animals create nuisance to their owner if they are being kept adjacent to the residing room of the owner.

As the problem of head shaking arises as a consequence of confined housing environment so it will be better if the animals are allowed for grazing or they should be kept untied for few hours so that may involve in social interaction with each other.

9. Feed Related Vices

- In order to satisfy their natural grazing and exploratory instincts some dairy animals are found to be indulge in some feed related vices such as – Feed tossing, Dropping of feed and Water lapping. In feed tossing behaviour the animal starts rooting, sorting and finally tossing the feeds along the sides of manger.
- In feed dropping behaviour the animal drops feeds from an elevated feed manger to the ground and then eats that feed which may be the cow's solution of fulfilling her natural grazing instinct. Such behaviour by the dairy animals may result in to 5 per cent feed loss of the feed offered to them.
- In water lapping behaviour the animal starts licking at water instead of drinking. It is commonly seen in animals that are not allowed for grazing and are deprived of any exercise.
- Problems associated with feeding of animals can be overcome by allowing grazing to the animals that are kept tied on their feeding stall round the clock. In case grazing facilities are not available then they may be kept loose for at least one hour daily so that they can overcome the frustration of being confined at one place. The fodder should be chaffed finely so that all part of the fodder plants get properly mixed which will preclude any preferential feeding by the animal. The mangers should be properly designed and the bottoms of the mangers should be close to the ground level so that the animals may satisfy their grazing behavior to some extent.

10. Rubbing

- Some parts of body is moved back and forward by the animal against a solid object.

- The movement is repeated so many times that it could not function only to alleviate a local irritation.
- It is more common in animals kept in confinement and comparatively more noticeable in horned breed and more common in bull than the other stock.

11. Bar Biting

- In this condition animal clamps his jaws around a bar and moving the head forth and back for a minute or more.
- Incidence of this behavioural problem has been found to be more in calves weaned in early age as well in those calves that are being kept in individual calf box and not having access to loafing area.
- This behaviour develops due to confinement for long duration at one place and weaning of calve in very early age life.
- This problem can be managed by feeding the calves by using artificial nurser/teat if weaning of calve in early age can't be avoided and use bedding material such as wheat or paddy straw which will provide oral occupation to calves.
- Some considerations to prevent the development of abnormal behaviour in cattle and buffaloes.
- If possible one should follow loose housing system and house the animals as per their age, body wt., physiological status and social hierarchy in the herd.
- In case the farmers are bound to opt for conventional housing system then they should provide ample space to animal for walking and exercise. If calves are weaned immediately after birth or at very early age then milk feeding to the calves should be done by artificial teats or a bottle with a screw nipple and immediately after milk feeding they should be fed ground grain mixture/ wheat bran so as to distract them from indulging in inter-sucking.

6.6.b. Common Vices of Sheep and Goats

1. Wool pulling and wool eating

- a) Wool pulling is a form of abnormal behaviour which occurs in sheep within restrictive enclosure and indoor management systems.
- b) Overcrowding and deficiency of roughage in the diet are the contributing factors for this vice.

2. Stealing young / lamb stealing

- a) Pre-parturient ewes, cows and mares often approach, sniff and remain close to the new born young of other members of the group. This leads to reduced maternal support to the young and it become weak.
- b) In lamb stealing, the foster mother may later reject her own lamb when it is born or may have no colostrums left for it. In these various situations lamb may often die. This problem can be controlled by separating the ewe or cow should separate from the group before and very soon after parturition.

6.7 Weaning of Calf, Lamb and Kid

Weaning of Calf : Weaning means separation of the calf from the mother and rearing separately. Calf can be separated from the mother immediately after calving/ 3-4 days after birth. Weaning is practiced in exotic cattle and crossbred cattle.

Advantages of weaning

- Correct quantity of milk can be fed to the calves. There will not be any over feeding/ under feeding.
- The actual milk production of the dairy animal can be recorded
- The dairy animal can produce milk whenever the calf is dead.
- Milk replacer can be introduced there by milk feeding can be reduced.
- Antibiotics/ any medicines can be given along with milk.
- Post partum heat will be earlier and service period can be reduced

Teaching the calf to take milk from pail/ milk bottle

- Teaching a calf to suck from a nipple bottle is much easier than teaching one to drink from a bucket.
- A nipple bottle is convenient for measuring the correct amount milk.
- A bucket is convenient for encouraging calves to consume calf starter (a dry feed, which can be put in the bucket as a calf finishes the milk replacer).
- Since calves will instinctively nurse, insert one or two fingers in its mouth and let the calf start sucking. Then insert the nipple of the bottle in its mouth and let it continue to suck.
- If bucket feeding is used, force the calf's mouth into the bucket of milk while it is sucking on your fingers.

- A good milk replacer will contain at least 22 percent protein and 15 percent fat. Because of the fat level, it is easier to mix when warm water is added.
- Hygienic conditions should be maintained in pail or bottle feeding. Milk may be fed warm, but not above 100 °F.
- Each calf should be fed from a separate nipple bottle or bucket to avoid spreading diseases from one calf to another.
- Separate pens will reduce disease transmission and make it easier to feed.
- Water should be made available for the calf even though it is being fed milk or milk replacer. It is best to offer water at least 20 minutes after feeding the liquid feed.

Weaning of Lambs and Kids: These are separated from their mothers after three months of age.

Lambs and kids take the milk from their mothers.

6.8 Grooming, Disbudding, Hoof Trimming, Castration and De-Ticking

1. Grooming: It is important management practice for the following reasons

- It removes loose hair and dirt and makes hair coat clean, glossy and pliable.
- It stimulates circulation of blood and lymph in the body.
- It helps in clean milk production.
- It makes animal more docile.

It is practiced one hour before milking by using a curry comb/straw.

2. Disbudding and Dehorning: Disbudding is the arresting the growth of horn buds. Dehorning is the removal of horns. Calves can be de buded at the early age preferably at below 10 days age.

Advantages

- Reduce the risk of injury and bruising to other animals in the herd / flock.
- Require less space at the feed trough and in transit
- Decrease risk of injury to farm workers
- decrease risk of horn cancer
- Produce docile cattle easier to handle

Methods of dehorning: 1. Chemical method 2. Electrical method

Chemical Dehorning: Caustic chemicals will prevent the growth of horns when properly applied to the horn buds of new-born (less than 10 days age) calves. The chemical destroys the horn-producing cells around the horn bud. The chemicals are available as sticks or pastes. Administer sedation, analgesia and local anaesthetic. Expose the horn bud (about the size of a 5-cent piece) by pushing the hair back (Figure 3). Apply the caustic to the horn button. Use a wooden applicator and rub the horn bud till bleeding comes.

Protect the calf from accidental caustic burns by applying Vaseline around the eyes.



Fig. 6.59 Horn bud in young Calf

The circle at the base of the ear shows the location of the horn bud in a young calf. The horn bud is readily visible after pushing back the hair. Reposition the hair over the paste and bud after applying the dehorning paste.

Hot Iron Dehorning : Hot iron dehorning tools are available in versions heated by a furnace or fire, 12-volt battery, 120-volt electricity, power packs. The head of the iron is a hollow circle and it fits over the horn bud. Proper application of the hot iron will destroy the horn-producing skin at the base of the horn. This technique works well for calves up to 12 weeks old. There are several sizes of dehorning irons. The proper size is one where the burner makes a complete ring around the base of the horn.

Technique

- Administer sedation, analgesia and local anaesthetic.

- Preheat the dehorning iron to a red colour. Both electric and gas irons work best when they are “red” hot.
- Hold the calf’s ear out of the way to keep it from being burned.
- Place the tip of the burner over the horn and apply slight pressure. When the burning hair begins to smoke, slowly rotate the dehorner by twisting your wrist.
- Continue the application of heat for 10-15 seconds. Do not leave the dehorner in place for much longer, especially in young calves. Heat can be transferred through the thin bones of the skull and damage the calf’s brain.
- Dehorning is complete when there is a copper-coloured ring all the way around the base of the horn.
- The horn bud or button will slough off in 4 to 6 weeks.

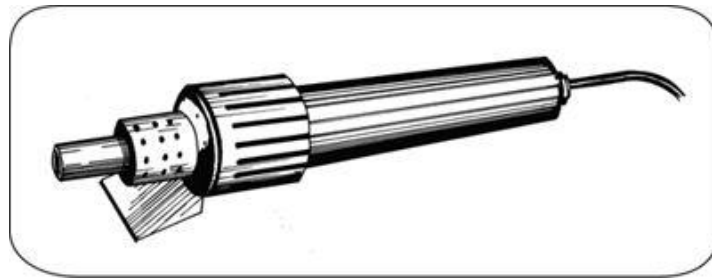


Fig. 6.60 Electronic Hot Iron Dehorner

An electric hot-iron dehorner will destroy the horn-producing skin at the base of the horn bud.

Advantages and Disadvantages

- Bloodless
- Can be used at any time of the year
- Young calves up to 12 weeks of age
- Unreliable when done incorrectly, leads to scurs (partial horn growth)
- Requires expertise - pain control and technique

Dehorning Spoon or Tube

Dehorning spoons or tubes provide a quick and efficient technique for removing horn buds in calves less than eight weeks of age. With this method, a sharpened metal tube cuts through and removes the horn-producing skin at the base of the horn bud. Use the proper size tube to remove the horn plus about 1/8 inch of skin around the entire horn bud.

Technique

- Administer sedation, analgesia and local anaesthetic.

- Select the correct size tube (4 sizes available) to fit over the horn bud, and cover about 1/8 inch of skin around the horn base.
- Place the cutting edge straight down over the horn.
- Apply pressure to the tube; push and twist the tube until the skin has been cut through.
- Cut under the horn bud and remove it, using a scooping motion.
- Apply an antiseptic to the wound. Some bleeding may occur.
- Clean and disinfect the cutting edge of the tube between calves.

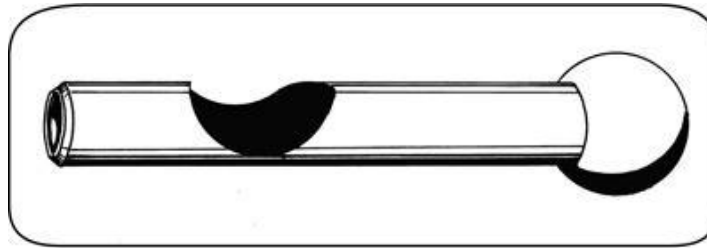


Fig. 6.61 A Dehorning Spoon or Tube

A dehorning spoon or tube is used to remove the horn bud plus the horn-producing skin at the base of the bud.

Advantages and Disadvantages

1. Not bloodless
2. Useful for young calves
3. Risk of infection because of open wounds
4. Avoid use during fly season
5. Unreliable when done incorrectly, leads to scurs.

Requires expertise - pain control, technique, control of bleeding.

3. Hoof Trimming

- The reason cows become lame can be quite complex, as many of the factors are interrelated. However, the main reason cows become lame is most often related to cows walking on hooves (claws) with a compromised or unbalanced weight bearing surface.
- Overloading the cow's claw due to excessive wear or overgrowth can create a claw that is sensitive, unstable and more prone to lameness. Therefore, cows' feet need to be checked and trimmed for two reasons:
- Restoration of appropriate weight bearing within and between the claws of each foot
- Early identification of claw lesions.

- It is important to note that not all cows examined will require trimming, as over-trimming can result in greater incidence of lameness.

Four-Step Hoof Trimming Technique

- Proper claw trimming forms the foundation of a comprehensive foot health program. By recognizing certain claw trimming fundamentals, one can help reduce the risk of lameness caused by claw trimming miscues.
- Following is an overview of the four-step functional claw trimming procedure, which is a slight modification of the original Dutch three-step procedure developed by E. Toussaint Raven. Each and every foot of the cow should be approached under this four-step process during claw evaluations to avoid over-trimming. This functional trimming process can be used to treat claw lesions. It is highly recommended that all claw trimming done on a dairy be conducted only by trained personnel.

4.Castration

Purpose of castration

- Helps in taming the oxen for draught purposes
- Prevent mating and reproduction of scrub bulls after the age of puberty
- Produce docile cattle that are easier to handle compared to bulls
- Enhance on-farm safety for animals, producers and employees
- Improves fattening in beef cattle

Castration can be done at any age up to 12 months.

Methods of castration

Burdizzo method of castration: It is a common method of castration in cattle.

Technique

- Find the spermatic cord on one side of the scrotum. Reach between the hind legs and grasp the scrotum above the testicles. The spermatic cord runs from the testicle into the calf's body. It is about the size of a pencil and moves easily from side to side in its half of the scrotum. Pinch the cord to the outside edge of the scrotum between your thumb and forefinger. If right handed, use your left hand to hold the cord and your right to operate the Burdizzo.

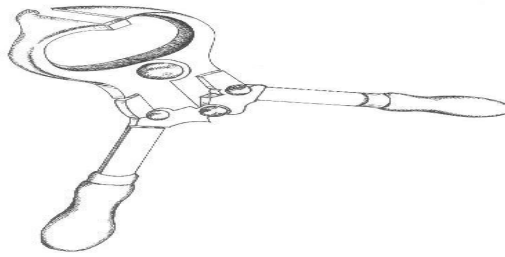


Fig. 6.62 Burdizzo castrator

- Position the Burdizzo correctly for crushing. One jaw of the Burdizzo has projections at each end to keep the spermatic cord from slipping out of the Burdizzo. Place the jaw with the projections on the front side of the scrotum. Point the projections toward you.
- Include only the part of the scrotum that contains the spermatic cord between the jaws of the Burdizzo. Do not crush more of the scrotum than necessary. The jaws should be placed just above (1-1.5 cm) the top of the testicle.
- Close the Burdizzo, count out 10 seconds and check to be sure the spermatic cord has been held between the jaws of the Burdizzo. You can also rock the spermatic cord back and forth in the jaws.
- Release the Burdizzo, move it to a new site 1 cm below your first site, and repeat steps four and five. Choose a site below the first crush to minimize acute pain from a second crush.
- Repeat the procedure on the opposite side. Stagger the pinched areas on the left and right side of the scrotum. Do not pinch a part of the scrotum that lines up with a pinch on the opposite side. The crush lines must not overlap the centre-line of the scrotum
- Check calves four to six weeks later to be sure the testicles have shriveled. The testicles swell initially and then degenerate and shrink in size.

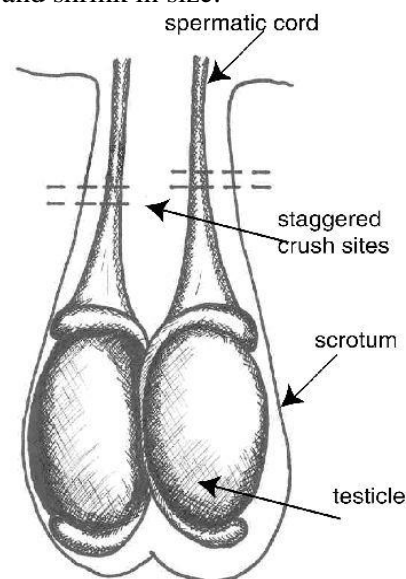


Fig. 6.63 Burdizzo Castration Sites

Advantages and Disadvantages

- Bloodless
- Slow to perform and requires expertise
- Unreliable when done incorrectly, leads to stags
- Equipment becomes ineffective after long-term use and must be replaced less reduction in weight gain after castration compared to surgical or latex-band

Elastrator Method

Elastic band castration cuts off blood supply to the testicles. A lack of blood supply kills the testicles. The equipment for banding calves less than three weeks of age is called an elastrator. An elastrator (Figure 6.49) is the tool used to apply an elastic band to the neck of the scrotum. The elastic band obstructs blood flow to the testicles and the scrotum. In time, the scrotum and testicles fall from the body. The elastrator band is most reliable for calves less than three weeks of age.

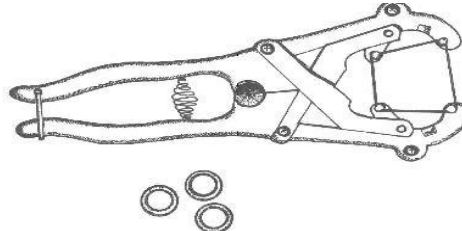


Fig. 6.64 Elastrator Method

Technique

- Use the elastrator technique for calves from birth to three weeks of age.
- Use elastic rings purchased within the last 12 months to avoid breakage and assure a tight fit. The rings must be strong enough to cut off blood flow in the arteries as well as the veins. If not, the scrotum will swell.
- Pull both testicles into the scrotum. A muscle attached to each testicle will be pulling against you.
- Place the rubber band on the elastrator. Hold the elastrator with the prongs facing up. Close the handles to open the band.
- With the calf standing and both testicles in the scrotum, stretch the ring open and slip the open band up over the scrotum. Release the band just above the top of the testicles (~0.5 cm), not at the base of the scrotum.
- Check to be sure both testicles are still in the tip of the scrotum and that the ring is placed properly. If not, cut the ring with scissors and start again.

- Remove the elastrator from under the band.

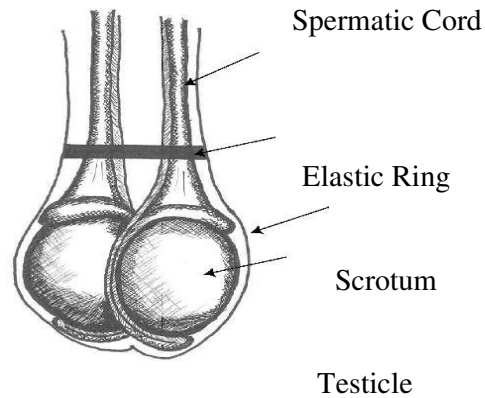


Fig. 6.65 Elastic Band at Top of Testicles

Advantages

- Calves are handled easily and little labor is involved.
- It is a bloodless method.
- preferred for castrating at a wet, muddy areas

Open wound castration (emasculator or knife)



Fig. 6.66 Emasculator



Fig. 6.67 Scalpel

Technique

Before the operation, the person doing the operation must wash his hands well, the instruments must be boiled and the scrotum disinfected thoroughly with iodine or another suitable disinfectant.

- Apply antibiotic powder to prevent infection, and a fly repellent.

- A sharp knife is used to remove the lower third of the scrotum, and each testicle is removed from its supporting membranes. Do not remove too little of the scrotum otherwise it will not drain well.
- The emasculator has a cutting and a crushing surface. The instrument is placed on the spermatic cord and the vascular supply closed so that the testes are removed while excessive bleeding is prevented by the action on the vascular tissue.
- If the knife is used, the cords should not be cut cleanly.. The instrument is held at an angle, and scraped over a distance of about 30 mm, until the cord breaks. This prevents too much blood flow.
- It is better to use the emasculator rather than the knife.

Advantage

Castration is irreversible because the testicles are removed.

5.De-Ticking: Ticks transmit diseases like anaplasmosis, theileriosis and babesiosis. Biting flies transmit diseases like Surra and E fever (see respective chapters). Heavy infestations may lead to anaemia and significant loss in productivity. Tick and biting flies cause severe discomfort to the animal and it may cause allergic reactions at the biting sites. They lay a large number of eggs resulting in further increase in population.

Tick control measures: Any newly purchased animal should be completely de-ticked before allowing with other animals. Malathion/ Sumithion/ Deltamethrin/ Cypermethrin may be sprayed on the animals and in the sheds as per the directions of local veterinarian.

6.9 Dipping, Clipping and Shearing Operations**6.9a.Methods of Dipping in Cattle, Sheep and Goats****1. Plunge Dip**

Tanks Plunge dip tanks are the preferred method of dipping large numbers, especially beef cattle. If constructed and used correctly plunge dips ensure complete wetting of the animal, particularly the important areas such as inside the ears and under the tail where ticks are found. Sheep and goats can be effectively dipped in a plunge dip but a handler must be ready to assist them when necessary. They may have to be physically thrown into the dip and prevented from turning around once in the dip tank.

Plunge dips must be correctly used and maintained to ensure adequate tick control.

2. Spray Race

The cattle spray race is a gentler method of dipping and more suitable for dairy cows, as there is less chance of injury. Dip is changed at every dip-day, unlike the plunge dip, so it is always at strength. However, correct maintenance and procedures must be followed to ensure adequate cover and effective tick control.

3. Topical Treatments (Pourons)

Pour-ons are concentrated acaracides which are applied topically to the animals skin in small doses. They contain a spreading agent, usually oil-based, which allows the dip to spread over the skin of the animal. Pourons can be used on small numbers of animals or for a temporary measure but should not be relied on for complete tick control.

4. Hand-spraying

Hand spraying is an effective method of tick control for a few animals who do not justify the expense of a spray race or plunge dip eg on small-scale commercial dairy farm.

5. Hand Dressing

Hand dressing is the topical application of tick greases or oils to parts of the animal where ticks congregate, eg in the ears, under the tail-head. It should not be used as a complete method of tick control but can be used as a spot treatment between dip-days or in addition to any of the other methods of tick control. Tick greases and oils stick better to hairless skin and generally have a fairly long residual period. Sheep and goats can be hand-dressed.

6. Belly Baths – Sheep and Goats

Where tick infestation is mainly on the belly and legs of sheep and goats, a belly bath may be used. The head may need to be treated separately, either by spraying or hand-dressing. If the whole animal is to be immersed, a bath can be made with a 200 litre drum, but care must be taken to smooth of cut edges and it is physically demanding as the animals have to be man-handled into the bath. Only suitable for small numbers of animals.

6.9.b Clipping : Clipping improves the animal's style and overall appearance. It is practiced in hairy breeds by using hair clippers. Buffaloes and buffalo calves are clipped during summer season in some places.

6.9c. Shearing operations: Removal of wool in wool breeds of sheep is called as shearing.

It is the process by which the woollen fleece of a sheep is cut off. The person who removes the sheep's wool is called a *shearer*. Typically each adult sheep is shorn once each year (a sheep may be said to have been "shorn" or "sheared", depending upon dialect). The annual shearing most often occurs in a shearing shed, a facility especially designed to process often hundreds and sometimes more than 3,000 sheep per day.



Fig. 6.57 Machine Shearing a Merino



Fig.6.58 Shearers and Cow Bells

Sheep are shorn in all seasons, depending on the climate, management requirements and the availability of a wool classer and shearers.

Typical mass shearing of sheep today follows a well-defined workflow:

- remove the wool
- throw the fleece onto the wool table
- skirt, roll and class the fleece
- place it in the appropriate wool bin
- press and store the wool until it is transported

6.10 Deworming and vaccination Program

6.10.1 Deworming and vaccination Program in Cattle: Elimination of internal parasites is called deworming.

Advantages of deworming

- Improves feed efficiency and body weight in calves
- Prevents death in calves due to Ascariasis
- Improves resistance in calves for other infectious diseases
- Prevents anaemia in calves
- Boost vaccination titres.

The following is the deworming schedule in calves.

Age of the calf	Deworming drug	Dose/kg body weight	Against
7 days	Piperzine adepate	200-400 mg	Ascariasis
30 days	Piperzine adepate	200-400 mg	Ascariasis
60 days	Albendazole	7.5-15mg	Round worms
90 days	Fenbendazole	5-10mg	Round worms
120 days	Oxyclozanide	5.10mg	Liverflukes
150 days	Albendazole	7.5 – 15mg	Round worms
180 days	Fenbendazole	5-10mg	Round worms

After 6 months deworming should be carried out for every 3 months up to 1 year and for every 6 months thereafter.

Precautions During Deworming

- Dose should be appropriate
- Deworming should not be carried out in sick calves
- Care should be taken while drenching the deworming drug to the calves.

- Faulty drenching leads to aspiration pneumonia

Vaccination : Vaccines are used routinely to prevent disease. A vaccine is a suspension prepared in a laboratory from the cause of the disease. When injected into an animal, the animal produces immunity to that disease, which protects the animal from that specific disease. Vaccines are of two types, dead and living vaccines. Always exactly follow the instructions given for the storage and use of vaccines. Most vaccines are injected under the skin. Always use sterile syringes and needles for vaccination. Always give the correct dose by the correct route.

Vaccination Schedule in Cattle and Buffalo

Sr.No	Disease	Vaccine	Dose(ml)	Schedule
1.	Foot and Mouth disease	FMD Vaccine Raksha FMD vaccine	5 ml 3 ml	Twice in a year September & March
2.	Haemorrhagic Septicaemia	Alum ppt. H.S. Vaccine H.S. vaccine	5 ml 3 ml	Annually before monsoon (twice a year in endemic areas)
3.	Black quarter	Alum ppt. B.Q. vaccine	5 ml	Annually before monsoon
4.	Brucellosis	Brucella cotton - 19 strain vaccine	5 ml	Only once i.e. at 4-8 months of age in females in problem herds.
5.	Theileriosis	Rakshavac-T- vaccine	3 ml	Annually.

Vaccination schedule for sheep

Disease	Age and Booster Doses	Route	Remarks
Foot and mouth disease	6 – 8 weeks, repeat every 6 to 9 months	s/c or i/m depending on the vaccine	
Hemorrhagic Septicemia	3 – 4 months, repeat annually	1 ml s/c	May / June
Sheep pox	3 months	s/c	
Tetanus	Tetanus toxoid	0.5 – 1 ml s/c or i/m	
Anthrax	4 – 6 months repeat annually	0.5 ml s/c at tail fold	In endemic areas only
Enteropoxaemia	3 – 4 months, repeat after 15 days and then annually	2.5 ml s/c	First two doses before August

Vaccination schedule for goats:-

Disease	Age and Booster Doses	Route	Remarks
Foot and mouth disease	6 – 8 weeks, repeat every 6 – 9 months	S/c or i/m depending on the vaccine	
Enteropoxaemia	3 – 4 months, repeat after 15 days and then annually	2.5 ml s/c	First two doses before august
Hemorrhagic Septicemia	3 – 4 months, repeat annually	1 ml s/c	May / June
Anthrax	4 – 6 months, repeat annually	0.5 ml s/c at tail fold	In endemic areas only
Tetanus	3 – 4 months, repeat at 6 months and then annually	0.5 – 1 ml s/c or i/m	

Short Answer Type Questions

1. Explain about casting of the dairy animal
2. Explain Trevis
3. Write about handling of head in cattle
4. Write the names of different methods of identification in cattle
5. Write any 5 names of vices in cattle
6. Write any 6 names of records to be maintained in a dairy farm
7. List out common vices in sheep
8. Explain castration in cattle
9. Explain debudding and dehorning in cattle
10. What are the advantages of grooming
11. Explain the importance of deworming
12. What is shearing and clipping

Long Answer Type Questions

1. Explain daily routine and periodical farm operations in dairy farm.
2. Explain daily routine and periodical farm operations in sheep and goat farms.
3. How do you determine the age of the cattle
4. How do you determine the age of sheep
5. Explain different methods of identification in cattle.
6. Write about various records to be maintained in dairy farm.
7. Explain different methods of castration in dairy animals
8. Explain about de worming and vaccination schedule in cattle, sheep and goat.

UNIT- 7**Reproductive System -Artificial Insemination****Structure**

- 7.1 Reproductive System of Cow, Ewe and Doe
 - 7.2 Reproductive System of Bull, Ram and Buck
 - 7.3 Oestrous cycle – symptoms of heat
 - 7.4 A.I Advantaged - disadvantages
 - 7.5 Collection, evaluation and freezing of Semen
 - 7.6 Insemination methods
 - 7.7 Embryo transfer Technology – Advantages and Disadvantages
 - 7.8 Pregnancy diagnosis
 - 7.9 Parturition - Assistance and other precautions
 - 7.10 Study of obstetrical equipment
-

7.1 Reproductive System of Cow, Ewe and Doe**7.1a. Reproductive System of Cow**

The re-productive organs or genital organs of a cow consist of ovary, fallopian tubes, uterus, cervix, vagina and Vulva. Each of these plays a vital role in the reproduction of animals.

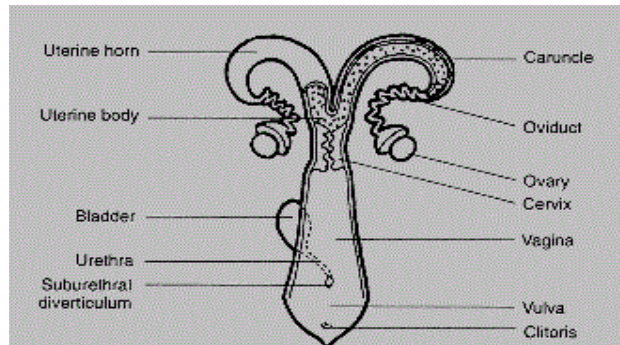


Fig. 7.1 The Reproductive Organ of Cow

Ovaries : The ovaries are two in numbers and almond shaped situated at a distance of 40 - 45 cm from the opening of the vulva. It is about 3.5 cm long 2.5 cm wide and 1-2 cm thick.

- The ova develop in structural units known as follicles which look like pimples on the ovarian surface known as graafian follicles. They produce female sex hormone known as oestrogen which is responsible for oestrous symptoms in the female cattle.
- Matured follicles bursts and release ova and the process is known as ovulation.
- At the site of rupture, new cells grow as corpus luteum which secretes progesterone hormone. It helps in preparing the uterus to receive fertilized ovum and maintain the pregnancy. When the heifer attains puberty, the functioning of the ovaries and the ova commences. The activity of the ovary is associated with the appearance of heat.

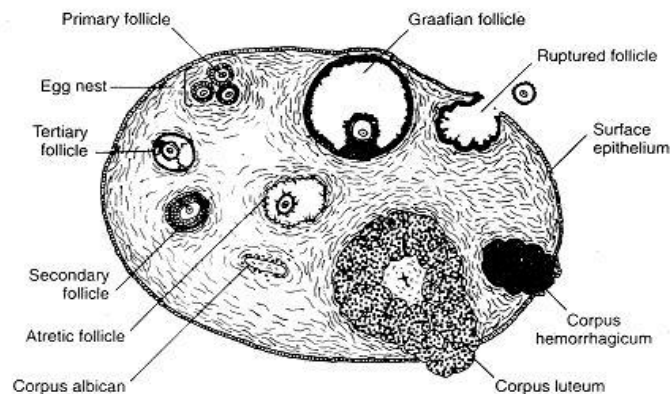


Fig 7.2 Ovarian function

Fallopian Tubes: These are two in number. They connect the ovary at the horns of the uterus on either side. Funnel shaped end of fallopian tube is known as infundibulum which receives ova. In fallopian tubes, the ovum is fertilized by the sperm and the cilia of the fallopian tube

helps upward movement of the sperm. The fallopian tubes are also known as ovarian tubes or oviducts.

Uterus: It is a hollow organ with a body and two horns. The body of the uterus is 3 to 5 cm in length and the horn is about 35 to 40 cm long. The foetus is developed in the uterus. The walls of the uterus are thick and muscular with numerous cotyledons. Villi of placenta are lodged in cotyledons for nourishment of the foetus.

Cervix: It is about 10 - 12 cm in length and located between uterus and vagina and also known as neck of the womb. The wall of cervix is firm and cervical canal or OS of the uterus is tightly closed. It is slightly relaxed during the heat period. The cervix wall secretes thick mucus forming seal to uterus during the pregnancy.

Vagina: It is a muscular passage, which accommodates the penis of the bull during coitus and also acts as a passage for the expulsion of foetus from the uterus during delivery. It is extending from the posterior of the cervix to uro-genital or vestibule from which it is separated by the hymen. It is highly elastic organ and is responsible for the secretion of the mucous.

Vulva: It is the terminal portion of the female genital tract. It has two lips. When the lips are drawn apart the glans clitoris is seen, which is the rudimentary penis in females.

7.1.b. Reproductive systems of Ewe and Doe

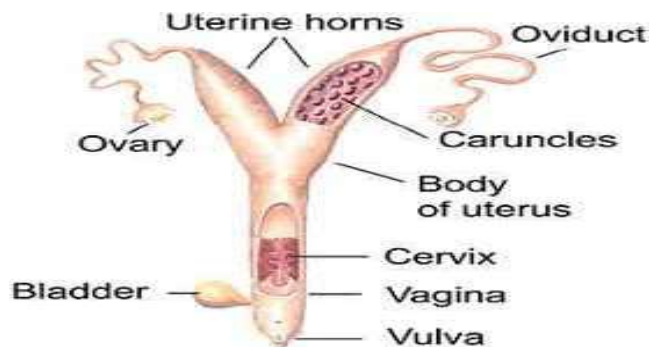


Fig 7.3: Reproductive organs of Female Sheep and Goat

The reproductive tract of ewes and does is almost similar. The female reproductive tract consists of the vulva, vagina, cervix, body of the uterus, uterine horns, oviduct (also called Fallopian tube) and the ovary.

Ovaries: The ovaries contain the ova (eggs), and secrete female reproductive hormones (progesterone and estrogens).

Oviduct: It opens like a funnel (the infundibulum) near the ovary. The infundibulum receives ova released from the ovary and transports them to the site of fertilization in the oviduct. The oviduct is involved in sperm transport to the site of fertilization, provides a proper environment for ova and sperm fertilization, and transports the subsequent embryo to the uterus.

Uterus: It consists of two separate horns (cornua). In animals with multiple births, each horn can contain one or more fetuses. The uterus provides a proper environment for embryo development, supports development of the fetus (supplying nutrients, removing waste, and protecting the fetus), and transports the fetus out of the maternal body during birth.

Cervix: It is the gateway to the uterus and is a muscular canal consisting of several folds of tissue referred to as “rings.” The cervix has relatively little smooth musculature. It participates in sperm transport, and during pregnancy, blocks bacterial invasion. The mucus produced during pregnancy (also during the luteal phase) forms a plug that makes the opening through the cervix impermeable for micro-organisms and spermatozoa.

Vagina: This is the exterior portion of the female reproductive tract and is the site of semen deposition during natural mating.

Vulva: It is a barrier for preventing external contamination of the female reproductive tract.

7.2 Reproductive System of Bull, Ram and Buck

7.2.a. Reproductive System of Bull

The reproductive organs of a bull consist of Testicles, Epididymis, vas deferens, seminal vesicles, prostate glands, Cowper's glands, urethra and penis.

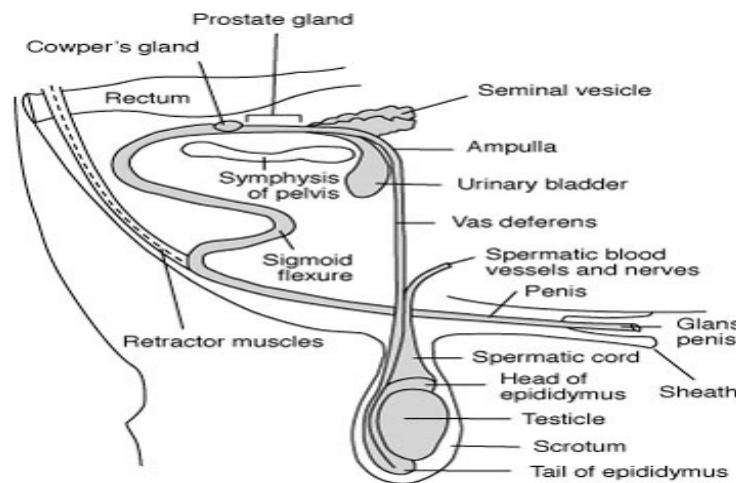


Fig. 7.3 Reproductive organ of bull

Testicles: These are known as Testes. These are the primary organs of reproduction in male. These are two in number. The bag like covering of testes is known as scrotum. Testes contain long coiled tubes known as seminiferous tubes which produces 'sperms'. Between these tubes interstitial or leydig cells which produce male hormone known as testosterone.

Epididymis: It is highly coiled tube attached to the testes along its posterior border. It has head, body and tail. The tail is attached to the lower side of the testes. The main function of the epididymis is to store the spermatozoa and to provide nourishment to the sperm during the process of their maturing.

Vasdeferens: It is a long narrow duct connecting to epididymis and its lower part and moving up through inguinal canal to join urethra posterior to the bladder.

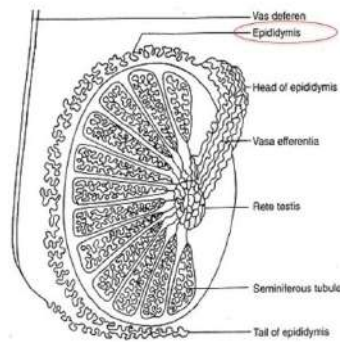


Fig. 7.4 Arrangement of tubules and-ducts in the testis

Seminal Vesicles: They have lobulated surface. Seminal vesicles secrete alkaline thick viscous fluid which is the largest portion of the seminal plasma.

Prostate Gland: It is an accessory gland situated at the neck of the urinary bladder surrounding the urethra. It is a compound gland having many lobules. It secretes a substance which absorb CO_2 given off by the sperm.

Cowpers Glands: These are two small glands situated one on each side of the urethra. Each gland has a duct which directly opens into the urethra. The secretion of these glands facilitates smooth movement of the sperms in the passage.

Urethra: It is a very long tube of musculature, extending from the urinary bladder to the glans penis. The urethra serves as a common passage for urine and semen.

Penis: The penis of the male copulatory organ and the urethra is run through it. The tip of the penis is known as glans penis. The penis has sigmoid flexure just behind scrotum. It is made

up of muscular and erectile tissue which becomes engorged with blood when the animal is sexually stimulated. During copulation whole sigmoid flexure of penis straightens. Its main function is to deposit the sperms in the vagina of the cow and pass urine.

7.2.b Reproductive System of Ram and Buck

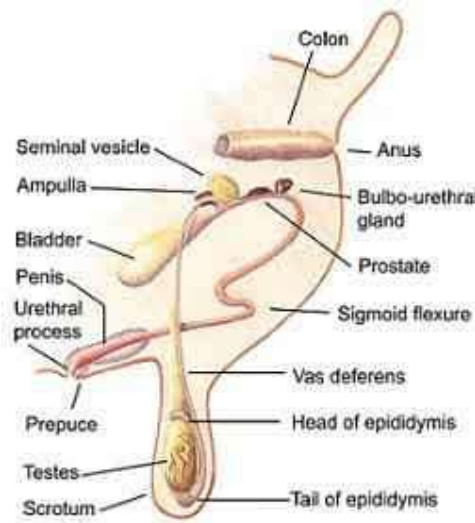


Fig 7.5: Reproductive organs of Ram and Buck

The male reproductive system consists of testicles, which produce sperm and sex hormones, a duct system for sperm transport, accessory sex glands, and the penis, or male organ of copulation, which deposits semen in the female.

Testes: They are paired organs which descend from the abdominal cavity during fetal development to lie in the scrotum. They produce the male gametes (spermatozoa) and secrete the male sex hormone, testosterone. Testosterone is essential for the development of male characteristics, maintaining normal sexual behavior and sperm production.

Scrotum: It is a muscular sac containing the testes. It supports and protects the testes and also plays a major role in temperature regulation. It maintains the temperature 3 to 5°C below body temperature for optimal function.

Single versus split scrotum: This could be breed-specific as in Somali goats. Some breeders consider the split scrotum as an undesirable trait and select against it. However, the important thing is to check if equal-sized testicles are present and sperm production is normal.

Epididymis: It is located in the testes and is a long and convoluted tube in which sperm cells produced by the testicles are stored and mature to a stage capable of fertilization. This change occurs as sperm cells move from the head to the body of the epididymis with mature sperm being stored in the tail of the epididymis.

Vas deferens: It is the duct that rises from the tail of the epididymis into the abdomen, where it joins the urethra at the neck of the bladder. It is often referred to as the 'spermatic cord.' Removal of a section of the vas deferens in each testis is known as a vasectomy, preventing passage of sperm from the epididymis.

Accessory sex glands: These are the bulbo-urethral, prostate, and seminal vesicle glands and the ampulla. Accessory glands secrete additional fluids, which when combined with the sperm and other secretions from the epididymis, form the semen. Some of the secretions contain nutrients like fructose while others produce alkali secretion to raise the pH of the ejaculate. These secretions are added quickly and forcibly during the mating to propel sperm into the urethra.

Penis: This is the final part of the male reproductive tract and its function is to deposit semen into the vaginal tract of the female. At the end of the penis is a narrow tube called the urethral process (or 'worm') that sprays the semen in and around the cervix of the ewe/doe. The preputial sheath protects the penis, except during mating.

7.3 Oestrous Cycle - Symptoms of Heat

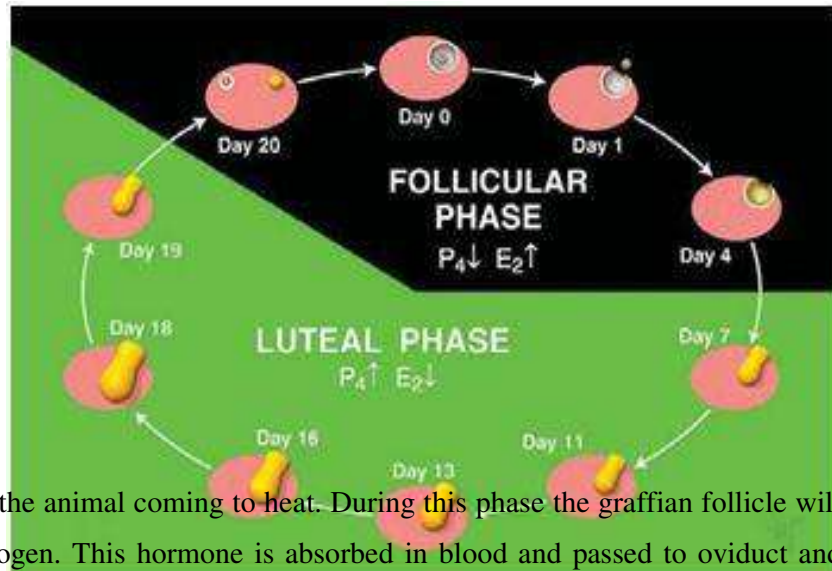
7.3.a. Oestrous Cycle - Symptoms of Heat in Cows

The period from one oestrous to the next oestrous is termed as oestrous cycle. The average length of oestrous cycle in cattle and buffalo is 21 days. It is divided into 4 phases, i.e. prooestrous, oestrous, metoestrus and dioestrous. The stages of the bovine cycle are

- Day 0 is considered to be estrus.
- Days 1-5 are met estrus.

- Days 6-17 are di estrus.
- Days 18-20 are pro estrus.

Fig 7.6 Oestrus cycle



Proestrous makes the animal coming to heat. During this phase the graffian follicle will grow and produce oestrogen. This hormone is absorbed in blood and passed to oviduct and causes the growth of cells lining the oviduct, which facilitates transport of ova. This hormone is also responsible for the oestrus symptoms in the cattle.

The oestrous or heat is the period in which female shows desire to be mated by the male. This period lasts for 24-36 hours. During this period the animals shows heat symptoms. Ovulation will occur at the end of oestrous period.

Metoestrus is the period just after the ovulation during which period level of oestrogen and leutinizing hormones fall and corpus luteum begins to function. Diaoestrus period predominated by the influence of the progesterone from the corpus leuteum. When the fertilization takes place, high level of progesterone will stop the formation and development of new graffion follicles in the ovaries. Progesterone maintains the pregnancy.

Symptoms of estrus(heat): The symptoms of heat are

- The animal is excited, restlessness and nervousness.
- Frequent bellowing and reduced feed intake.
- Peculiar movement of lumbo-sacral region
- The estrus animals will lick and smell other animals.
- The estrus animals will try to mount on other animals
- The estrus animals will stand still when other animal try to mount. This period is known as Standing heat. This extends 14-16 hours.
- Frequent micturition (urination) is observed.

- Clear mucous discharge is seen from the vulva, sometimes it will be string like. The Mucous also stick to the near the parts of vulva.
- Swelling of the vulva
- Congestion and hyperemia of the vaginal mucus membrane
- The tail will be in raised position.
- Milk production is slightly decreased.
- On palpation, the uterus will be turgid and the cervix is opened.

7.3.b. Signs of Oestrus in Sheep and Goat

- Bleating continuously
- Swollen – red colored vulva
- Flagging of the tail
- Frequent urination
- Cervical mucus discharge, which
- Causes hairs to stick together
- Restlessness and mounting on other goats and seeking the buck

The best confirmation of oestrus is when the doe or ewe stands when being mounted. This is commonly called '*standing heat*.' Normal duration of oestrus will be 24 to 36 hours. The duration of oestrus is variable. It is shorter in younger ewes and does but longer in older animals.

Oestrus Detection Techniques

Oestrus in sheep and goats is relatively easy to detect compared to that in cattle as heat signs are well pronounced, particularly in goats. Still, where controlled mating or artificial insemination (AI) is used regular detection of estrus is necessary through using a teaser ram or buck. Teasers are vasectomized or epididymized males. When a ram/buck with a marking paint at brisket region mounts a female in oestrus, some of the marking pigment will be transferred to the rump of the female. Tying an apron made of leather or canvas around the body of a ram/or buck prevent the penis to enter the vagina of females.

7.4 Artificial insemination Advantages - Disadvantages

Artificial insemination (A.I.) is deposition of semen into the female genital tract by means of instruments.

Advantages of A.I:

- There is no need of maintenance of breeding bull for a herd; hence the cost of maintenance of breeding bull is saved.
- It prevents the spread of certain diseases and sterility due to genital diseases. E.g. contagious abortion, vibriosis.
- By regular examination of semen after collection and frequent checking on fertility make early detection of inferior males and better breeding efficiency is ensured.
- The progeny testing can be done at an early age.
- The semen of a desired sire can be used even after the death of that particular sire.
- The semen collected can be taken to the urban areas or rural areas for insemination.
- It makes possible the mating of animals with different body sizes without injury to either of the animal.
- It is helpful to inseminate the animals that are refusing to stand or accept the male at the time of oestrus.
- It helps in maintaining the accurate breeding and calving records.
- It increases the rate of conception as insemination carried on animals free from reproductive disorders.
- It helps in better record keeping.
- Old, heavy and injured sires can be used.

Disadvantages of A.I

- Requires well-trained persons and special equipment.
- Requires more time than natural services.
- Necessitates the knowledge of the structure and function of reproduction on the part of operator.
- Improper cleaning of instruments and in sanitary conditions may lead to lower fertility.
- When the bull is not properly tested, the spreading of genital diseases will be increased.

- Market for bulls will be reduced, while that for superior bull is increased.

Artificial Insemination (AI) : It is a technique in which semen is collected from a ram or buck and put into the reproductive tract of a ewe/doe. The standard procedure of inseminating does/ewes involves lifting up of their rear quarters with their front legs remaining on the ground. With the aid of speculum and pen light the cervical opening or 'os' is located and, under visual control, an insemination pipette is passed into or through the cervix for semen deposition.

7.5 Collection, evaluation and freezing of Semen

Collection of Semen: Various methods of collection of semen have been devised from time to time. There are three common methods of semen collection.

- Use of Artificial vagina
- By Electro-stimulation method.
- By massaging the ampulae of the ductus deferens through rectal wall.

The ideal method of semen collection is use of artificial vagina which is safe for sire and the collector.

Artificial Vagina Method:

The artificial vagina has the following parts

- A heavy hard rubber hose 2" diameter open at both ends with a nozzle for air and water in and outlet.
- Inner sleeve of rubber or rubber liner.
- The semen receiving cone or rubber cone.
- Semen collection tube made of glass or plastic graduate in cc and its fraction correct to 0.1 CC
- Insulating bag

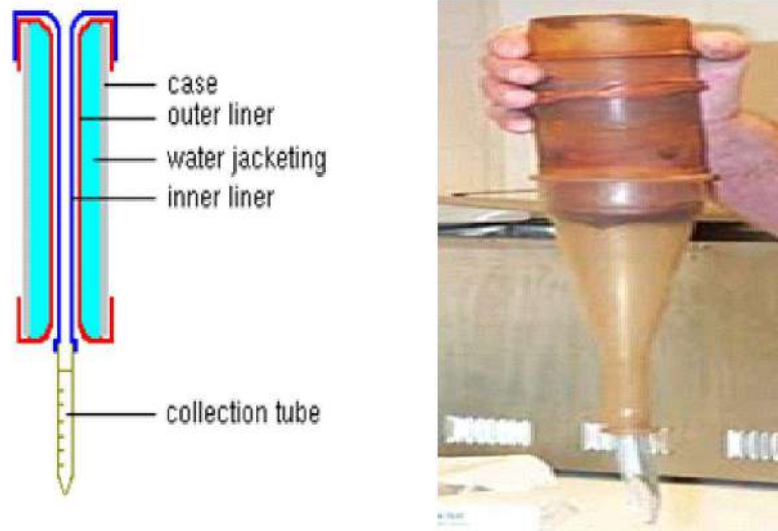


Fig. 7.7 Artificial Vagina of Cattle

Before using for semen collection all the parts of A.V are washed thoroughly, sterilized properly and assembled in to artificial vagina. The rubber liner is inserted into the rubber hose inverting both ends back by folding back from both sides opening and fastening with rubber bands. Now the space between the hard rubber hose and inner rubber liner forms a water tight compartment. The nozzle at one end of the hose can be fixed or removed by turning through the threaded nut up or down. The water jacket of the artificial vagina is- filled with hot water at a temperature of 45°C (113°F) by opening the nozzle. The graduated semen collection tube is fixed to the narrow end of the artificial vagina hose and fastened by a rubber band.

The inner side of the rubber liner on the anterior side of the artificial vagina is lubricated with sterile jelly to a length of 3 to 4 inches. Air is blown through the nozzle into the water jacket to create pressure in it and the same is exerted the rubber linear to simulate natural vagina. The temperature of the artificial vagina is to be checked, at each collection and it should simulate natural vagina at mounting time. If the artificial vagina is too hot it will burn the penis of the bull, and the bull refuses to mount later. If it is too cold ejaculate may not be there after a thrust, or even if ejaculate is there; it may be contaminated with urine and becomes unfit for use.

Procedure : The cow or dummy is secured in a service crate. It is important that the collection area have non-slip flooring to avoid injuries and because ejaculation may be inhibited if the bull is nervous about his footing. The assembled A.V is held with the left hand by a right handed person at 45° angle from the direction of penis.

When the bull mounts on the cow, the sheath of the bull will be grabbed by the operator, directing the glans penis into the artificial vagina and then the bull gives a thrust to ejaculate. The operator should evince care so as not to touch the exposed part of the penis.

After the bull dismounts, the artificial vagina is taken off from penis and the air vent is opened to release the pressure from the jacket. The water from the jacket is also drained by opening the nozzle. This allows the ejaculate to flow from the cone to the semen collection tube. The semen collection tube is detached from the cone, plugged with cotton wool and taken to the laboratory for examination. The rubber cone and the semen collection tube can be protected from external contamination, heat or air by covering with an insulation bag with zip.



Fig 7.8(a). False mounting to arouse bull arousal



Fig.7.8(b) An erect penis indicates



Fig 7.8 (c).Collector ready with AV



Fig.7.8 (d) Collector diverting penis to the

Frozen semen - Method and Preservation

Freezing of semen for successful preservation of spermatozoa, for long periods is of great importance in livestock breeding and farm management. It has made it possible to make

available the use of outstanding proven sizes for larger number of cows covering larger area. Frozen semen shipment has become possible to different continents in the globe to any place connected with any service. Now a day a farmer can get semen of an outstanding sire for inheritance of high milk yield at his door step. At present frozen semen is used in most of the states in India. The technique of semen preservation in straws was developed in France. Freezing of semen is done with a special diluent, which has the following composition.

Sodium citrate	1.856 gm
Fructose	1.0 gm
Water	Fill to 66 ml
Glycerol	14 ml
Egg Yolk	20 ml
pH	to 7.0 with HCl
Dihydro-streptomycin	50.0 mg

The addition of glycerol to the diluent makes the cells more resistant to the rigours of freezing and icy crystals, which form are smaller and smoother thus creating less damage to the spermatozoa. The addition of fructose to the diluent improves sperm resistance to glycerol and also provides nutrition. Frozen semen is packed in single plastic straws at 5°C. The final level of glycerol should be 7.0 to 7.6 % during the freezing process. The antibiotics are added to inhibit bacteria and to kill pathogen organisms.

The semen to be diluted in such a way that one ml. of extended semen will contain 20 million motile spermatozoa. The semen must be cooled carefully for spermatozoa to remain with life. The final temperature is lowered to -79°C or still lower. Quick freezing is done for a period of 3 to 5 minutes to -75°C with the help of atmosphere created by liquid nitrogen.

In the slow freezing technique cooling is done at the rate of 1°C per minute from +5°C to -15°C. From -15°C to -31 °C at the rate of 2°C per minute. From -31°C to 75°C at the rate

of 4 to 5°C per minute. Thus taking 40 minutes in total, further cooling to -96°C can be done quickly as it is not critical after freezing. Before freezing the diluted semen is equilibrated for 3 to 5 hours or for the best 16 to 20, hours period in refrigerator at 5°C. Liquid nitrogen plays a vital role for storing the frozen semen straws, at a temperature of -196°C for longer periods.

7.6. Insemination Methods : There are different methods of insemination in different species of animals.

- Speculum method
- Vaginal method
- Recto vaginal method.

Out of the above three methods, recto vaginal method is popular in dairy animals.

Recto Vaginal Method

The recto-vaginal technique is the most commonly used method of artificially inseminating (AI) cattle. Regardless of whether the inseminator is left or right handed, it is recommended that the left hand be used in the rectum to manipulate the reproductive tract and the right hand be used to manipulate the insemination gun. This is because the rumen or stomach of the cow lays on the left side of the abdominal cavity, displacing the reproductive tract slightly to the right. Thus it may be easier to locate and manipulate the tract with the left hand.

Steps in performing successful AI

Step 1: Restrain the animal to be inseminated. A gentle pat on the animal's rump or a soft spoken word as the inseminator approaches will help to avoid startling or surprising the cow.

Step 2: Raise the tail with the right hand and gently massage the rectum with the lubricated glove on the left hand. Cup the fingers together in a pointed fashion and insert the left hand in the rectum, up to the wrist.

Step 3: Gently wipe the vulva with a paper towel to remove excess manure and debris.

Step 4: Insert the gun at a 30° upward angle to avoid entering the urethral opening and bladder located on the floor of the vagina.

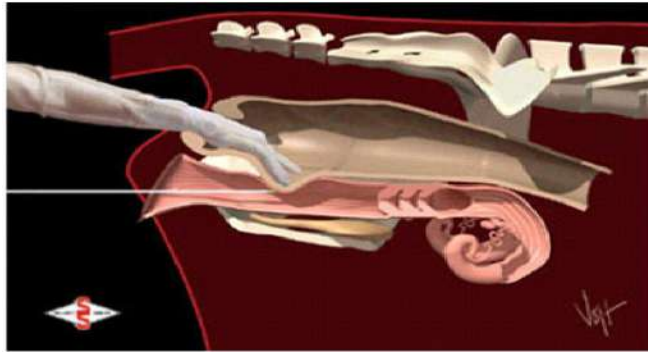


Fig. 7.9 Keeping the gloved hand even with the tip of the inseminator gun

The cervix can be located, grasp it and gently push it forward. This will straighten the vagina and the gun should pass freely up to the cervix. The inseminator will note a distinct gristly sensation on the gun when it contacts the cervix.

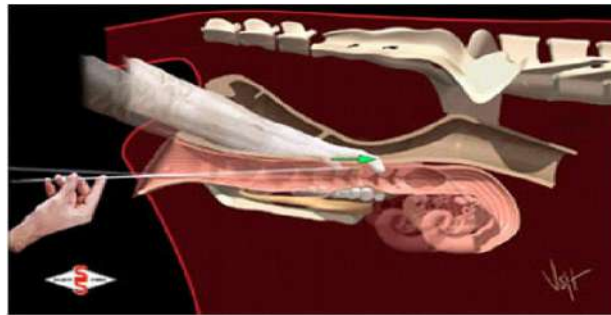


Figure 7.10 Grasping the cervix and gently moving it forward

The cervix (Figure 10) consists of dense connective tissue and muscle and is the primary landmark for inseminating cattle. The cervix usually has three or four annular rings or folds. The opening into the cervix protrudes back into the vagina.



Figure 7.11 Close-up of the Cervix

Step 5: Once the gun is in contact with the external surface of the cervix, grasp the external opening to the cervix with the thumb on top and forefingers underneath (Figure 7.11). Use the palm and these two fingers to guide the gun tip to the cervical opening located between the

thumb and forefingers. With gentle probing, the opening of the cervix should be located. The inseminator will feel the gun slide forward until it contacts the second cervical ring.

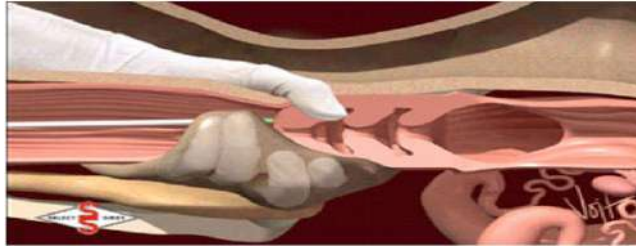


Figure 7.12 Finding the opening of the cervix

Step 6: Maintain gentle but steady forward pressure on the gun and slide the thumb and forefingers just in front of the gun tip and re-grasp the cervix. Using the flexibility of the wrist, gently twist and bend the cervix until the second ring of the cervix slides over the gun tip (Figure 7.12). Repeat the process until all the rings have been passed over the gun tip. When all rings of the cervix have been cleared, the gun should slide forward freely with little resistance. Since the uterine wall is very thin, the inseminator will once again be able to feel the tip of the gun.

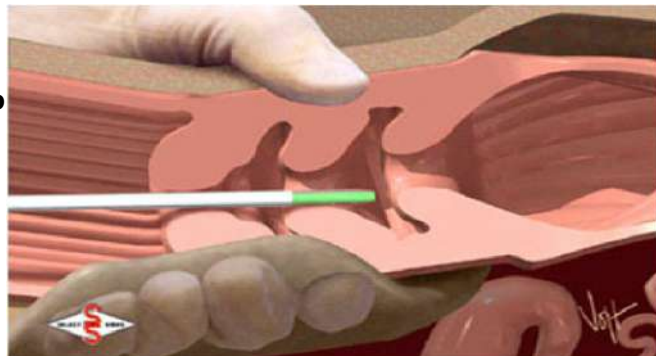


Fig 7.13 Moving the cervix over the tip of the insemination gun.

Step 7: It is now time to check the gun placement and deposit the semen. Rotate the gloved hand until it lies on top of the cervix. With the index finger of that hand, locate the far end of the cervix (Figure 7.13). Pull back on the gun until the tip of it is directly underneath the index finger near the internal opening of the cervix. Raise the finger and slowly deposit the semen (Figure 7.14). Push the plunger slowly so that drops of semen fall directly into the uterine body.

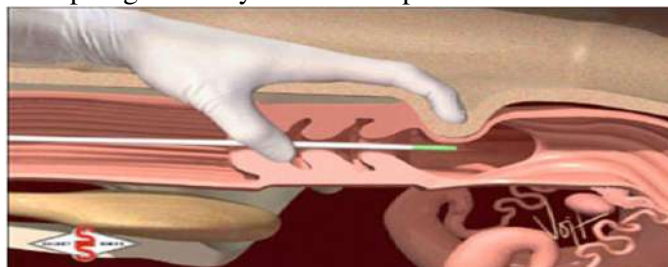


Figure 7.14 Locating the end of the insemination gun.

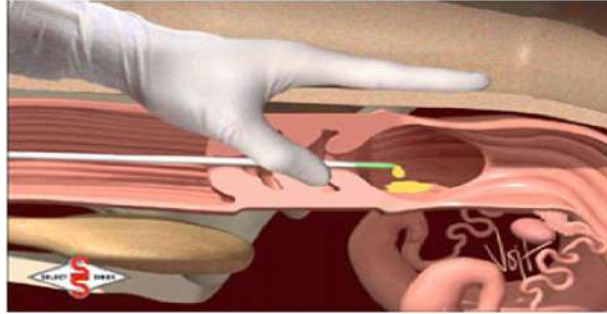


Fig. 7.15 Depositing the semen in the body of the uterus.

With proper AI technique and gun placement, semen will be deposited in the uterine body. Uterine contractions will then transport spermatozoa forward to the horns and oviducts with a good distribution of both sides (Figure 7.15). When the insemination gun is more than 1 inch through the cervix, all the semen will be deposited in only one horn (Figure 7.16).

**Fig. 7.16. Good distribution of the semen
to both uterine horns**

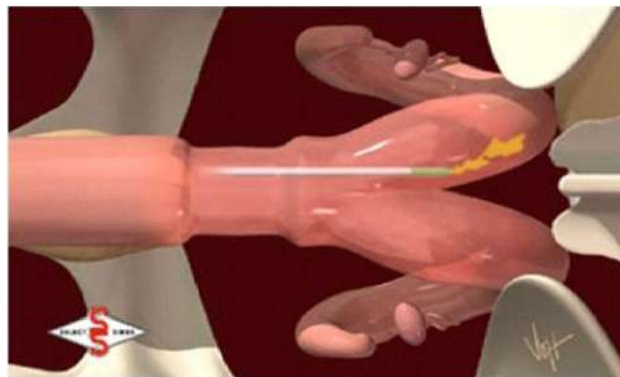
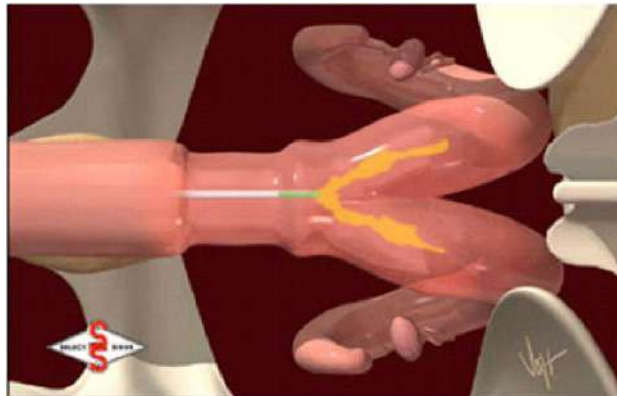


Figure 7.17 Improper distribution of the semen into one horn because the insemination gun is pushed too far forward.

Step 8: After properly depositing semen, slowly pull the gun from the reproductive tract. Remove the gloved hand from the rectum. Check the gun tip for signs of blood, infection or semen leakage inside the sheath. Wipe the gun clean and dry and return it to the proper storage location.

Speculum Method: Speculum is placed in the vagina of the cow which provides passage from outside to the site of insemination, then inseminating tube is passed through the speculum and semen is deposited at the cervix.

Vaginal Method: Hand is passed through the vagina and the inseminating tube is guided by hand to the site of insemination and semen is deposited. Here there is a risk of contamination and injury to the female genitalia.

7.7 Embryo Transfer Technology - Advantages and Disadvantages

Definition: It is a technique by which fertilized embryos are collected from donor female and transferred to a recipient female that serves as a surrogate mother for the remaining period of pregnancy.

Advantages

- It is used for rapid multiplication of genetically superior females.
- It is used for rapid determination of genotype of an animal, especially when the characters being investigated are dependent on dominant genes.
- Using genetically unreliable mothers as foster mothers for embryo of superior genetic makeup.
- For economic and safe transfer of exotic germplasm from one country to another.
- For increasing the litter size in sheep and pigs
- For production of twin calves in cattle.
- For production of identical off springs which are useful as research material.
- For production of young ones with a sex of choice.

- To study the maternal influence on the foetus.
- Rapid multiplication of endangered, rare and commercially desirable breed
- Production of transgenic livestock.

Disadvantages

- Availability of progeny tested bull frozen semen is important.
- The super ovulatory response of the donor cows under local agro climatic conditions may be far lower than what is possible in foreign countries. High atmospheric temperature and poor nutrition will have adverse effect on super ovulatory response, fertilization and embryonic development.
- Embryo transfer technology is very expensive due to low survival rate of embryos. The hormones are very costly and they have to be imported.
- Embryo Transfer Technology reduces highly technical skills.

Stages in Embryo transfer Technology

- Super ovulation of donor cow with follicular stimulating hormone at 32 mg.
- Inseminating superovulated cow twice on the day of oestrous.
- Embryo collection

There are two methods commonly used for embryo collection

a) Surgical method Flush 2 to 20 ml of flushing medium (Dulbecco's phosphate buffered saline) through the oviduct from the upper part of uterine horn towards the fimbriae using a syringe and blunt needle. Collect flushings through a small glass tube inserted into the infundibulum.

b) Non surgical method

Dilate the cervix with cervical dilator and insert foley catheter into uterine horn by manual guidance per rectum, in that balloon with air, irrigate uterine horn with 100 - 800 ml of flushing medium. In cattle inflate balloon at base of uterine horn. Each time 30 -60 ml of medium is infused into the horn.

Preparation of donor

- Donor cow is placed in a traxis
- The perineum of the donor cow is cleaned and scrubbed with antiseptic solution. Epidural anaesthesia is given.
- Foley's catheter is introduced in to the uterine horn.
- The plastic balloon is inflated to seal off the horn of the Uterus. Embryos are flushed out with culture media and collected in Petri dish.

Selection of Embryo for transfer: The embryos can be screened by 200m stereo microscope. The embryo should be morphologically normal. Blastomeres should be in uniform size. It should not possess cellular debris in the morula. It should not have fragmentation of cytoplasmic and nuclear material. No vacuoles in the blastomeres.

Selection and preparation of recipients: Recipients should be a regular (good breeder). It should have infection free genital tract. It should have calved 3 months back. (Post partum period 90 days). Recipients should be sexually matured, cycling normally, physical condition should be good and should not be fatty.

Synchronization of estrous between donor and recipient: For successful of embryo transfer, synchronization of the stage of oestrus cycle between the donor and between the stage of embryo and recipient is necessary. For good results, the recipient should be in estrous within 12 hours of the donor. This can be achieved by using synchronizing agents (PG F2)

Transfer of Embryos: Transfer of embryos can be done by two methods

(a) Surgical transfer

Laparotomy will be performed under local anaesthesia. The tip of uterine horn is exposed through the incision in the flank. The embryo is deposited in the uterine lumen.

(b) Non surgical method

It is preferred in cattle. Embryo is deposited in the uterus through cervix with an E.T. gun loaded with straw which contains embryo, 6 days after oestrus. The embryos at the time of examination and selection can be manipulated for in-vitro culture of embryos for preservation

Success Rate: The average number of calves produced per super ovulation is 3-4. It is possible to induce super ovulation in a cow for 4-5 times per year. 10 calves can be obtained cow per year on an average.

7.8 Pregnancy Diagnosis: Pregnancy can be diagnosed by

1. By observing the signs of pregnancy.

- The animal will not come to heat again
- The animal tends to become sluggish in temperament and tractable
- The animal has tendency to grow
- Increase in the volume of abdomen
- Increase in body weight
- The mammary gland become firm, enlarged and teats takes waxy appearance.

2.Examination of Uterus per rectum

- Ovaries contain corpus luteum throughout the gestation period. C.L. is firm, rounded at the top and slightly elevated from the surface of the ovary.
- From the beginning to middle of the 2nd month, one horn of the uterus is enlarged. If enlarged horn is allowed to slide between the thumb and the first two fingers, a sphere can be felt, which has characteristic slippery feeling. At the end of 2nd month sensation of foetal membranes can be felt.
- By third month uterus distention can be seen. If distended horn is tapped with fingers, it reveals like a piece of wood floating in fluid beneath.
- Early in 4th month cotyledons can be felt. By the end of 4th month uterine artery starts enlarging. If the artery is slightly compressed between the fingers and thumb, continuous vibrating fremitus (uterine thrill) can be detected which later changes to pulsation.
- From 5th month onwards uterus sinks below the pelvic cavity until middle of 6th month. After wards presence of calf can be easily detected.

3.Laboratory tests

1. Serum of pregnant cows contains globulins.
2. **Barium chloride test:** 4 to 5 drops of barium chloride when added to urine of the same volume from a pregnant cow does not affect the colour, but it becomes turbid with non pregnant.

3. **Specific gravity test:** 0.25ml of cervical mucosa is placed in copper sulphate with 1.008 specific gravity. If it sinks it is pregnant and if floats it is non pregnant
4. **Sodium hydroxide test:** 0.25ml of cervical mucosa is added to 5ml of 10% sodium hydroxide solution and heat over flame till boiling. Development of orange colour indicates positive and pale colour indicates negative.
5. **Oxidation reduction test:** To 3ml of urine 0.6ml of sodium benzoate indicator is added in a test tube. Tubes are inverted and allowed to stand for 30 minutes green colour is developed. If the colour is permanent the animal is positive for pregnancy, where as with non pregnant green colour returns to original colour.

7.9 Parturition - Assistance and Other precautions

- Parturition is the expulsion of the foetus and its membranes from the uterus through the birth canal. This process is also known as calving in cattle.
- In cows, the gestation period will be 275 - 285 days and in buffaloes 300 – 310 days.
- The pregnant animals kept under careful observation when they are approaching parturition, and after seeing the symptoms of parturition i.e. developed udder, enlargement of vulva etc., the pregnant animal is kept in a calving pen with sufficient bedding of soft straws.
- The concentrate feeding should be given separately to the animals near parturition which should be laxative and easily digestible.
- The calved animal is kept warm. The cow should be given plenty of lukewarm water to drink. The cow is washed with clean water and sufficient quantity of green grass and food is supplied.
- After parturition due to straining sometimes prolapse of uterus or vagina is seen. In such cases it should be immediately referred to a qualified veterinarian. Sometimes heavy milking cows will show the symptoms of “Milk fever” which has to be attended by a veterinarian to give 300-500ml of calcium borogluconate intravenously. After parturition or delivery the placenta is not expelled (Retained placenta), in such cases it is removed manually after 24 hours.

7.10 Study of Obstetrical Equipment

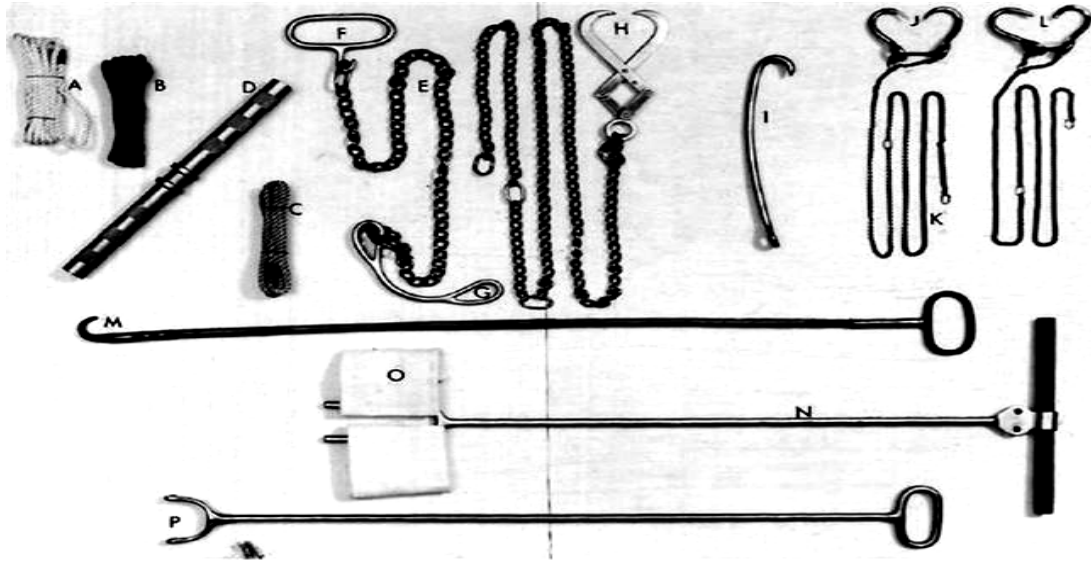


Fig 7.18: Obstetrical equipment

In this picture Obstetric snares, i.e 1m lengths, with loops, of cotton rope (cloths line), nylon cord or webbing (A,B,C), a finer cord for snaring the mandible is essential – and traction bars (D). These items are essential and it is advisable to have at least two sets; they can be sterilized.

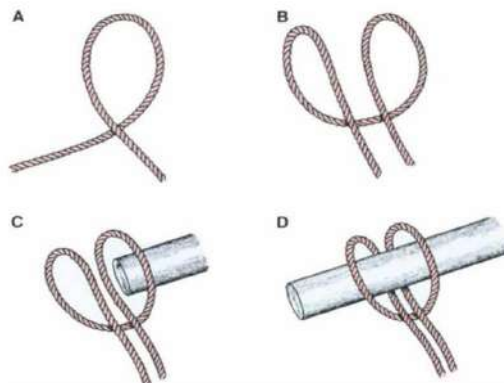


Fig 7.19: Nylon cord

As an alternative snares one may use Moore's obstetric chains (E) with handles (F). Many veterinarians find those easier to use than rope snares. Their main advantage is that they

are heavier and do not move so readily when they are repositioned during intrauterine or intravaginal manipulation. A snare introducer (G) is also illustrated. This can be used with ropes as well as chains.

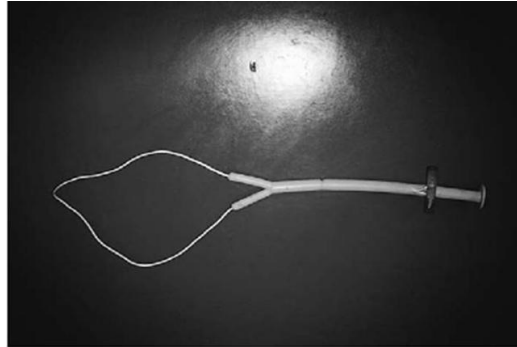


Fig 7.20: Plastic head snare for use in ewes and sows

Obstetrical hooks include Krey – Schottler double – jointed hooks (H), Obermeyer’s anal hook (I), Harms’s sharp (J) or blunt (L) paired hooks on a fine (farrowing) chain (K), and Blanchard’s long, flexible cane hook (M). These are useful when performing fetotomy to enable traction to be applied to various fetal segments.

Additional instruments are Cammerer’s torsion fork (N) with canvas cuffs (O) and Kiihn’s obstetrical crutch (P).

Traction may be applied using a block and tackle, or a calving aid such as an HK calf puller or Vink calving jack.



Fig 7.21: (a)

(b)

(c)

(a) vink calving jack

(b) vink calving jack in use to apply traction to calf in anterior longitudinal presentation with snare attended to both fore limbs.

(c) HK calf puller

Obstetrical Instruments for Large Animals : This section covers instruments that are used to assist with obstetrical difficulties and breeding and infertility issues.

Cow Catheter: To catheterize the bladder



Fig 7.22 Cow Catheter

Chains & Handle: To assist with the delivery of a calf



Fig 7.23 (a) Chains (b) Handle

Fetal Extractor: To assist with the delivery of a calf.



Fig 7.24: Fetal Extractor (Calf Puller)

Characteristics: The strap on the brace piece is placed over the hips of the cow. Obstetrical chains or straps are attached to the legs of the calf. Along the shaft of the calf puller is a come along, which is a cable attached to a ratchet that reels the cable into a spool. The cable is attached to the OB chains, and the user gently inches the calf out of the cow, while working with the cow's contractions and at the correct angles.

Calf Snare: To assist with the delivery of a calf.



Fig 7.25: Calf Snare

Characteristics: This nylon coated cable is equipped with a locking device that will not tighten down on the body part to which it is attached. This is very useful in pulling a head into proper alignment and keeping it in place until the calf is delivered.

Obstetrical Wire: To disarticulate a dead fetus so as to aid in its removal.



Fig 7.26: Obstetrical Wire

Characteristics: This is a rough cable like material that cuts through bone and sinew when it is rubbed back and forth. As parts are removed, the calf can be pulled from the cow.

Obstetrical Wire Guide: To help guide the OB wire to the appropriate area for cutting.

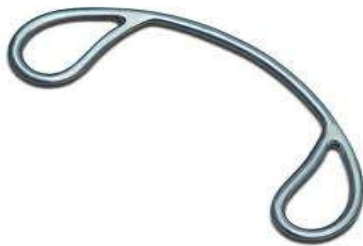


Fig 7.27: Obstetrical Wire Guide

Characteristics: A curved handle ends in a weighed bulb in which the wire is threaded.

Fetotomy Knife: To disarticulate a dead fetus so as to aid in its removal.



Fig 7.28: Fetotomy Knife

Characteristics: This instrument is designed to fit into the palm of the hand. The index finger is slipped into the ring and the curled over the top of the blade. This allows the knife to be directed to the appropriate area for cutting.

Fetatome: To disarticulate a dead fetus so as to aid in its removal.



Fig 7.29: Fetatome

Characteristics: An OB wire is passed inside the fetatome, it protects the mother's delicate tissues as the saw is worked back and forth.

Krey Obstetrical Hook: To hold on to the fetus while performing an embryotomy.



Fig 7.30: (a) Krey OB Hook

(b) Ostertag's blunt eye hook

Characteristics: The hooks bite into the fetus to hold it steady.

Short Answer Type Questions.

1. What is Oestrus cycle
2. What is A.I.
3. What is frozen semen?
4. What are the functions of ovaries
5. Name the different semen collection methods.
6. What are the methods of insemination in cattle
7. What are the function of testes
8. Write any six names of Obstetrical equipment
9. Write the advantages of E.T. technology
10. What are the pregnancy diagnosis tests

Long Answer Type Questions

1. Explain briefly the reproductive system of Cow with the help of diagram?
2. Explain about the reproductive system of Bull with the help of diagram?
3. Write about the Oestrous cycle and symptoms of heat in cows
4. Define A.I and write its advantages and disadvantages.
5. Describe the Recto – Vaginal method of A.I. in cattle.
6. Define ETT. Write its advantages and disadvantages.
7. Describe the precautions to be taken before and after parturition.

UNIT-8**Lactation & Milking Methods****Structure**

8.1 Mammary Gland, Structure and Development

8.2 Lactogenesis and Galactopoiesis

8.3 Milk letdown

8.4 Milking methods

8.5 Sources of Milk contamination - steps in clean milk production.

8.6 Marketing of Milk

8.1 Mammary Gland, Structure and Development

The udder is a modified skin gland and is located entirely outside the abdominal cavity. It is supplied with blood vessels i.e. mammary artery or mammary vein. It is composed of two halves, the right and left, divided by median suspensory ligament. Each half is further divided into two separate quarters by thin membranes. There is no communication among the four quarters of the udder.

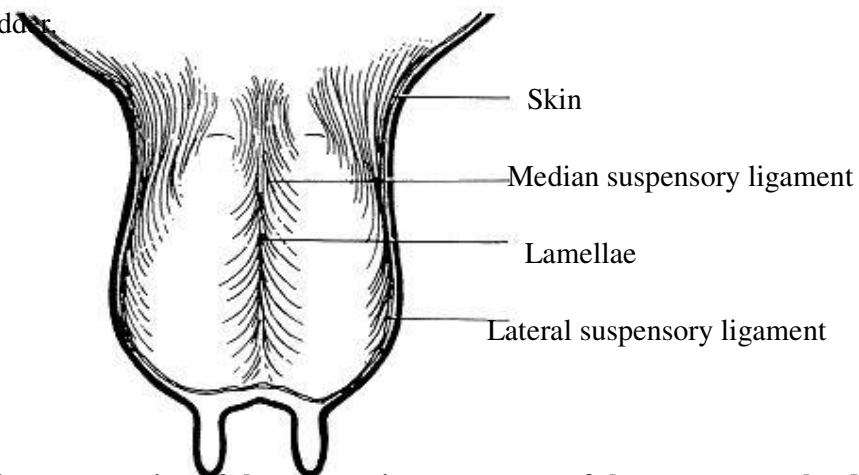


Fig. 8.1 Diagram of a cross section of the supporting structures of the mammary glands

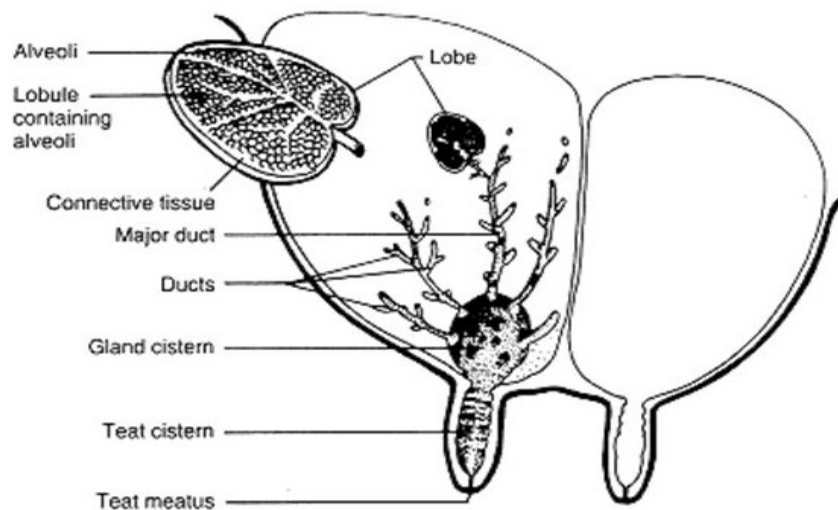
Each quarter is composed of secretory tissue and some supporting connective tissue. The secretory tissue consists of numerous “Alveoli” or tiny chambers lined with many secretory

cells. Each Alveolus is supplied with tiny capillaries which lie outside the secretory cells. Small muscle fibres, called myoepithelial cells also surrounding each alveolus, which causes contraction of the alveolus and produce “Let - down” of milk. Each alveolus is drained by a small duct called alveolar duct.

A cluster of alveoli and their ducts resembling a bunch of grapes constitute a lobule. These ducts units successively to larger ducts called intralobar (within lobe) and inter lobular (between lobules). The interlobular ducts units successively to form galactophores that empty into the glands cistern or milk cistern as sinus at the tip of the udder which is continuous with teat cistern. The teat cistern in joined with streak canal a narrow tube that opens at the lower end of the teat.

The teat canal is surrounded by ‘muscular sphincter’ which remains constricted and prevents leakage of milk until milking commences. The streak canal and sphincter are also responsible for preventing entrance of bacteria and other contaminants in the teat.

The blood to the udder is carried by pair of external pudic arteries (majorly) and parineal arteries. The blood is carried away from the udder by a pair of external pudic veins and one subcutaneous abdominal vein. In addition to the arteries and veins, there are numerous lymph vessels, which carry lymph away from the udder to the supra mammary lymph glands. Blockage of lymph vessels may result accumulation, which is commonly seen in heifers before causing.



8.2The mammary gland of a cow

8.2 Lactogenesis and Galactopoiesis

Lactogenesis: The initiation and synthesis of milk is called as lactogenesis. Milk is synthesised in the cells of alveoli from various blood constituents. Some of the milk components are taken as such from the blood such as water, vitamins and minerals while others are synthesized by the alveoli cells from the ingredients picked up from the blood.

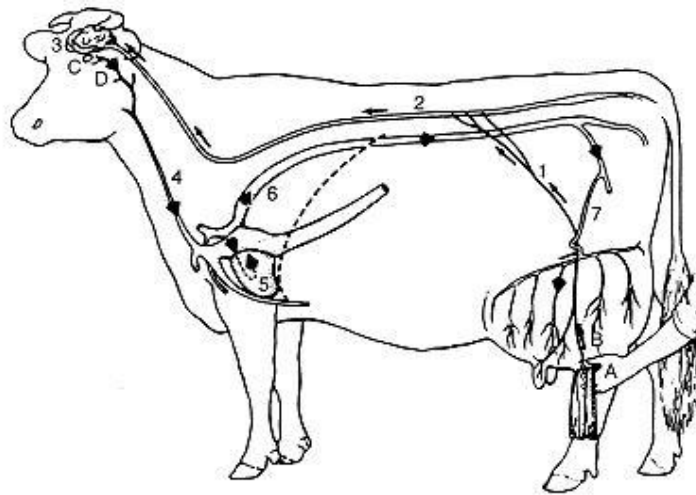
Once the milk is formed in very small droplets in the alveolar cells, it migrates towards the apex of the cells, where is finally ejected into the lumen of the alveoli. It is estimated that 500 volumes of blood flows through the udder for each volume of milk synthesized.

Hormones that induce lactogenesis vary from species to species. In general it appears that prolactin and adrenal corticoids are mainly involved. At the time of parturition a rise of prolactin adrenal corticoids occurs with concomitant decline in oestrogen and progesterone, resulting in the initiation of lactation.

Galactopoiesis: Maintenance of lactation is known as Galactopoiesis. Milk production increases rapidly following parturition and replace a peak in 4 to 6 weeks where it remains for a short period and then gradually declines. The sucking stimulus and intra mammary pressure are two important factors. The stimulus of sucking or milking causes release of almost all the hormones which is accumulated in the udder is also important.

8.3 Milk Let Down: When milk secretion has continued for considerable time after milking, the alveoli ducts and gland and teat cisterns are filled with milk. Milk in the cisterns and larger ducts can be removed readily. Milk in the smaller ducts and alveoli does not flow out easily. The sucking action of the calf is ideal for milk let down. However, massaging the udder or washing with warm water is also equally effective.

Stimulation is carried by the nerves to the brain which is connected with the pituitary gland located at its base. Pituitary gland releases oxytocin hormone. Oxytocin is carried by the blood stream to the udder where it acts on the small muscle cells surrounding the alveoli, causing them to contract. The pressure thus created forces the milk out of the alveoli and smaller ducts as fast as it can be removed from the teat. The letting down process can be stimulated within half to one minute's time. The effective time of the hormone is limited and milking should be completed within seven minutes.



8.3 The neuro-hormonal reflex of milk ejection.

(A) that a cow associates with milking causes a nerve impulse (B) to travel via the inguinal nerve(1) to the spinal cord(2) and the brain(3). The brain causes the release of oxytocin (D) from the posterior pituitary (C). Oxytocin is released into a branch of the jugular vein(4) and travels to the heart(5) and is then transported to all parts of the body by the arterial blood. The oxytocin reaching the udder leaves the heart by the aorta(6) and enters the udder through the external pudic arteries (7). It causes the myoepithelial cells to contract, resulting in milk ejection from the alveoli.

8.4 Milking Methods: Hand milking and machine milking are the two methods practiced to remove the milk from the udder.

1. Hand milking: Hand milking of cows is the most common practice in India. Cows are milked from left side. The order of milking the various teats also differs. Teats may be milked cross-wise or fore quarters together and then hind quarters together or teats appearing most distended milked first.

The milk must be squeezed and not dragged out of teats. The first few streams of milk from each teat should be let on to a strip cup to see clues in milk for possible incidence of mastitis. This also helps in getting rid of bacteria which have gained access and collected in the teat canal.

Methods of hand milking: Stripping, knuckling and full-hand milking are the commonly used methods of milking.

Stripping method: Stripping consists of firmly seizing the teat at its base between the thumb and forefinger and drawing them down the entire length of the teat pressing it simultaneously to cause the milk to flow down in a stream. The process is repeated in quick succession. Both hands may be used, each holding a different teat, stripping alternately. The full-hand method comprises holding the whole teat in the fist, fingers encircling the teat.

Knuckling: It is also known as fisting. It is practiced in buffalos by most of the milkers in some areas. Milkers bend their thumb against the teat while milking. This method is not advisable as it causes pain and injury to the teats of the animal.

Full hand milking : It is the recommended method of hand milking. The base of the teat is closed in the ring formed by the thumb and fore finger so that milk trapped in the teat sinus may not slip back into the gland cistern. Simultaneously, teat is squeezed between the middle, ring and little fingers and the hollow of palm, thus, forcing the milk out. This process should be repeated in quick succession. By maintaining a quick succession of alternate compressions and relaxations the alternate streams of milk from the two teats sound like one continuous stream.



Fig. 8.4 Full hand milking

Advantages of full hand milking: Full-hand milking removes milk quicker than stripping because of no loss of time in changing the position of the hand. Cows with large teats and she buffaloes are milked by full-hand method. Full-hand method is superior to stripping as it simulates the natural sucking process of calf.

Stripping causes more irritation to teats due to repeated sliding of fingers on teats and so discomfort to cows, but stripping has to be adopted for cows with smaller teats for obvious reasons. Stripping should be resorted to remove the last drawn milk i.e. strippings which is richer in fat.

In India, milkers are mostly accustomed to wet hand milking. They moisten their fingers with milk, water or even saliva, while milking. This should be avoided for the sake of cleanliness. Wet-hand milking makes the teats look harsh and dry chafes, cracks and sores appear which are painful to animal. The hands should be perfectly dry while milking. When cracks and sores are noticed on teats, some antiseptic ointment or cream should be smeared over them after milking.

2. Machine Milking : Machine milking is more efficient method of milking compared to hand milking. Modern milking machines are capable of milking cows quickly and efficiently, without injuring the udder, if they are properly installed, maintained in excellent operating conditions, and used properly.

Advantages of milking machines

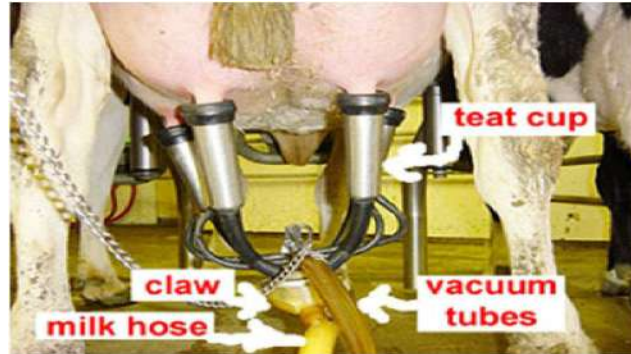
- Saving of labour expenses.
- Reduction of dependency on skilled farm workers.
- Enables rearing of larger herd strength.
- 3-4 times faster than hand milking.
- Increase in the milk yield.
- Increase in the quality of milk.
- Reduces stress throughout the lactation by creating good milking routines.

Limitations

- Some of the older cows which are accustomed to hand milking may not adjust to machine milking.
- Standby power supply is essential.
- High initial investment and training of staff.
- Negligence in following the strict cleaning procedures would lead to severe contamination and higher incidence of mastitis.
- Greater water requirement for cleaning of equipment.
- Prompt service and availability of spares is essential

Parts of the milking machine

- The machine includes teat cups that contact the cow's teats and remove the milk, a claw where milk pools as it is removed from the four teats, vacuum tubes that provide vacuum to the teat cups and a milk tube that removes milk away from the claw, a source of vacuum for the machine, and a pulsator that regulates the on-off cycle of the vacuum.
- Many milking machines today have an automatic take-off (ATO or detacher) device that removes the machine from the cow when milking is completed.



8.6. Milking machine on a cow indicating machine parts.

- 8.6 (A) one inside of the liner and (B) one between the metal shell and the outside of the liner. A vacuum is pulled in both chambers; the vacuum in chamber A is continuous, while the vacuum in chamber B alternates between atmospheric pressure and the vacuum.

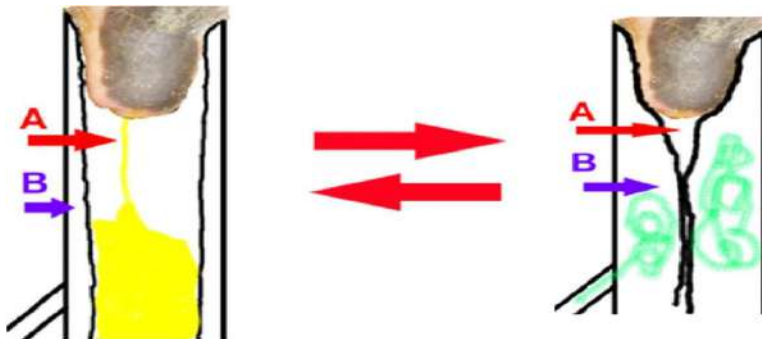


Fig. 8.7(a) Milk phase of the pulsation cycle. 8.7(b) Rest phase of the pulsation cycle.

- When the teat cup is applied to the teat, the end of the inside chamber is filled by the teat.
- During the milk phase the vacuum applied inside the liner is constant and keeps a constant negative pressure at the end of the teat, drawing milk (in yellow) from the gland.

- The vacuum applied to chamber B, between the shell and the thinner walled part of the liner, keeps the liner from collapsing under the vacuum. During the rest phase, the vacuum inside chamber B is momentarily off. Air (in green) enters chamber B instantly reaches atmospheric pressure, collapsing the rubber liner around the teat end, massaging the teat and maintaining blood flow.
- The lower part of chamber A maintains its vacuum (lower part of right diagram), while the upper part around the teat momentarily loses vacuum. This alternating vacuum-atmospheric pressure in chamber B is controlled by a pulsator.
- However, if the constant vacuum were left onto the teat end for an extended period, blood and lymph would accumulate in the end of the teat, causing trauma to the teat. This would be like attaching a vacuum hose to the end of your finger. A proper pulsation rate, that is the number of cycles of vacuum on - vacuum off (in Chamber B above), or milk phase – rest phase cycles, usually is about 45-60 per minute. The ratio of time that the machine is in milk phase vs rest phase should be between 50/50 to 60/40 (**pulsation ratio**). Pulsation is important for maintaining teat end health.

8.5 Sources of Milk Contamination - Steps in Clean Milk Production

Milk is contaminated by various sources like udder, exterior of cow's body, milking barn, flies, milker, utensils etc. On consumption of contaminated milk, one may get health problems. The sources for contamination are discussed below with their relative importance.

Udder: Un Sanitary conditions of milking barns and bedding of the animal causes bacterial growth. Such bacteria may enter in to the udder through teat canal, which causes infection in the udder like mastitis resulting contamination of milk. The fore milk may be discarded as it contains high bacterial count. Complete milking should be done. Incomplete milking may lead to infection of the udder.

Exterior of Cow's Body: Bacteria present on the animal body may enter in to the milk at the time of milking. Maintenance of clean skin, washing flank and udder with clean damp cloth before milking reduces the contamination from this source.

Milking Barns: Milking barns with good ventilation and neat flooring avoids contamination from these sources, dry feeds or forage should be fed after milking.

Flies and Other Vermin: External parasites like flies, lice, mosquitoes etc. may have their entry in to milk. So that care should be taken to avoid these parasites from the barn by spraying, fly proofs or by fly traps. Breeding places for these parasites like stagnant water, moist atmosphere etc may be avoided.

Milker: Milker is directly responsible in producing good quality milk. Dirty hands and clothing of the milker may be the source of contamination. Several bacterial diseases may transmit from the milker, or handler to the consumer through milk. Persons suffering from diseases like T.B, Typhoid fever, diphthiria may not be employed for milking. Dirty habits like smoking, drinking should be avoided.

Utensils: Utensils are the containers or equipments in which the milk is handled, processed, stored or transported. Clean sanitized, smooth copper free and dry utensils may be used for handling milk.

Milking Methods: Wet hand milking and fisting causes contamination of milk. Milkers generally moisten their fingers with milk, water or even saliva, while milking. This should be avoided. Wet hand milking makes the teats look harsh and dry chokes, cracks and sores appear which causes contamination. Twisting causes damages to the teat tissue which leads to udder infection. So that dry hand milking may be practiced to avoid contamination of milk. Major contamination of milk is caused by bacterial entry. So that steps are to be taken to monitor such bacterial entry like avoiding insanitary conditions of the barn, cleanliness of the milker, utensils and avoiding unfair milking practices.

Steps in Clean Milk Production: Clean milk production is important to control the milk born diseases due to contamination and adulteration of milk to the human beings. It is also important to increase the keeping quality of milk. Good quality milk improves the quality of milk products.

- The milch animals should be healthy and free from any chronic diseases.
- The animal should be washed before milking.
- Washing of cows before milking is the best practice to minimise the bacterial contamination.
- If calf is allowed for sucking, udder may be moist, cleaned with weak disinfectant solution later with fresh, clean water and wiped dry with a smooth and clean cloth.

- Hands of the milker should be clean and dry. Wet hand milking may result in high bacterial count in the milk.
- Nails of hands of the milker should be well trimmed.
- Milker should be free from all diseases and he should have good habits and neat dress
- Dusty feed like Rice polish should not be fed to the animal at the time of milking.
- Milking barns should be well ventilated free from flies and they should be kept clean before milking.
- Utensils used for milking should be clean, sanitized, smooth and copper free.
- Flavour producing feeds should be fed only after milking so that flavours will not appear in milk.
- The hind legs and the switch of the animal will be tightened with the help of a milk man's rope at the time of milking.
- Milk is kept in cool place to maintain the flavour and keeping quality.
- Milk should be covered with lids to avoid dust, dirt, entry hot, or cold, day light or strong artificial light, all at which tend to decrease milk quality.

8.6 Marketing of Milk: Milk is disposed from the milk producer to consumer through the following channels in different areas.

1. Direct sale to consumer: Milk producers sell the milk directly to consumer, hotels, hospitals, schools and hostels in peri-urban and urban areas. The producer gets more price for the milk in this system.

2. Sale of milk to the milk vendors: Milk vendors collect the milk from producers in the remote areas where cooperative/private dairy collection centers are not available and sell the milk to urban consumer. The producer may not get remunerative price and consumer may not get good quality milk in this system. Here the payment for milk is not prompt and assured in some places.

3. Sale of milk to the milk cooperative dairies: Milk producers supply the milk to the village level milk collection center. The price is fixed based on the basis of fat and SNF per cent of milk. The producers get remunerative price for milk apart from technical services and inputs for milk production. The payment for milk is prompt and assured.

4. Sale of milk to the private dairies: Milk producers supply the milk to the milk collection centers of private dairies. The price is fixed based on the basis of fat and SNF per cent of milk. The producers get remunerative price for milk. Some private dairies are also providing feed on cost basis for milk production. The payment for milk is also prompt and assured.

Short Answer Type Questions

1. What is Galactogenesis
2. What is Galactopoiesis
3. Name different hormones concerned with lactation.
4. Write the names of milking methods
5. What are the sources of milk contamination
6. What is the importance of clean milk production
7. Write the advantages of machine milking

Long Answer Type Questions

1. Explain the structure of udder with the help of sketch diagram.
2. Briefly write about the Machine milking
3. Briefly write about the steps in clean Milk Production
4. What are the?
5. Briefly write about the Marketing of Milk?

DAIRYING

Paper - II

NON-RUMINANT LIVESTOCK PRODUCTION & MANAGEMENT INDEX

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UNIT- 1

Poultry production

Structure:

- 1.1 Poultry statistics - Role of Poultry production in Indian Economy
 - 1.2 Common terms used in poultry production
 - 1.3 External body parts of Fowl
 - 1.4 Reproductive system of hen and cock.
 - 1.5 Formation of egg and structure of an egg
 - 1.6 Classification of poultry
 - 1.7 Important indigenous and exotic breeds of poultry like Aseel varieties, White leghorn, Rhode island red, Plymouth rock, Cornish and Newhampshire
 - 1.8 Deep litter and cage systems of poultry housing.
 - 1.9 Housing systems for Brooders, growers, layers and broilers.
 - 1.10 Selection and culling of poultry
 - 1.11 Breeder flock management - Systems of breeding in poultry
 - 1.12 Brooding and rearing practices used for chicken.
 - 1.13 Care and management of different classes of Layers
 - 1.14 Care and management of Broilers
 - 1.15 Summer management of poultry
 - 1.16 Transportation of day old chicks and adult birds.
 - 1.17 Poultry farm routine
 - 1.18 Cleaning and sanitation in poultry sheds
 - 1.19 Identification of poultry
 - 1.20 Debeaking and vaccination schedule
 - 1.21 Layout of hatchery and hatchery practices
 - 1.22 Incubators, setters in hatchery
 - 1.23 Selection, care and incubation of hatching eggs.
 - 1.24 Sexing, grading, packing and dispatch of chicks
 - 1.25 Disinfection and fumigation of hatchery equipment – biosecurity in hatchery
 - 1.26 New breeds/strains developed for backyard poultry.
 - 1.27 Backyard poultry management
 - 1.28 Management of ducks, quail, turkey and guinea fowl
-

1.1 Poultry statistics - Role of Poultry production in Indian Economy

Poultry means all the domesticated species of birds reared for egg, meat and feathers and include chicken, ducks, quails, geese, turkeys, guinea fowl, pheasants etc. The most important bird of the family is the domestic fowl or chicken (*Gallus gallus domesticus*).

Chicken is the most popular domesticated poultry, account for more than 90% of the total poultry production of the country. Ducks account for 7% of poultry population and are mostly found in coastal states of the country and in the states with more lakes and rivers like West Bengal, Odisha, Andhra Pradesh, Tamil Nadu, Kerala, Assam, Jammu & Kashmir and Tripura. Japanese quail meat and eggs have become popular. Turkey, Guinea Fowl and Goose farming are still in their primitive stage due to lack of customer awareness.

1.1.a Chicken production in India:

At present poultry is one of the fastest growing segments of the agricultural sector in India. While the production of agricultural crops has been rising at the rate of 1.5 to 2.0 per cent per annum that of eggs and broilers has been rising at the rate of 8 to 10 per cent per annum. As a result India is now the third largest egg producer in the world (after China and the United States of America), and the seventh largest chicken meat producer. Total poultry population (2012) in India is 729.21 million, which includes 692.65, 23.54 and 13.02 million chickens, duck and turkeys & other poultry, respectively.

1.1.b Chicken Meat Production

Total meat production including poultry meat was 5.9 million tonnes in 2012-13. Nearly 45% of the production of meat is contributed by Poultry alone. The availability of meat in India is only about 15g/person/day against the ICMR recommendation of 30g/person/day.

1.1.c Egg production

The total egg production in India during the year 2012-13 was 69.73 billion. About 94% of total egg produced in India is contributed by chickens while remaining 6% is equally contributed by ducks and other poultry. Andhra Pradesh produces maximum eggs in India followed by Tamil Nadu, West Bengal, Maharashtra and Haryana. West Bengal ranks first in terms of total duck egg production. Per capita availability of eggs in India was 58 eggs per annum in 2012-13 which is still far below the ICMR recommendation of 180 eggs/ annum.

The value of output from the poultry sector is nearly Rs 330 billion and there are a total of 300,000 poultry farms in India. Over 90 per cent of the poultry production comes from small poultry farmers, who are located in rural areas. There are about 123,000 poultry farmers in India. In recent years, poultry farming has gained much importance as a subsidiary occupation of the farmers. It could play an effective role in improving the socio-economic status of the rural people by increasing their income besides providing nutritious food through meat and egg. Poultry egg and meat, in recent years, have become important food for 68 per cent of the non-vegetarian population of the country.

Poultry has also helped in developing many ancillary industries such as hatchery operation, poultry equipment and processing of poultry products. Egg is used for preparation of a variety of products such as medicines, paints, varnishes, soaps and shampoos. India exports a variety of poultry products like eggs, hatching eggs, egg powder, frozen egg yolk, frozen poultry and poultry meat to Europe, Japan, Maldives, Oman and other countries.

1.1.d Potential for employment generation

Poultry farming has tremendous potential for expansion and employment generation. Youth in general and educated unemployed youth in particular can take up this profession easily. The inputs required for poultry farming are available locally in rural areas. Simple equipment for feeding, watering and sheltering for small units can be manufactured from materials locally available in the villages with the help of local artisans. Land required for starting poultry units is small. Qualified veterinary doctors and even some businessmen have entered the field. Women are also engaged in decision-making related to poultry production.

Poultry farming provides employment to those who are engaged in the production of eggs and chicken meat, hatchery operators, feed dealers, building materials, egg cases and trucks, processors of egg and poultry products and all dealers engaged in the marketing of eggs and poultry meat from the time they leave producers' premises until they are in the hands of the consumers.

Poultry production may be taken up as a full-time or part-time activity in specialized farms. A sizeable income may be realized even if the individual producer is engaged in some other occupation. Poultry farming can be taken as a part-time occupation especially by women, landless, small and marginal farmers. Traditional and commercial poultry is nowadays more popular among rural women. They can earn a handsome income within a short period of time by selling birds and eggs. A matured bird can fetch a profit of Rs 10-15.

According to the ICAR Vision- 2025, an increase in per capita availability of one egg will generate 50,000 more jobs. Similar increase in employment generation is anticipated due to acceleration in broiler production, marketing of eggs and meat, processing, etc. So increase in poultry production activities will help to generate more employment. It will also help to solve gender issues in employment since the poultry operations can be handled with ease both by men and women. With the globalization of world trade, there are greater challenges today for making the Indian poultry farming globally competitive and viable. With the changing food habits and preferences, there is a great need to promote export-oriented poultry egg and meat-based processing units in the country. Global market surveys have identified India as a promising consumer market in the world. It is both a challenge and an opportunity for all those concerned with all-round development of this sector.

1.2 Common terms used in poultry production

All-in All-out: a flock of birds enters and exits a facility as a single group. New birds are not introduced and flocks are not mixed. This strategy minimizes the risk of new birds introducing disease agents into a flock.

Ante mortem inspection: inspection of birds just before slaughter.

Biosecurity: procedures such as sanitation and isolation used to prevent disease exposure to birds or premises.

Broiler breeder: breeders that produce hatching eggs for commercial broiler production.

Broody: A hen which has stopped laying eggs temporarily.

Brood: A group of chicks of same age raised in one batch is called as a brood.

Brooder: A device for providing artificial heat to the chicks.

Broiler: They are the hybrid chicks having rapid growth and attaining about 1.5 kg weight during the period of 6 weeks of age. Sold for table purpose within 8 to 10 weeks period. They possess a very tender and delicious meat.

Capon: It is a young male birds of which testicle are removed.

Chick: A young male or female fowl below 8 weeks of age.

Chicken: the domestic fowl, *Gallus domesticus*, used for meat, eggs, feathers and showing. There are several hundred recognized breeds of various sizes, only a few of which are important for meat and eggs.

Clutch: The number of eggs laid by a bird on consecutive days. A clutch of 3-4 eggs is preferred.

Cock: A matured male chicken above 20 weeks of age.

Cockerel: A young male chicken from 5-8 months of age.

Culling: Removal of unwanted bird from the flock is known as culling e.g. old non-laying birds, sick birds and masculine hens are removed.

Day-old chick: Hatched out chick is called as day-old-chick up to 24 hours.

Designer eggs: eggs produced to contain higher levels of certain constituents, such as omega-3 fatty acids.

Drake: a male duck.

Duck: small to moderate sized fowl (waterfowl) with web feet of the Anatidae family that are used for meat, eggs and feathers.

Duckling: young duck.

Emu: a large flightless bird (*Dromiceius novae-hollandiae*) of Australian origin similar to the ostrich, but smaller, that is used some for meat production.

Flock: a group of birds that feed or move together. In domestication they will normally be of the same type and age, housed together, and managed the same.

Fowl: domestic birds used for food and other economic purposes, including chickens, turkeys, ducks, geese, guinea, quails, pheasants, pigeons, etc.

Grower: A young chick of 9th week of 20th week of age of either sex.

Hen: A matured female chicken generally above 20 weeks of age.

Hen-day-production: This is arrived by dividing total eggs laid in the season by the average number of birds in the house.

Hen-housed-average: This is arrived at by dividing the total number of eggs laid in the season by the number of birds originally placed in the house. No deductions are made for any losses from the flocks.

Layer: An egg laying female chicken up to one year after starting the laying of eggs.

Litter: materials used on the floor of poultry houses. Common litter materials are wood shavings, sawdust, rice hulls, peanut hulls, chopped straw and shredded paper.

Moulting: The process of shedding old feathers and growth of new feather in their place moulting normally occurs once in a year.

Offal: the waste material from poultry processing, excluding feathers, that is useful as a feed ingredient when cooked and prepared as a meal.

Ostrich: the largest living bird (*Struthio camelus*), flightless, native of Africa and Near East, that is used commercially for meat and feathers. Feet have only 2 toes.

Pause: It is the period between two clutches in which eggs are not laid by hen.

Post-mortem inspection: inspection performed on the carcass of the bird after slaughter.

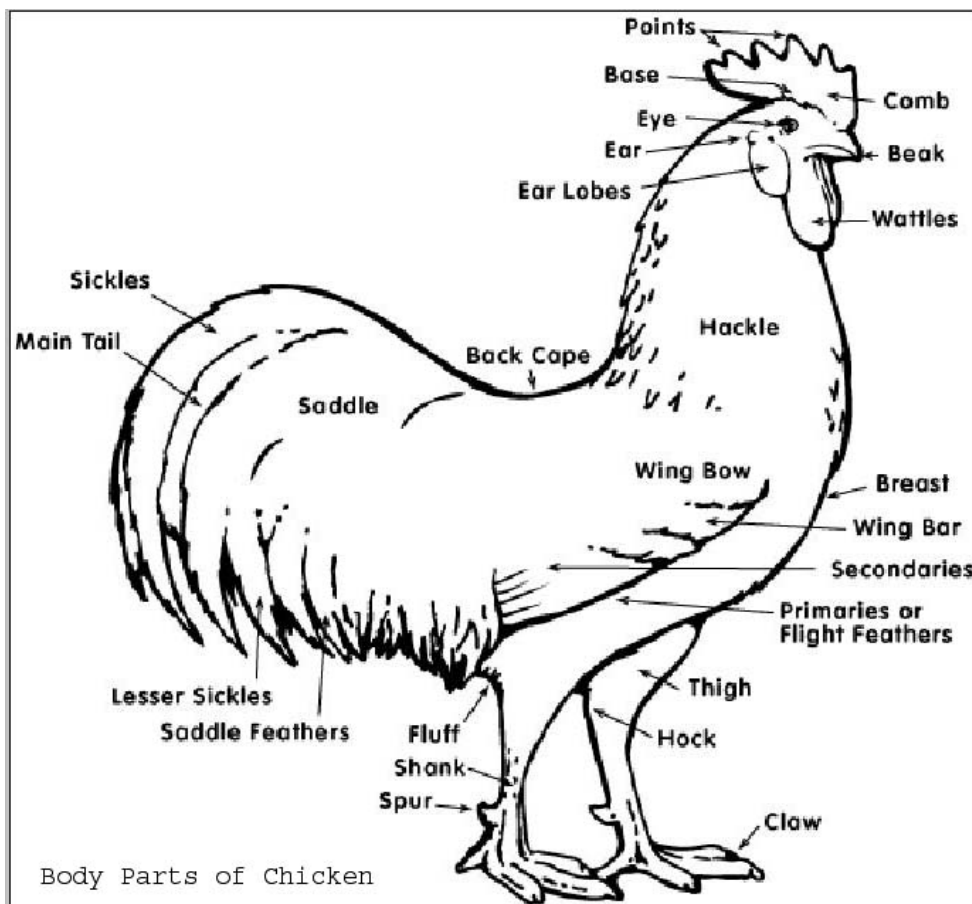
Poultry: domestic fowl such as chickens, turkeys, guineas, geese and ducks that are raised for meat, eggs, feathers, or other products.

Pullet: A young female chicken from 9 to 20 weeks of age.

Vent sexing: a procedure for determining the sex of newly hatched poultry by examination of the cloacal anatomy.

1.3 External body parts of Fowl

The external body parts of Fowl can be studied for while handling bird culling, judging or to detect external parasites.



Comb – The comb is a red fleshy appendage on the top of the chicken's head.

Eyes -Chicken have two eyes, one on each side of their head and the eyes should be dark and prominent.

Ear Lobes – Chicken have two ear lobes, one on each side of their head.

Beak – Chicken have an upper and lower beak. The beak is usually a yellowy colour.

Wattles – Chicken have two wattles which hang below the beak. Wattles are fleshy skin and are generally red in colour.

Breast – The breast is at the front of the bird and should be broad and plump.

Wings – Chicken have a set of wing feathers on either side of the body which allow them to fly.

Tail Feathers – The tail feathers are the same colour as the other feathers and point upwards.

Vent – The vent is the external opening referred to as the anus or cloaca. This is the opening which allows the birds to excrete and for the females to lay their eggs.

Hock – The hock is the leg joint which bends in the opposite direction to a human knee.

Shank – The shank is the bird's lower leg. Chicken have two legs which have a scale like appearance.

Toes – Chicken have four toes on each foot. Three of their toes point forward and one faces back for balance.

1.4 Reproductive system of hen and cock.

1.4. a. Male Reproductive system:

The male reproductive system produces male reproductive cells (spermatozoa), meant for introducing them into oviduct of the female for fertilization of the egg and secondly for producing a hormone which influences sex characters.

The male reproductive system consists of **testes, vas deferens, and papillae or rudimentary copulatory organs.**

Testes:

The testes are two small ovoid organs situated at the anterior end of the kidneys in the dorsal body wall. The left testes is usually larger than the right one. Each testes consists of

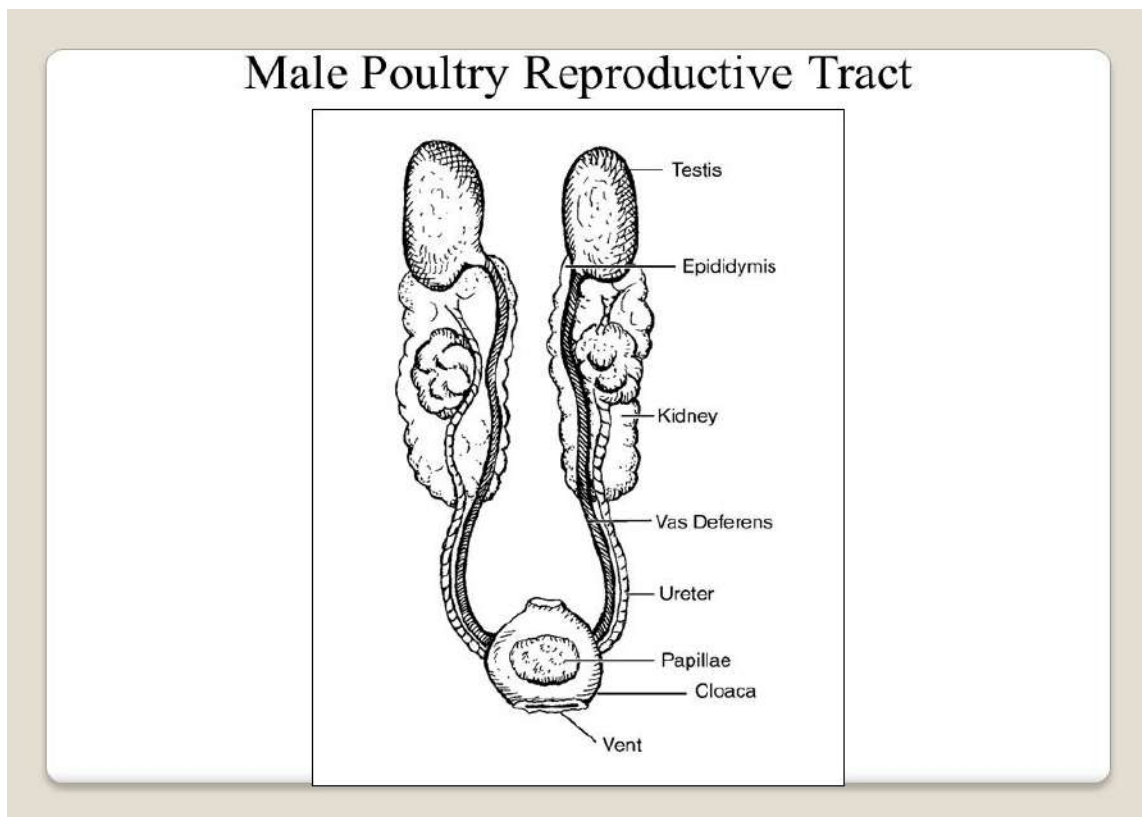
large number of seminiferous tubules, from the linings of which the reproductive cells are given off.

Vas deferens:

These are two tubes passing from testes to cloaca. They convey the spermatozoa and seminal fluid from the testes to the cloaca.

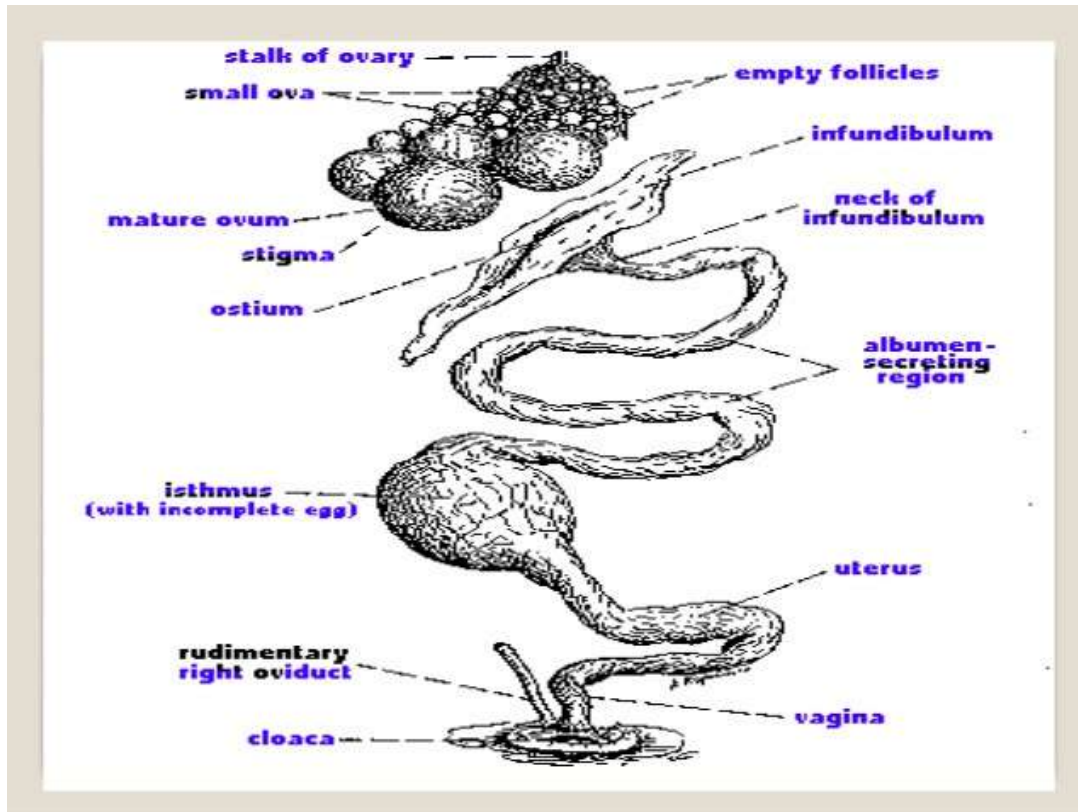
Papillae:

The rudimentary copulatory organ of the male is located in the median ventral portion of one of the transverse fold of the cloaca. At the time of mating sperms are introduced by the papillae into the oviduct in the cloacal wall of the female.



Cloaca:

The enlarged section of elementary canal that connects the large intestine and the vent is called cloaca. The vent is the external opening of the cloaca. Sperms from the testes, faecal material from the large intestine and the urine from the kidneys all pass through the cloaca and are eliminated through the vent.

1.4. b. Female Reproductive system:

The female reproductive system includes right and left ovaries and oviducts. In adults only left ovary and its oviduct are functional. The right ovary and oviduct are present in rudiments. The left ovary is attached to the body wall through meso-ovarian ligament.

The oviduct extends from the ovary to the cloaca. It has 5 distinct parts namely infundibulum, magnum, isthmus, uterus and vagina. Infundibulum is the funnel shaped, anterior portion of the oviduct. It receives the yolk from the ovary. The magnum, largest portion of the oviduct, which secretes the thick albumen or white. The isthmus, which secretes the shell membranes. The uterus, which secretes the thin white, the shell and the

shell pigments. The vagina is the terminal portion of the oviduct which holds the egg until it is laid.

1.5 Formation of egg and structure of an egg:

The knowledge of the formation and structure of the egg is essential for an understanding of fertility, embryo development, egg quality, any disease of the female reproductive organs.

1.5.a Formation of egg

The ovarian tissue appears as a cluster of tiny ova or yolk. Food materials are carried to the developing ovum by the blood circulation in the follicle. When the ovary starts to function a few of the ova starts to increase in size. The ovum is enclosed in a thin membrane, the vitelline membrane. The yolk and its vitelline membrane are in turn enclosed in a highly vascular coat of connective tissue, the follicle. As the ovum or yolk increase in size it is suspended in its follicle and held to the ovary by a slender stalk, the follicle stalk. Each yolk grows very slowly for about 10 days before it is ready to leave the ovary. The size of the yolk influences the size of the finished egg.

When yolk has reached maturity, the follicle ruptures along a definite line, the stigma, where there are normally no blood vessels. The ovum is discharged into the body cavity and is engulfed by the infundibulum of the oviduct.

Fertilization usually takes place after ovulation in infundibulum of the oviduct, provided that the hen has been mated and the sperm cells have time to move to the infundibulum of the oviduct. It is possible to fertilize the eggs within 24 hours after mating.

The fertilized ovum starts cell division and embryo development soon after fertilization. The germ spot of blastoderm increases in size and there is change in consistency of yolk and white. Unless the fertile egg is held below 82°F after it is laid, there will be further germ development. It is therefore desirable to produce infertile eggs at all times except when there are needed for hatching.

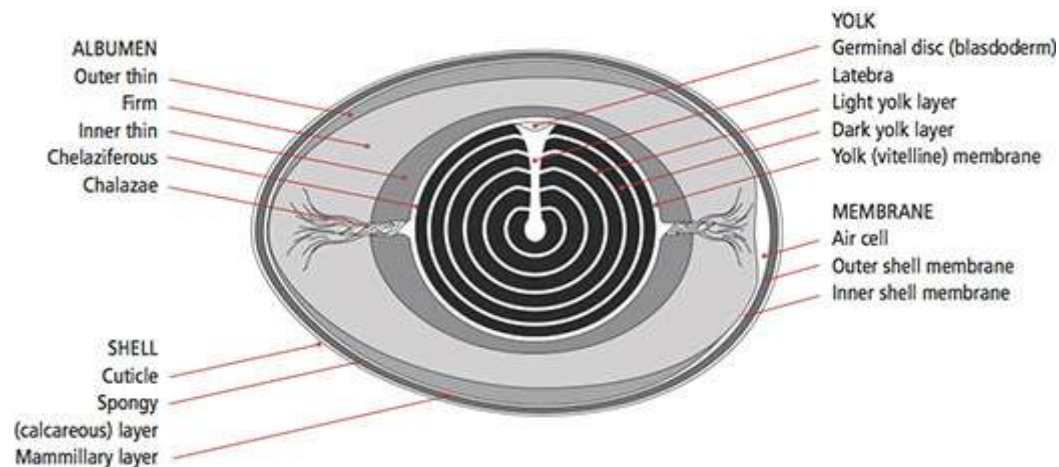
After grasping of the ovum by infundibulum of the oviduct, it is forced by ciliary action or by peristaltic movements of the walls of the oviduct to the magnum region. The

inner surface of the magnum secretes albumen. At this region the yolk acquires the mass of firm white albumen, which makes up about one – half of the total white by volume.

The yolk, surrounded with its thick white, passes from the magnum through a short part of the oviduct known as the isthmus. Here the two shell membranes are added and the shape of the egg is determined.

The developing egg passes from isthmus into the uterus, where it remains for about 24 hours. In addition to formation of inner and outer layers of thin white, the uterine glands also secrete material for shell, consisting largely of calcium carbonate.

Structure of an egg:



The chicken is usually ovoid in shape, broad at one end and tapering at other. It has hard calcarious covering called shell on which about 7000-17000 shell pores are situated. The shell is covered from outside by a very thin layer called cuticle. From inside shell is attached with two thin shell membranes adhering to each other except at broader end where they are separated from each other to form each other. Immediately after shell membranes a layer of outer loose albumen is situated followed by outer thick albumen. It is followed by inner thin and finally inner thick albumen layer is located. In the center of egg a round yolk is placed. It is hold in position by chalazae or inner thick albumen layer.

1.6 Classification of poultry

Poultry may be classified on the basis of utility, economic value or fancy purpose and these include meat type (broilers), egg type (layers), dual-purpose (layer-cum broilers), Ornamental (fancy), Bantam and game types. They are further classified as Class, Breed, Variety and Strain.

Class

The term 'Class' is used to designate groups of breeds which have developed in certain regions or geographical areas ; thus the class name –Asiatic, Mediterranean, English, American etc.

Breed: The term 'Breed' denotes an established group of birds having the same body shape, weight and some common characteristics.

Variety : The term 'Varieties' represent a sub-division of a breed, distinguished either by colour pattern, shape, comb type or feather pattern. For example in Leghorns, some of the varieties are Single Comb White Leghorn, Rose Comb Leghorn, Rose Comb brown Leghorn etc.

Strain : The term 'Strain' is used to denote a given breeder who has done the breeding on the bird and has introduced certain economic characters in the bird.

Class	Common breeds
American	Plymouth Rock, Rhode Island Red, New Hampshire Wyandotte Jersey Black Giant
English	Australorp Sussex Cornish Orpington Dorking

Mediterranean	Leghorn Minorca Ancona Andalucian
Asiatic	Brahma Cochin Langshan

1.7 Important indigenous and exotic breeds of poultry

Aseel:



It is popularly known as ‘Indian fighter’ or ‘game bird’. It has strong build up of body. The comb is small and pea shaped. Neck is long and thick, face long, bones are heavy and body is hard with closed feathered and bread is broad. The different varieties vary in colours from black, white, black and white with spotting, black and red, brown to golden red. They produce well flavoured ample flesh but these are poor layers.

White Leghorn:



The birds of this breed are small, compact, carry tail rather low and small heads with well set combs and wattles. They have long back, with prominent breast with relative long shanks. All the varieties of Leghorns have yellow shanks, toes, beak and skin. This White Leghorn variety well suited for commercial egg production with excellent feed efficiency. Standard weights of White Leghorn birds are: cock 2.7 kg, hen 2.0 kg, cockrel 2.3 kg, and pullet 1.8 kg in India.

Rhode Island Red:



It is a dual purpose breed possessing a fleshing as well as egg laying abilities. The body is long, broad and deep with well forwarded breast and flat back. The plumage colour of male should be rich dark red with black tips of tail. The female have deep red colour throughout the body except tip of tail. The bird of this breed have single or rose comb. This breed is sturdy and withstands in tropical climate. The standard weights of these birds is: cock 3.8 kg, hen 2.9 kg, cockrel 3.4 kg and pullet 2.5 kg.

Plymouth Rock:



Barred and white Plymouth Rocks are popular. Barred Plymouth Rocks possesses grayish –white plumage. The feathers are crossed by black bars, even in width, straight and extend down to the skin. Each feather ends in a narrow dark tip. White Plymouth Rock with long body of good depth and a broad and prominent breast is especially favoured for broiler production.

Standard weight (kg) : Cock, 4.3; hen, 3.4; cockrel , 3.6; pullet, 2.7;

New Hampshire:



The body is broad, deep and rounded and less rectangular than Rhode Island Red birds. The plumage colour is chestnut in colour. The combs are single type. The standard weights of birds of this breed are: cock 3.7 kg, hen 3.0 kg, cockrel 3.4 kg and pullet 2.5kg.

Cornish:



It is having close and compact feathering and well fleshed body that has a distinctive shape. The breast is very deep and broad giving the shoulders great width. Cornish birds have pea comb and yellow skin. Standard weights for dark and white varieties are : cock 4.5 kg, hen 3.4 kg, cockrel 3.6 kg and pullet 2.7 kg.

1.8 Deep litter and cage systems of poultry housing.

1.8.a. Deep Litter System:

In this system the birds are kept inside the house all the time. The birds are kept on suitable litter material of about 3 to 5 inches depth. Generally paddy husk, saw dust, ground nut hulls, chopped paddy straw or wood shavings are used as litter materials. This arrangement saves labour involved in frequent cleaning of faecal matter. But it needs frequent stirring.

A concrete floor is advised for proper disinfection at the end of each batch. Initial about 3-5 inches of litter is put into the house and after bacterial decomposition of litter and excreta into crumble form, more quantity is added till a depth of about 8-12 inches is reached. Before adding fresh litter material the wet litter material is to be removed. The litter should be thoroughly be raked to break the clumps and allow it to dry. In winter the litter depth can be increased to 10-12 inches while in summer it may be reduced to 2.5 to 4 inches.

Qualities of good litter material:

1. It should absorb moisture from droppings quickly.
2. It should release moisture and dries up rapidly.
3. It should have least tendency to form cakes.
4. It should be free from growth of moulds.
5. It should be free from sharp objects.
6. It should possess good insulating properties.
7. It should be non-toxic, inert and compressible.
8. It should be cheap and locally available material.
9. It should be biodegradable
10. It should have medium particle size, soft and light in weight.

The quality of litter material is tested by picking a hand full of litter material and press it tightly. A good litter material is the one which breaks up when hand is open and the litter material with more moisture will form a ball in the hand. Too much dried litter material causes dustiness in the farm.

1.8.b. Cage system:

This system involves rearing of poultry on raised wire netting floor in small compartments, called cages. This system is very efficient for laying operations, right from day old to till disposal. At present 95% of commercial layers in India are kept in cages. Feeders and waterers are attached to cages from outside except nipple waterers, for which pipeline is installed through or above cages. Auto –operated feeding trolleys and egg collection belts can also be used in this rearing system. The droppings are either collected in trays underneath cages or on belts or on the floor or deep pit under the cages, depending on type of cages.

Advantages	Disadvantages
Minimum floor space is required	High initial investment cost
More number of eggs per hen can be received	
Less feed wastage	Handling of manure may be problem
Better feed efficiency	
Protection from internal parasites and soil borne illness	Commonly, flies become a greater nuisance
Sick and unproductive birds can easily identified and eliminated	The incidence of blood spots in egg is more
Clean egg production	There may be problem of cage layer fatigue, in which laying birds in cages develop lameness.
Vices like egg eating and pecking is minimal	
Broodiness is minimal	
No need of litter material	
Artificial Insemination can be adopted	In case of broilers, incidence of breast blisters is more; especially the weight of broilers is more than 1.5 kg.

1.8.c. Types of cages:

Based on the number of birds in a cage, it is classified as –

- a) Single or individual bird cage (only one bird in a cage)
- b) Multiple bird cage (From 2 – 10 birds , usually 3-4 birds per cage)
- c) Colony cage (Holding birds more than 10 per kg)

Based on the number of rows

- a) Single Deck
- b) Double – Deck
- c) Triple – Deck
- d) Four – Deck
- e) Flat – Deck

Based on arrangement of cages:

- a) Brooder/Chick cages
- b) Grower cages
- c) Layer cages
- d) Breeder cages

Brooder cage/Chick cage:

Chick cages are arranged either as single deck or double deck system. The feeders and waterers are arranged on outside. Nowadays nipple drinking system is followed from day – old itself. News paper may be spread over the cage floor for first 7 – 10 days. Feed is usually provided inside the cage during the first week of age.

Specifications: Front feeding length : 60 inch; Front and back height: 12 inch; Depth: 36 inch;

No. of chicks: (0-8 weeks) accommodated per box: 60

Grower cage:

Specifications: Front feeding length: 30 inch

Front and back height: 15 inch

Depth: 18 inch

No. of growers (9-18 weeks) accommodated per box – 10

Layer cage: Two types of stair step layer cages are commonly used in open sided poultry houses.

Specifications for each box: Front feeding length: 15 inch

Front height: 18 inch

Back height: 15 inch

Depth: 18 inch

Reverse cages:

Specifications for each box: Front feeding length: 18 inch

Front height: 18 inch

Back height: 15 inch

Depth: 15 inch

These cages can hold 3-4 birds. They are arranged either in 2- tier or 3 – tier. A slope of 1/6 is provided in conventional cages, where as in reverse cages slope is 1/5.

1.9 Housing systems for Breeders, growers, layers and broilers.

Poultry can be housed in different systems based on following factors.

1. Availability of land
2. Land cost
3. Type of farm activity
4. Climatic condition
5. Labour availability

Classification of Poultry housing systems:

Poultry housing systems are broadly classified in to three systems.

1. Free range or extensive system
2. Semi-intensive system
3. Intensive system
 - i) Deep litter system
 - ii) Slatted floor system
 - iii) Slat cum litter system
 - iv) Cage system

Free range system:

This system is adopted only when adequate land is available. In this system birds are left loose on fields to harvest their feed on their own farm range. We can rear 250 adult birds per hectare. The range should provide shelter, greens, water, feed, shed and safety. The fields are used on rotational basis after harvesting of crops by moving of birds from one field to another. All categories of birds can be reared in this system. This system is most preferred for organic egg production.

Semi- intensive system:

In this birds are confined to houses in night and they are also given access to runs. The houses are solid floors while runs are fields only. The success of rearing depends up on maintenance of condition of runs to reduce the contamination. The runs can also be used on turn basis. The stocking density on an average for adult birds is 750 per hectare. The system is usually adopted for duck rearing. The feeding and watering facilities are provided in the pen.

Intensive system:

In this system birds are confined to floor or on wire netting in cages or on slats. It is most efficient, convenient and economical system for modern poultry production with large numbers.

Deep litter system:

Rearing of birds on floor spread with litter material like paddy husk, saw dust, ground nut hulls or sugar cane bagasse. It is mostly adapted to rear broilers and breeders. Built up litter supplies animal protein factor (APF) and Vitamin B₁₂ and also fulfills natural thrust of birds to have litter bath. It avoids cage fatigue problems. But the floor space requirement per bird is 2 to 3 times more than cage system of rearing. The eggs are dirty, soiled and breakage is higher when compared with cage rearing.

Slatted (slotted) floor system:

In this system iron rods or wood reapers are used as floor. Usually 2-3 feet above the ground level to facilitate fall of dropping through slats. Wooden reapers or iron rods of 2 inch diameter can be used on length wise of the house with inter-space of 1 inch between rods.

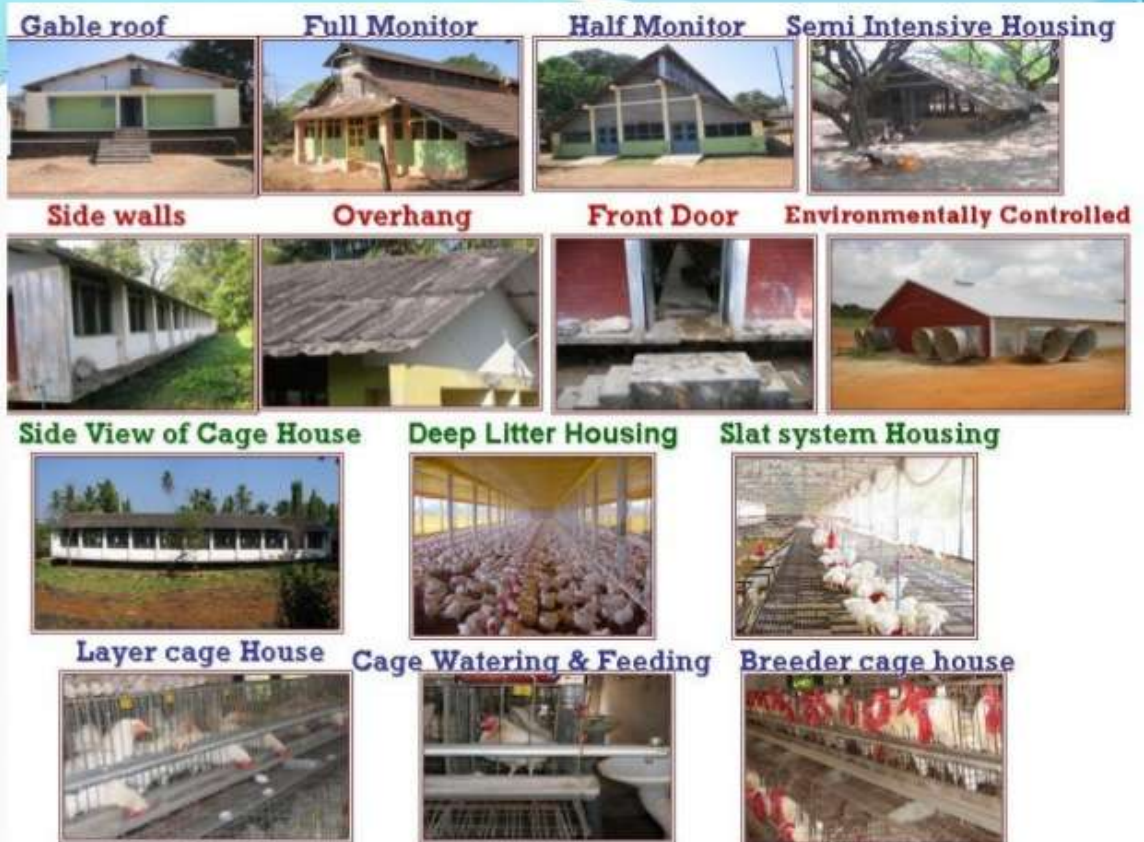
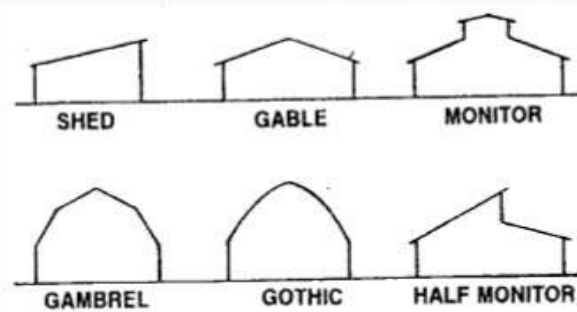
Slat (Slot) cum litter system:

This system is commonly practiced for rearing birds for hatching egg production, particularly meat type breeders. In this a part of floor area is covered with slats. Usually 60% of floor area is covered with slats and rest with litter. Feeders and waterers are arranged in both slat and litter area. In case of breeder flock, nest boxes are usually kept on litter area.

Cage system:

Rearing the birds on wire floor in wire netting compartments is called cage system of rearing. It is mostly used for commercial egg production. Eggs obtained are clean and breakage is reduced. The day – to – day managerial operations like feeding, watering, egg collection etc., are easy. The important advantage is the saving of floor space per bird.

Types of roof



1.10 Selection and culling of poultry

Selection:

Selection is carried out on the basis of general appearance, grace and body characters of birds for specific breeds and varieties of poultry. Physical examination by careful observation, handling and assessment of bird is correct way of judging of poultry. It is carried out by score card method by allotting points as follows.

Score Card

Particulars	Points
1. Condition and vigour	25
2. Shape	25
3. Size	25
4. Colour, good width, uniform body depth and good capacity of abdomen with soft, pliable skin	25
TOTAL:	100

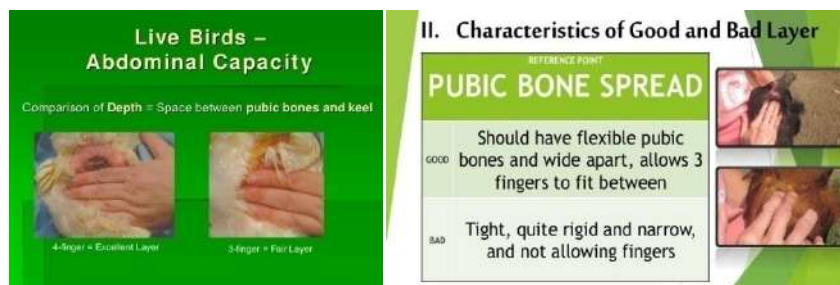
Culling:

Culling is an important management tool to be practiced in case of layers and breeder females. It is continuous operation once laying starts because all the layers/breeders, in spite of good start may not be persistent in laying for complete laying period. Therefore usually monthly culling is followed to improve economy by removing unproductive birds.

The following characters are considered for separation of good and poor layers are given in the table below.

Character /body part	Good layer	Bad/poor layer
Health	Healthy, vigorous, well fleshed but moderate fatty	Appearance sick, sluggish, thin or debilitated or

		extremely fatty
Feathering	Tight and close feathering, tail and wings well carried up	Loose and scattered feathering, tail and wings are droopy.
Plumage	Initially bright and dark coloured but faint and dull in later stage	Always bright and dark coloured
Comb and Wattles	Large, glossy, red and warm	Small, dry, scaly, pale and cold
Eyes and expression	Bright and alert	Sunken and dull
Abdomen	Well developed, soft and pliable	Contracted, hard, tight and fatty
Pubic bones	Soft, flexible, well spread, distance between two pubic bones 2 to 3 fingers	Hard, brittle, tightly placed, distance between two pubic bones less than 2 fingers
Keel bone and distance	Soft, flexible, distance between keel and pubic bones is more than 4 to 5 fingers	Hard, brittle, distance between keel and pubic bones is less than 3 to 4 fingers
Skin	Soft, thin, loose, silky	Rough, thick, tight and under laid with fat
Vent	Large, oval, dilated and moist	Small, round, contracted and dry



1.11 Breeder flock management - Systems of breeding in poultry

Management of breeding birds is aimed to produce more number of fertile eggs and healthy chicks per hen.

Types of Breeder Flocks: There are two types of breeding stock.

Egg type: Layer breeder parents to produce female chicks for table egg production.

Meat type: Broiler breeder to produce straight run broiler chicks.

Housing for breeders:

The type of housing that can be used for the breeders are as follows:

The deep litter system of rearing birds, the deep litter cum slatted floor and breeding cages.

If the birds are kept in cages, artificial insemination has to be practiced. The floor space requirement of breeders is furnished below.

Type of bird	Deep litter (cm ² /bird)	Slat cum deep litter (cm ² /bird)	Cage (cm ² /bird)
Layer dams	1950	1350	450-540
Broiler dams	2700	2250	675-900
Layer sires	2250	1800	540-900
Broiler sires	3600	3150	900-1125

Nest boxes:

One box can be used for five birds. The various types of nest boxes are-

1. Mud pots with a head diameter of 16 to 18" with holes provided for ventilation; with nesting materials added.
2. Two tier nest boxes.

3. Automatic nest boxes are also used for which the cost is high but the disturbance is minimum.

Hatchery Procedures for Breeder Chicks

Production of breeder chicks is different from producing commercial broiler or layer chicks.

1. High level of bio security and sanitation is to be maintained in hatchery since the value of breeder birds is high
2. Number of each sex to deliver: The ratio of males to females in case of egg type breeder chicks is 1:10 to 12 and in case of meat type breeder chicks is 1:12 to 15.
3. Toe trimming: To prevent the injury to the backs of the females during mating, toes are trimmed.
4. Dubbing/ Comb trimming: To prevent comb injuries and to help identify sexing errors in the female line, the combs of male chicks are usually trimmed at the hatchery.

Management of breeder growers (0 to 20 weeks)

1. Rearing Sexes separately: Males should be separated from females at least the first several weeks of the growing period. Separation reduces the stress and allows the males and females to attain the target weight.
2. Restricted feeding: Breeder parents especially broiler breeder parents have inherent ability to grow rapidly. When full fed during the growing period they gain excessive weight and mature earlier. This will lead to little persistency of peak production and decrease the number of hatching eggs.

Advantage of feed restriction

1. Uniformity in the flock
2. Produces better egg size
3. Reduces body weight at sexual maturity
4. Offers better livability during egg production
5. Avoid problems of fertility and hatchability
6. Leg disorders due to over feeding can be controlled.
7. Mortality due to over feeding will be prevented.
8. Avoid mating difficulties due to their large body size in males.

3. Egg type breeders are not selected for growth and therefore do not experience excessive weight gains as meat type breeders do. Most of the primary breeders advised a full feeding program during the growing period.
4. Grading and Uniformity: For optimum egg production, controlled growth on an optimum growth curve for particular strain and uniformity of the flock are essential. Poor distribution, inadequate feeding time, too large flock size and too little feed and water equipment are attributed to loss of uniformity of body weight in breeder pullets.
5. Water restriction: Birds under restricted feeding consume excessive quantities of water to satisfy physical hunger. This will lead to distended crop, sudden death syndrome and wet litter problems. It is advisable to provide water to the birds 30 min to 1hr prior to feed delivery and an additional hour of water supply can be given in the afternoon.
6. Lighting Management: Never increase the day length while birds are immature. Once the pullets are matured, extra light is given. In environmentally controlled houses the day length can quickly be reduced to 8-10 hours after first week of age.
7. De-beaking/ Beak trimming: To prevent cannibalism among the breeders, pullets must be trimmed at 7-10 days of age and then re-trimmed at 8-10 weeks of age. Water soluble vitamin K is added in.
8. General Feeding: Breeding birds should be given breeder mash or layer mash supplemented with manganese sulphate, choline chloride, selenium, vitamin E as per standards. Males are fed separately leading to higher volume of semen production and better quality.
9. Body weight control: This is very important for meat type of birds. The body weight should be as per the chart provided by grandparent breeder. Males should be culled regularly.

Management during breeder Layers (above 20 weeks)

1. **Male: female Ratio:** When parents are reared in deep litter system of rearing and adopting natural mating system, the males are reared along with females for mating at the ratio of 1:10 for broiler breeders and in case of layer breeders, the sex ratio is 1:12. When more males are allowed than the recommended numbers, the fertility will be reduced due to the phenomenon called physiological castration.
2. **Feeding Separately sexes:** Separate sex feeding techniques is means of controlling male body weight during the period from 20th week to depletion. This can be achieved by installing a separate male feeding system and protective grill.

3. **Lighting Management:** At 20 weeks of age all flocks should receive a minimum of 14 hours total light. An additional one hour should be provided at 24 weeks of age. Breeding stock should never be subjected to a decreasing day length from 20 weeks onwards.
4. **Pullorum Testing Programme:** All the breeder parents are to be checked for pullorum on 18th week of age. If positive reactors are found repeat pullorum testing at 23rd week.
5. **Spiking:** As roosters get older, their sexual activity declines due to overweight. It can be overcome by spiking, which means new roosters are introduced into an established older breeder flock.
6. **Vaccination:** Successful hatching egg production depends upon adequate protection against diseases. Hence vaccination schedule may be developed against the diseases prevalent in particular region of rearing.
7. **Artificial Insemination:** Adoption of AI or natural mating in breeder farm is dependent on labor costs, breed and environmental conditions. In A.I., semen is collected from breeding males twice in a week and insemination is done once in a week.

1.12 Brooding and rearing practices used for chicken.

Systems of Brooding:

There are two general systems of brooding : 1. **Natural Brooding.** 2. **Artificial Brooding.**

Natural Brooding:

The natural method is used on farms where only few chickens are raised each year. Deshi hens as a class are ideal mothers as they possess a strongly developed maternal instinct, moreover, because of their small structure they seldom injure the young chicks by trampling on them. Depending upon her size, a hen will brood 15-20 chickens. The broody hen will provide all the warmth required by the chicks. Before placing the chicks with the hen she should be examined for her good health and free from lice, etc.

Rearing coop A rearing coop is made up of packing box material which is about 2 feet square, slopping down from front to back, say about 2 feet height in front and 18 inches at the back. The essential requirements of such a coop are dryness, durability, ventilation, cheapness, roominess and safety. Wire enclosed runways are a desirable attachment for brooding coops.

Food for chicks and mother: For the first week, it is advisable to give small quantities of feed frequently (every two hours) this should consist of a chick mash, mixed with water or milk.

The hen must be given a suitable wet or dry balanced growers mash. Care must be taken that the chicks do not get access to hen feed.

Other managerial practices: The cage should be cleaned and sprayed regularly to hold mites and similar pests under control. Wire netting of suitable mesh should cover the top of the run and the floor of the coop to prevent damage from rats, cats, owls and other predator animals.

Movement of coop and run: Frequent moving of the coop along with its run to a fresh site will prevent out-break of disease and parasitic infestation. It is also desirable to let the chicks and broody hen in the sun for a short time once or twice a day.

Artificial Brooding:

Artificial Brooding is the handling of newly born chicks without the aid of hen. It is accomplished by means of a temperature controlled brooder. Artificial Brooding has several advantages over the natural method.

1. Chicks may be reared at any time of the seasons.
2. Thousands of chicks may be brooded by a single person.
3. Sanitary condition may be controlled.
4. Temperature may be regulated.
5. Feeding may be undertaken according to plan.

There are many types, styles and sizes of brooder units on the market that employ a variety of fuels. Basket brooders and brooders from packing cases are very popular where small no. of chicks raised. For large no. of chicks battery brooders of multiple tiers having adjustable feeding and water trough with thermostatically heat regulating mechanism are very common now a days.



Floor space, Temperature and Water space for chicks in Artificial Brooder

Age	Floor space	Brooder temperature	Water space
1 st wk	100 – 200sq.cms	95°F	Start on shallow pans to avoid crowding, use 4 waterers per
	Per chick		Brooder.
2-4wk	250-300 sq.cms	90°F...2 nd wk	Provide 4-6 waterers of 3litres
	Per chick	85°F...3 rd wk 80°F...4 th wk	capacity per brooder. Fill waterer twice daily.
5-8wk	700-800sq.cms	80°F	Use water trough with adjustable stands. Keep waterers at chicks shoulder level -2 cm space per chick.
	Per chick		

1.13 Care and management of different classes of Layers

Layers are usually mature female birds producing eggs. The laying starts at 20 weeks of age, egg production is high and economical up to 72 to 75 weeks of age after which the decline begins, When the egg production goes below the economical level or the breakeven point, the birds are culled.

Housing of Layers:

In our country open sided poultry houses are very popular. A floor space of 1950 cm² per birds is recommended for egg type chicken in floor house. For broiler parent stock the requirement for floor space is slightly higher because of their size.

Laying Cages:

Nowadays cage rearing of layers is getting popular. Some of the advantages are easier culling, less problem due to parasites and other diseases, housing of more number of birds in

limited space, clean egg production etc. Some of the disadvantages include high initial investment, wet litter and fly problem. Four bird cages are ideal for commercial layers. The specifications are given below.

Length -	45cm
Height at back-	38 cm
Height at front-	42 cm
Width-	38 cm

Many methods have been developed to house the birds in a given area. Single deck, double deck and triple deck arrangement can be adopted. In order to collect the droppings from the cages a shallow pit at a depth of 30 cm from the ground level at length wise just under the cages may be constructed. Long continuous troughs are used for feeding and watering of caged layers.

Homestead Cages: These are specially designed for rearing laying hens.

Light in Layer houses: Light entering the eyes of the birds induces the response in the hypothalamus, which in turn, through the releasing factors affects the rate of secretion of gonadotrophic hormones from the anterior pituitary gland. Age at sexual maturity and rate of egg production are affected by pattern of lighting in layer house.

Use of correct lighting schedule increases the performance of the birds. It would be advantage to increase the light period for laying chicken from 22nd week of age onwards at the rate of 15 to 30 minutes per week so as to reach 16 hrs of total photo period at 33 weeks of age. Never decrease light during laying period. The light period may be constantly maintained throughout the rest of the laying period. Intensity of light is not a very important factor.

The types of light used are either florescent, incandescent or the mercury vapour light. The bulbs have to be provided at a height of 7-8 feet above the floor level. The distance between the bulbs being 10 feet. Distance between two tube lights should be 15 feet.

Vaccination Schedule for Layers

Age (days)	Name of the vaccine	Route
0	MD(Bivalent)	S/C
5-7	ND (Lentogenic)+IB (Mass) Live	I/O
7-10	MD(Bivalent)	S/C
12-14	IBD (Intermediate plus/Hot) Live	I/O
22-24	IBD Booster	I/O
28-30	ND(Lentogenic)+IB(Mass) Live	I/O
35-37	Coryza(killed)	S/C
45-47	Fowl pox	I/M
63-65	Coryza killed (Booster)	S/C
70-72	ND Mesogenic	I/M
80	IB(Mass) Live	D/W
88-90	Fowl pox booster	I/M
105-107	ND live (lentogenic)	D/W
112-114	ND+IB killed	S/C
270	ND Live (Lentogenic)	D/W
280	ND+IB killed	S/C
370	ND live (Lentogenic)	D/W
460	ND live (lentogenic)	D/W

Feeding: A good quality layer mash with BIS specifications should be provided to the laying birds. The feed may be given in linear feed troughs or in hanging feeders.

Laying nests: Layers on deep litter must be provided with nests. Different types of nests are single compartment nests, community nests, trap nests and roll away nests.

Layer Production Indices

The egg industry has two principal methods of measuring daily, weekly and total egg production i.e. the hen day and hen housed systems. These serve as efficiency measures in a layer farm

FCR*Feed efficiency/kg egg mass= $\frac{\text{Kilograms of feed consumed}}{\text{Kilogram of eggs produced.}}$

This takes into consideration of feed intake, egg weight and egg production. It is the ratio between the feed consumed and the egg mass. A value of 2.2 or less is advantageous to the farm.

FCR* Feed efficiency/dozen eggs= $\frac{\text{Kilograms of feed consumed} \times 12}{\text{Dozen eggs produced.}}$

This takes into consideration of the feed intake and egg production. A value of 1.5 or less is advantageous to the Farm.

HDEP***Hen Day Egg Production= $\frac{\text{Total number of eggs produced on that day} \times 100}{\text{(one day) Total number hens housed on that day}}$

HDEP***Hen Day Egg Production= $\frac{\text{Average daily number of eggs produced} \times 100}{\text{(longer period) Total number birds housed during that period.}}$

HHEP***Farm Housed Day Egg Production%= $\frac{\text{Number of eggs produced on that day} \times 100}{\text{(one day) Total number of live hens on that day}}$

HHEP***Hen housed Egg Production= $\frac{\text{Total number of eggs produced during a period of time} \times 100}{\text{(longer period) Total number of hen days.}}$

Average Egg Mass= %HDPExAverage egg weight in grams.

(Per hen per day in grams)

Egg: Feed price ratio (EFPR)= $\frac{\text{Total value of egg produced}}{\text{Total value of feed consumed.}}$

An EFPR of 1.4 and above is desirable.

1.14 Care and management of Broilers

The basic principles of broiler rearing are similar to the chicken farming for egg production. However there are some differences as far as the birds are used for broiler production, their feed, housing and other management requirements, including their processing and marketing.

The broiler type birds should have genetic and physical potential for rapid growth, high feed efficiency, early feathering, low mortality and good body confirmation.

Rearing systems: The systems of rearing refer to either single batch at a time (all – in- all – out system) or multiple batches of brooding and rearing of broilers.

All- in All –out System:

Under all in – all – out – system, the farm will have only one batch of broilers, belonging to the same batch at any time. Sufficient chicks will be purchased to accommodate the entire farm capacity, reared and marketed in single lot. This system is more hygienic , lesser sub-clinical infections and horizontal spreading of diseases and there by lesser mortality rate, better growth rate and improved feed efficiency. However, this system is not suitable for large scale farming and needs higher fixed and working capital per bird.

Multiple batch system:

It consists of more than one batch of chicks at any time, with a batch interval of 1 to 4 weeks. In this system, the farmer is buying day-old chicks and selling grown up broilers at weekly, fortnightly, once in three weeks or at monthly intervals. The chicks are reared for five to six weeks of age, or until they attain the desired body weight.

The ideal system for India at present is having 5 to 6 batches of broilers at any time, with weekly interval between batches and ‘direct retail marketing’. Here , the birds will be marketed daily from 40 to 54 days of age, based on their body weight, that is heavier birds will be sold earlier, giving a chance for weaker birds to have a compensatory growth.

Floor space, Feeder space and waterer space:

The following is the approximate floor, feeder and waterer space requirements for broilers.

Age	Floor space /bird	Feeder space/bird	Waterer space/bird
Up to 18 days	450 cm ² (0.5 sq.ft)	3 cm	1.5 cm
From 19 to 42 days	1000 cm ² (1.1 sq.ft)	6-7 cm	3 cm

Brooding and rearing of broilers is similar to that of egg – type chicks.

Cage rearing of broilers:

Broilers can also be reared on cages. Broiler cages are similar to that of grower cages. To prevent the breast blisters, the bottom of the cages may be coated with some plastic materials. The floor space requirement in cages is 50% of the floor space needed in deep litter.

Measures of performance efficiency in broilers:

$$\text{Livability \%} = \frac{\text{Number of birds sold}}{\text{Number of birds at the beginning}} \times 100$$

Normal value is 97 to 98%

$$\text{FCR} = \text{Feed Conversion Ratio or} = \frac{\text{Total quantity of feed consumed per bird in kg}}{\text{Mean body weight gain in kg}}$$

Feed Efficiency

A value of 1.8 or lesser at 6 weeks of age is preferable.

Broiler feeds:

Broilers are usually fed with three types of ration – pre starter (0-2 weeks), broiler starter (3-4 weeks) and broiler finisher (5-6 weeks). Broiler starter ration contains about 22 to 23 per cent protein with a calorie protein ratio of about 130. In broiler finisher ration, protein is slightly lower, 20% with a metabolizable energy level of 2900 kcal per kg. A calorie protein ratio of 150 to 155 is desirable.

Lighting:

It is desirable to provide 24 hours light during brooding and early growing period. There after the house should be darkened to reduce the activity of the birds, so that the consumed is not wasted in roaming around.

De-beaking:

Since the broilers are given very little floor space , often the habit of pecking each other develops. De-beaking may be done if pecking develops in the flock.

Vaccination:

F1 strain of Ranked or Lasota strain vaccination should be given to one day old chicks which make them disease resistant against this disease for their short life. IBD vaccination done at 10-14 days and repeated at 20-24 days of age in drinking water.

1.15 Summer management of poultry

Commercial broilers and layers are very sensitive to environmental temperature. Their growth, egg production and health are severely affected during extremes of weather. For optimum feed efficiency an ideal temperature of 21°C-24°C is needed. By proper management losses can be overcome to a great extent.

1.15.a. Adverse effects:

The various physiological and pathological changes that take place in the flock, during high summer temperature are as follows.

1. Energy intake and feed consumption reduces as environmental temperature increases.
2. There will be two fold increase in water consumption of birds during the summer, as there is loss of water vapour through expired air.
3. High ambient temperature increases the respiratory rate and body temperature. Since there are no sweat glands in poultry, they will start panting vigorously to lose the excess body heat produced.
4. High environmental temperature decreases the oxygen consumption.

5. The problem with the ectoparasites will be more during summer and the following monsoon. Low feed intake and thereby low coccidiostat consumption will further aggravate coccidiosis outbreaks.
6. The heavy broilers are more prone for disorders like heat stroke, liver rupture etc.
7. Birds will shed more feathers during summer, to lose the excess body heat produced.
8. If both temperature and relative humidity were high the birds will not be able to lose the body heat and finally die of heat prostration.
9. Caged birds and birds reared on slatted floors will suffer more because birds on litter can cool themselves by dusting in litter.
10. Heavy mortality due to heat stroke is seen in heavy broilers, in late afternoon and evening.
11. Temperature affects egg breakage and decreases the shell quality.
12. Reduction in shell thickness is due to respiratory alkalosis.
13. As the ambient temperature increases above 26°C, the egg size declines.

1.15.b. Alleviating measures /summer management practices:

The above adverse effects can be overcome by proper management of flock, house, feed etc during summer as indicated below.

1. By proper roofing, the temperature inside the poultry house cage maintained at 5-10°C below the outside temperature.
2. In large farms, aluminum roof is preferred due to its durability, resale value and rear reflecting properties.
3. In case of non insulated houses, the roof must be raised. The height between the floor and roof must be 1.0 and 3.5 m at the ridge and eaves, respectively.
4. The eaves at roof shall project out at least 1m on all the four sides as overhang to prevent direct sunlight and rain water entering into house.

5. Provide ridge ventilation such as half monitor or full monitor.
6. Further, where summer is very severe, the roof may be insulated either by covering with a layer of thatch or by painting the upper side of the roof with white paint.
7. In tropics, to prevent direct sunlight falling into the poultry houses, the long axis of the houses have to face north and south i.e. the houses must be oriented east to west.
8. Open type cross ventilation is recommended in tropics.
9. As far as possible the width of poultry houses shall not exceed 10m, if it is more cross ventilation may not be effective.
10. Provide tunnel ventilation along the pad coolers or foggers, to produce evaporative cooling.
11. Sprinklers may be fixed on the top of the roof and operated continuously from 10-18 hours, to cool the roof.
12. Foggers may be fixed inside the broiler house and operated during hot and dry weather to produce evaporative coolness.
13. Grow fast growing shady trees around poultry houses.
14. Rear relatively more heat tolerant strains of broilers suitable for tropical climate.
15. Provide double watering space in poultry houses during summer. Provide plenty of fresh, clean and cool drinking water during hot weather.
16. In order to encourage the feed intake of birds during summer, reduce the energy content of the feed by about 10 per cent.
17. Since feed consumption generates more body heat, avoid feeding broilers over four weeks of age during hot weather. Feed broilers using night time and cooler hours of the day.
18. The energy from carbohydrates and proteins may be replaced by adding fat or oil.
19. Large farms in hot and dry climate may opt for environmentally controlled poultry houses.
20. Drugs and chemicals like electrolytes, ascorbic acid etc may be given through feed or water during hot weather.

21. Thick and wet litter generates more heat, Hence, in summer the thickness must not be more than 6 cm.
22. Avoid overcrowding, increase floor space at least by 10% during summer.
23. If mechanical ventilation is provided, increase the air flow rate and air exchanges by at least 25% during summer.
24. Do not disturb the birds and make them panic during hot weather.
25. For birds kept in cages, the centre height of the building should be minimum of 14 feet.
26. Addition of 0.48% potassium chloride to water lowered the heat stress in layers.
27. Add 1 Kg of sodium bicarbonate to one tone of feed to lower heat stroke and to increase shell thickness.
- 28 Two kg of sodium bicarbonate may be added to one tone of feed.

1.16 Transportation of day old chicks and adult birds.

Livestock and poultry transport is one of the most critical and visible components of the farmed animal production system and stakeholders want assurances that transport is done with animal welfare in mind.

Proper handling and transportation of poultry will:

- improve the well-being of poultry by reducing handling and transport stress;
- address customer/societal concerns and regulatory oversight (e.g. company reputation, retail audit requirements, government regulations, etc.); and,
- have positive financial implications for the poultry handling, transportation and processing sectors (e.g. minimize mortalities, maximize yields, protect meat quality, shelf life, etc.), and safeguard product integrity (e.g. food safety, etc.).

Preparing the Chicks for Transport:

The birds are counted and placed in new cardboard boxes or in cleaned and disinfected plastic boxes. Ensure the plastic boxes are not damaged.

- Both plastic boxes and birds should be completely dry before transport. Birds should not have

any wet or crusty feathers.

- Provide no less than 24.5 cm² (3.8 in²) box floor space per chick.
- If chick paper is used in the boxes, it must be new, clean and dry.
- Chicks must be able to stand erect during transport.
- Maintain holding areas for boxes of chicks at a temperature range of 21° to 27°C/70° to 80°F

and a relative humidity of 40% to 60%.

- The time from hatching to farm delivery should be kept as short as possible. Ideally, transport time should not be longer than 24 hours and cannot exceed 72 hours from time of hatching. Gel packs or alternative sources of hydration should be provided if the time between hatch and placement will exceed 24 hours.
- Chicks that are deemed unfit for transport must be cared for or euthanized by a trained and competent person.

Loading the Truck:

- If travelling in a non-climate-controlled vehicle, consider both the outside temperature and the duration of transport when determining the optimum density of chicks in boxes. In hot weather or when transporting chicks over long distances, reduce the packing density.
- Load stacked boxes onto the truck by sliding them or rolling them in on dollies. Avoid sudden, jarring movements.
- Boxes with chicks must be moved smoothly and in such a way that the chicks do not pile or become trapped.
- Loaded containers should be moved, as much as is possible, in a horizontal position. Avoid tilting, dropping or sudden jarring of loaded containers.
- Secure stacks with separation bars. Avoid overloading the vehicle as this may result in poor ventilation and temperature control. Double-check bird quantity during loading.

- When making multiple deliveries, the birds that will be unloaded first should be placed inside the truck last.
- After the birds are loaded, close, secure, and lock the door.
- Check the temperature sensors again. Some trucks also have automatic temperature recorders that measure temperatures inside the truck at regular intervals. These recordings are printed and kept with the other documents.

Unloading the Birds at the Farm:

As appropriate, wear protective clothing (e.g. coveralls, boot covers, hair net) while helping to unload the chick boxes. Ideally, for bio-security reasons, drivers should not enter the barn.

- Monitor the birds' condition and activity level upon delivery. In a delivery log book, note any abnormalities, including:
 - excessive panting;
 - Piling/ suffocation in the boxes; and
 - number of dead on arrival (DOAs).
- Observe conditions in the barn. Note if the building has been adequately prepared to house birds:
 - Are water and feed available?
 - Has the building been preheated to an appropriate temperature, specifically the floor area?
 - Do conditions appear sanitary? e.g. clean bedding
 - Is lighting adequate for birds to find food and water?

Unloading Chicks into Pullet Cages:

Confirm the cage capacity guidelines before proceeding to unload chicks.

- Check that cages are clean and prepared for the chicks. Some cages require chick paper to permit the chicks to move freely to feed and water.
- Take the chicks out of the box by forming a scoop with your hands. Chicks should never be Squeezed during handling other than during sexing. Chicks should be supported from the bottom and placed gently into the pullet cage.

- Be sure to keep an accurate count of how many chicks are placed into each cage. As the chicks grow, their cage space will decrease. If too many chicks are put into the cage, they will have too little space.
- If handlers do not use gloves, they should wash their hands and/or use hand sanitizer before and after unloading.
- Close the cage door properly. Make sure chicks cannot escape their cages and fall into an area where they do not have access to feed and water.

Preparing for Catching and Transportation of adult birds:

Different species of poultry must not be mixed during travelling.

The farm owner or manager should ensure birds are ready to load before crews arrive.

- The farm owner or manager should also:
 - Evaluate flock fitness for transport including any health challenges.
 - Look for signs of heat stress such as rapid and open-mouth panting, wing spreading and squatting close to the ground, birds with red/flushed faces, combs and wattles or birds that are difficult to move (lethargic).
 - Implement procedures to reduce bird stress. For example, add electrolytes or Vitamin C to drinking water one to two days before periods of high heat and humidity.
- The farmer must contact the processor if birds are not fit for travel on the day of loading anytime up until the catchers arrive so that stakeholders can make informed decisions for bird welfare before loading starts.
- During loading, the farmer and farm personnel should do everything possible to protect the birds from being exposed to a sudden change in temperature.
- Be flexible to allow for changes in loading times that will reduce bird stress. For example, loading later in the evening during periods of heat and humidity.
- Develop contingency plans in the event that birds cannot be loaded due to flock health issues, extreme cold, snow, wind chill, or road closures or, conversely, extreme heat and humidity.
- The catching area must promote safe and humane handling and catching. The barn must be prepared by the farm owner or farm personnel before being entered by workers, including raising or removing feed and water lines (if possible) so catchers can walk without

obstructions over which they may trip. Equipment should be raised or removed to prevent workers striking their heads.

Care of adult birds during Loading :

- The farmer or farm representative should be present during the catching and loading process.
- The ventilation system should be operating for the duration of loading to provide fresh air to the barn area. Ensure the fan exhaust is not causing temperature or dust issues outside at the truck.
- DO NOT LOAD wet birds in cool or cold weather. Wet birds that are loaded in cool or cold weather are at high risk of poor welfare including death (DOA's).
- Every effort should be taken to ensure the birds are dry when they are loaded and stay dry during transport. Protect birds from getting wet during loading.
- Any unfit birds found during loading should be left in the barn and euthanized by the flock owner or manager. Euthanasia should only be performed by properly trained and competent personnel. This has been followed commonly in Western countries.

1.17 Poultry farm routine

The poultry farmers have to look to ways of maximizing their profits under the conditions of fluctuating market for his products. Some of the routine activities that could be adopted by poultry farmers to increase hen housed egg production in layers and improve feed conversion efficiency in broilers have been discussed below.

1.17.a. Routine activities in broiler farm:

1. Regularly remove the waterers from the shed and after thorough cleaning fill them with fresh cool water.
2. Always check the waterers for water thorough the day. If there is any waterer without sufficient water due to spillage, that waterers should fill it immediately. So, always make available water to the birds throughout the day.
3. Remove the feathers in feeder and fill them three fourth full. Never fill the feeders to its full capacity to prevent wastage of feed due to spillage while taking feed by birds.
4. Remove the feathers in the litter material. If the litter material wet near the waterers, remove the wet litter and replace it with new dry litter.

5. Regularly turn the litter material to prevent flake formation and also to keep the litter material always dry.
6. Clean the overhead tank with suitable disinfect once in two months.
7. Regularly observe the birds for any disease signs, if any signs are found, treat them with the help of veterinarian.
8. If any birds are found dead in the farm, post mortem should be conducted, and after finding of cause of the disease, treat them with suitable medicines.

1.17. b. Routine activities in layer farm:

1. Clean and disinfect the layer shed regularly to prevent fly problem.
2. Regularly check the water nipples for its working condition.
3. Remove the feathers in the feeders, after that fill them three fourth full to prevent unnecessary wastage during feeding of the birds.
4. Regularly remove the eggs in the cages, at least three times a day to prevent spoilage and breakage of eggs.
5. After removing of the eggs, keep them in cool place.
6. Grade the eggs regularly before sending the table eggs into market. Remove double yolk eggs and small egg. These double yolk eggs and small eggs will not fit into the normal filler flats.
7. Sell the double yolk eggs at farm itself or surrounding villages.
8. In summer months regularly use the foggers, to alleviate summer stress
9. Poor or non layers birds should be identified and remove it regularly.
10. Post-mortem should be conducted regularly at the farm itself with the help of veterinarian, and treat them with suitable medicines.
11. Maintain a daily record of feed consumption, egg production, mortality, income and expenditure to pin point problems areas and find their solution. This will help in improving farming efficiency.

12. All critical items of management should be listed on a daily, weekly or seasonal checklist. Every item should be checked. It helps to locate the problem when it occurs.

In spite of all the above routine activities of the poultry farm, tender loving care of the birds is very much important for efficient poultry farm management.

1.18 Cleaning and sanitation in poultry sheds

Sanitation refers to a state where in pathogenic organisms are present but not a threat to birds health. Disinfection indicates destruction of all vegetative forms of microorganisms where as spores are not destroyed and sterilization means destruction of all infective forms of all microorganisms like bacteria, fungi, virus etc.

The main purpose of cleaning and disinfection programme is to reduce the number of pathogens in the environment so as to reduce the potential for diseases to occur in subsequent flocks.

Cleaning: Cleaning is the physical removal of organic material like manure, feed etc. It is important to remove these organic materials before the disinfection process begins because disease agents are often protected in these materials and can survive the disinfection process. The cleaning process can include a dry cleaning and a wet cleaning.

Dry cleaning involves the physical removal of organic material, such as removal of feed, litter and manure. Wet cleaning involves use of water. There are four basic steps in wet cleaning process – soaking, washing, rinsing and drying.

Cleaning procedure of floor house:

The following procedures are recommended for a complete house cleaning of floor houses.

1. Litter removed from the poultry houses and shifted as far away from the houses as possible or a minimum of 100 m.
2. House swept thoroughly to clean all floors, lighting fixtures, fan blades. Burnt-out light bulbs replaced and all other bulbs cleaned.
3. All waterers, feeders and other equipment scraped, scrubbed, and cleaned. Brooder guards, hand feeders, and jugs that will be used for the next flock must be soaked, then hand scrubbed and disinfected.
4. The sills of the house scrapped and cleaned.

5. The curtains are kept up and fully extended when cleaning and spraying. Both sides of curtains and wire screens completely and thoroughly covered with spray to remove dirt, dust and down.
6. When the floor is dry, 10 cm of dry, absorbent litter is spread.

Cleaning procedure for cage houses:

The following procedures are recommended for complete house cleaning of **cage houses**.

1. Manure moved from the poultry house and as far away as possible or a minimum of 90 m.
2. House swept thoroughly to clean all floors, lighting fixtures, fan blades. Burnt-out light bulbs replaced and all other bulbs cleaned.
3. The ceiling, curtains, walls, partitions, cages, feeders, waterers and other equipment thoroughly disinfected. Extreme care should be taken about not getting any spray into electric motors.
4. If curtains are used cover them completely and thoroughly with spray to remove dirt, dust and down. When dry, the curtains should be dropped and the house allowed to air out completely.
5. Between flocks, house repairs if any should be identified and completed.

1.19 Identification of poultry

WingBands

Wing bands are a permanent type of identification with a high retention rate that will stay with the chick for life and grow with it. Wing bands will not bother the bird, and may be covered with feathers when they are older, making it more difficult to read. Wing bands are usually put on chicks, anywhere from a day old to a few weeks, but can also be put on adult birds.



LegBands

Leg bands are aluminum or plastic band that wrap around a bird's leg and must be fitted to their leg size. Leg bands are more commonly used on fully grown birds, but when used on a young bird, the band must be constantly changed as the bird's leg grows. Leg bands can be a temporary source of identification or a permanent one. Plastic leg bands will fall off easier than metal ones due to the bird pecking at it or excess exposure to weather. Leg bands are the best option for those who do not wish to pierce the skin with a wing band or toe punch.



Neck Tags – Plastic tags that can be hung by the neck of a baby chick.



Wing Badges – Large plastic badge that attaches to the wing and has large visible numbers.



1.20 De-beaking and vaccination schedule

De-beaking: De- beaking is a convenient and quick way to prevent cannibalism or to stop , if it is already exist in the flock.

De-beaking in baby chicks:

1. De-beaking may be done soon after hatching or at day old. It is generally done within the first week of age.
2. Use an electric debeaker (preferably one with a guard or jig)
3. Hold the chick correctly and make sure the beak is held at 90° angle to the debeaker blade at the time of debeaking.
4. The upper beak is cut half-way between the nostrils and the tip of the beak.
5. Debeaking accomplishes both cutting and cauterizing (which prevents bleeding)
6. Skill should be developed before attempting to gain speed.

Debeaking in pullets:

To assure protection against cannibalism during the laying period, debeak grown-up stocks before putting them into the laying houses.

1. A good electric debeaker with a sharp blade is used
2. The bird is held by holding the feet with left hand
3. Place the index finger of the right hand between the upper and lower beak and guide the head with the thumb and second finger
4. Rest the upper beak on the anvil of the debeaker at the desired point, at an angle of 90° to the blade.
5. The upper beak is cut mid-way between the nostrils and the tip of the beak by pressing down the paddle slowly with the foot, to cut and cauterize.
6. As the hot blade reaches the anvil, the back of the chicken head is raised slightly to bring the cut surfaces of the beak more directly in contact with the hot blade for proper cauterizing.

De-beaking Layers:

Debeaking programme should be completed before laying commences. However, because of emergency, if a laying flock is to be debeaked, it is wise to debeak less severely than when debeaking pullets. In such cases only the tip of upper beak is cut which will usually stop cannibalism, without effecting the egg production.

Vaccination schedule:

Vaccines are important part of disease prevention and control. Vaccines should not be expected to eliminate all disease problems. Many managerial procedures such as animal density, nutrition, environmental control, movement of birds, levels of stress, cleanliness of the environment, cleanliness and availability of drinking water, and the number of various disease causing organisms in the environment can all influence how well a vaccine will work. Therefore, it is important to view vaccines only as an aid to health management and not the foundation of bird health. Therefore appropriate biosecurity measures should be followed.

In a satisfactory vaccination programme, particular attention should be paid to such factors as 1) Age of birds 2) Maternal antibody levels 3) Genetic resistance of the flock, 4) Health status of the flock 5) Feeding and managerial practices 6) Vaccines used and method of administration etc.

Vaccination programme for layer type chicken:

Age	Disease	Vaccine	Route
1 day	Marek's	HVT Vaccine	I/M
5-7 days	RD	Lasota/F	Occulonasal
24-28 days	IBD	LIVE	Drinking water
8 th Week	RD	R2B/RDVK	S/C
16-18 week	RD	-do -	-do-

Note: Administer Fowl Pox and IB vaccines at appropriate age in endemic areas.

Repeat Lasota vaccine at every 8th week to maintain antibody titre.

Vaccination Programme for broiler chicken:

Age	Disease	Vaccine	Route
4-5 days	RD	Lasota/F	Occulonasal/Drinking water
12-14 days	IBD(Gumboro)	IBD live Vaccine	Drinking water
28-30 days	RD	Lasota /F	Occulonasal/Drinking water

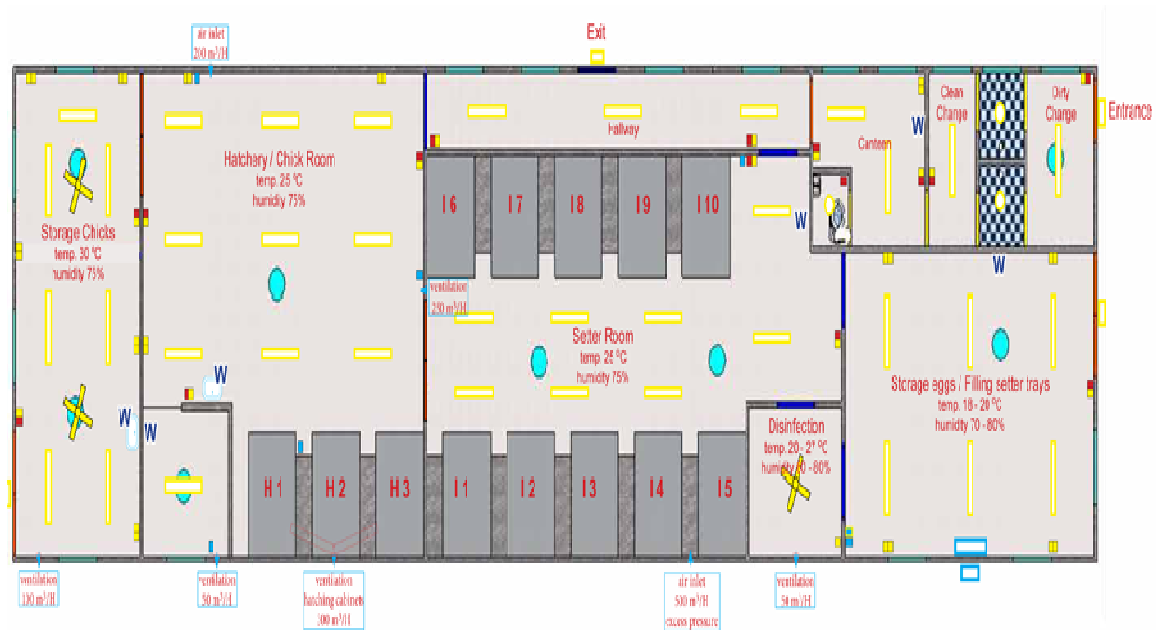
Precautions during Vaccination:

1. Use only fresh vaccines that have been stored under right conditions. Do not mix two vaccines together while administering so as to save time and effort.

2. During summer months avoid getting vaccines by post . It may be obtained through messenger, who should handle it packed in thermos flask. This will avoid exposure of vaccine to high temperatures during transit.
3. Vaccines should be stored in deep freezer or refrigerator
4. Strictly follow the manufacturers instructions regarding use of vaccines. Do not vaccinate when the birds are in the stress due to disease or any other factor.
5. Use only recommended diluents /distilled water for reconstituting vaccines.
6. Reconstituted vaccines should be used as early as possible. It can not be stored for long.
7. No chemicals , antiseptics and disinfectants should be allowed to come in contact with vaccine or containers like syringe, mortar and pestle required in connection with vaccination.
8. Anti-stress medicines like vitamins, anti-biotics etc., should be used three days before and three days after the vaccination to reduce the stress of vaccination.
9. All birds in the poultry house should be vaccinated at one time. Un - vaccinated young chicken should not be allowed to come in contact with vaccinated chicken directly or indirectly.
10. Vaccination should be conducted only the flock is healthy. Vaccination should be carried out in the cooler part of the day, preferably in the morning or evening.
11. Crowding or piling of birds in corners should be avoided while catching of birds while vaccination.
12. Always maintain proper vaccination records.

1.21 Layout of hatchery and hatchery practices

1.21.a. Layout of hatchery:



1.21.b. Hatchery practices:

The operation of chick hatchery involves the production of largest number of quality chicks from the hatching eggs. In addition chicks must be produced economically. The sequences of hatchery practices followed in commercial hatcheries are –

1. Receiving cleaned hatching eggs from the breeder farm: Fumigation of eggs for sanitation – (3X concentration for 20 minutes); 3X means 60g KMnO_4 and 120 ml of formalin for 100 cubic feet space.
2. Storage in egg holding room (65 °F temperature and 75% R.H)
3. Pre-incubation warming at room temperature (4-6 hours)
4. Loading eggs in the setter (for first 18 days)
5. Candling of eggs for removing infertile eggs
6. Transfer to the hatcher (last 3 days)
7. Pulling out the chicks (at 90% dry condition)
8. Sexing (only for layers)
9. Grading
10. Vaccination (Marek's vaccination – s/c on neck)
11. Delivery (plastic or cardboard chick box with proper ventilation and comfort)

1.22 Incubators, setters in hatchery

In fowls the hatching period is 21 days. For successful incubation optimum and uniform temperature, humidity and gaseous environment and turning of eggs are very essential. Most of the incubators available at present are electrically operated and using forced draft hot air for heating eggs. Eggs are incubated initially in an incubator called setter and last few days in the hatcher.

Types of incubators:

Still –air incubators: Heat is supplied to the top of the machine, and as air cools, it passes slowly down to the bottom through the eggs. There may be 7.7°C difference between the temperature at the top of the machine and at the bottom, and 2-3°C across the eggs.

Cabinet incubators:

There are three types: a) the combined setter and hatcher b) separate hatchers, and c) the small type machines with air circulation assisted by a fan. In combined types, the excess heat at hatching is usually compensated for by putting the hatching trays in a part of the machine where the temperature is a degree or two lower than the setting trays. This has to be accompanied by alterations in the humidity as well as in the setting temperatures. Separate hatchers, high humidity and slightly lower temperature depending on air flow. In small table machines, insulation is poor and heat loss is greater than natural heat production. So, hatching temperature should be same as setting temperature.

Functions involved in incubation and hatching: There are five important functions are involved in incubation and hatching of poultry eggs.

1. Temperature
2. Humidity
3. Ventilation (Oxygen and carbon dioxide and air velocity)
4. Position of eggs
5. Turning of eggs

1. Temperature:

It is the most critical factor in incubation. The physiological zero is the temperature below which the embryonic growth is arrested. The temperature varies with strains and varieties of chicken and it is generally 21.1°C .

The three optimum temperatures for hatching of eggs as follows.

Prior to egg laying: The optimum temperature for the embryonic development during this period is 40.6 °C and 41.7 °C.

During the first 18 days of incubation: In forced draft incubators, the temperature is about 37.7°C.

During the last three days of incubation: In forced draft incubators, best hatchability occurs when the temperature is reduced than the initial periods (1-18days). The temperature can range between 36.7°C to 37.2 °C.

Species of birds vary in their temperature requirement for incubation. But in most of the poultry species temperature requirement varies from 37.2 °C to 37.7 °C depending up on the construction of the incubators. In setter cum- hatcher the same temperature is maintained throughout the incubation period. Where the hatcher is separate, temperature is slightly reduced as indicated earlier.

High incubation temperature results in embryonic mortality, particularly when there is high temperature during the last part of incubation period. Other adverse effects of high incubation temperature are small chicks, lack of alertness of chicks, crooked toes, straddled legs, crooked necks etc.,

2. Humidity:

To regulate the evaporations of the egg contents the amount of moisture in the air surrounding the eggs must be controlled, since the outside moisture determines the rate of egg weight loss. High humidity reduces egg evaporation, while low humidity increases it.

For chicken eggs, 60% relative humidity during the first 18 days and 70 % thereafter is recommended. Low humidity during incubation results in excessive water loss from the eggs. The eggs will have small and hard chicks. High humidity during incubation results in large and soggy chicks. And the chicks will have poor navel healing.

3. Ventilation:

Ventilation is important in setter and hatcher because fresh oxygenated air is needed for the respiration of developing embryos. The best hatching results are obtained when the oxygen content inside is the same as in pure atmosphere that is 21 per cent. At above and

below this level, the hatchability of eggs is reduced. Carbon dioxide content in the incubator should range between 0.3 to 0.5 per cent. Concentration of carbon dioxide above 1 per cent increases embryonic mortality and at 5 per cent for prolonged period all embryos will die.

4. Position of eggs:

Eggs should be held with their large end up in artificial incubators. Eggs positioned horizontally will incubate and hatch normally as long as they are turned frequently. Under normal circumstances eggs are set with large end up for the first 18 days in setters and in horizontal position for the last 3 days in hatchers.

5. Turning of eggs:

Turning should be done for the first 18 days of incubation once in every 3 hours. There is no need to turn chicken eggs during the last three days. Under natural conditions, birds, including chicken and quail turn their eggs during nest incubation. Turning of eggs during incubation prevents the developing embryo adhering to the extra-embryonic membranes and reduces the possibility of embryo mortality. Most eggs are turned to a position of 45° from vertical, and then reversed in the opposite direction of 45° from vertical.

1.23 Selection, care and incubation of hatching eggs.

1.23.a. Selection of eggs for hatching purpose : The following points should be considered while selecting eggs for hatching purposes.

Size of eggs:

The optimum weight of chicken egg is about 53 grams but it can vary from 50-55 g. Too small and too large eggs create hindrance in setting in incubation trays and also do not hatch properly. Duck eggs should vary between 65-70g and turkey eggs should be between 80-85 g.

Normal shape:

The shape of hatching eggs should be ovoid. Excessively long, thin or completely round eggs do not hatch well. Eggs which have ridges, pointed ends etc., do not hatch satisfactorily. Duck and turkey eggs may be less oval than chicken eggs.

Shell quality:

Eggs with sound shell should be selected. It should be clean and should have thick shell.

Shell thickness:

Egg shell with thickness between 0.33 and 0.35 mm is considered to be best.

Interior quality of eggs:

Hatching eggs should have good albumen and yolk quality, and they should be free from blood and meat spots.

1.23. b.Care of hatching eggs:

Collection of eggs:

Three or four gatherings of eggs from poultry sheds will be necessary to avoid undue effect of weather on embryos. Use of enough clean, dry and mould free nesting material can avoid cracked and dirty eggs. Similarly hens to be trained to use nests to lay eggs instead of avoid cracked and dirty.

Selection of eggs:

Eggs that are cracked, dirty or misshapen are usually not used for hatching. Very small or very large eggs do not hatch as that of eggs in the normal range.

Hygiene:

The bacterial load found on the egg shell at the time of lay ranges from 300-500 organisms. After the egg is laid it begins to cool. During the cooling process the egg contents begins to shrink and producing negative pressure. At this time most of the bacteria on the shell surface will penetrate into the shell contents and spoil the eggs.

Egg sanitation:

Common method of sanitizing egg shell surface is by fumigation with formaldehyde gas. Solutions containing quaternary ammonium compounds, formalin, hydrogen peroxide or phenols may be moderately effective in reducing the microbial load over hatching eggs.

Storage temperature:

It is important that eggs should be stored below 'Physiological Zero' temperature, which is approximately 21.1°C. The ideal temperature for holding hatching eggs is near 10°C. It may range from 7.2 to 15.5°C without much affecting the hatchability of eggs. Pre-worming is beneficial if eggs are stored at 10°C. A pre-worming temperature of 23°C for 18 hours before setting is recommended. Many hatcheries set eggs once or twice in a week.

Storage humidity:

A relative humidity of 75-80 per cent during storage is necessary.

Length of storage:

Depends up on the condition of storage particularly temperature and humidity. Weekly setting of hatch is desirable. After one week of storage hatchability starts decreasing and reaches almost zero by fourth week.

Handling of eggs:

Hatching eggs should be stored in hard and clean filler flats keeping broad ends up.

Cleanliness of the shell:

Clean eggs hatch better than soiled eggs. Dry cleaning of soiled eggs with rough cloth or sand paper may be done before setting but it involves risk as dry- cleaned soiled eggs may explode in the incubators.

Transport of hatching eggs:

After transportation of fertile eggs allow to settle for 24 hours before setting.

Incubation period of various species of poultry:

Species	Incubation period (days)
Chicken	21
Duck	28
Goose	28-34
Japanese Quail	17-18

Emu	52
Turkey	28
Muscovy Duck	35
Guinea fowl	28
Ostrich	42

1.24 Sexing, grading, packing and dispatch of chicks

1.24.a. Sexing: Separation of male and female is called as sexing. This is adopted for breeder and layer chicks at day old age. The broiler chicks are unsexed hence called as straight run chicks. Three types of sexing are Japanese/vent sexing, Sexing by proctoscope and Feather sexing

Japanese / vent sexing:

This is most popular method of sexing day old chicks and named after the country in which it was first invented. The sexing is carried out on the basis of presence of grain size and genital eminence or rudimentary copulatory organ called papilla in vent in case of male. The vent is everted by thumb and examined under powerful light for the presence of protuberance of papilla designating chick as male, while its absence groups chicks as female or pullet.

Sexing by proctoscope

The Chick tester machine features a blunt-ended telescopic tube, containing a light. The sexer inserts the tube into the evacuated cloaca and with the help of the light can identify either testis or ovaries. Successful development of this technique depends on the capability of the students and their level of experience.

Feather sexing /Auto- sexing:

Male and female are identified by the colour pattern of their plumage or colour of down or fluff. But it is limited to specific breeds only. For example barring pattern in Barred Plymouth Rocks. When barred females are crossed with males of other breeds, all males will be barred. While females will be dark colour of other breeds.

1.24.b. Grading:

Advantages of chick grading

1. Achievement of purpose of providing quality chicks to the customers.
2. There is good reputation of the hatchery
3. Uniformity among the flock is maintained.
4. Removal of birds which will not show better performance in the future.
5. Better profit is obtained.

There are different types of grading of chicks which are as follows

Grading at hatchery:

There are different types of grading which is done at hatchery.

- a) Grading by sex, which has been discussed earlier.
- b) Grading by quality will be assessed by the following parameters

1. Activity

Chick was placed on its back and observed to see how quickly it returns to its feet. An immediate return to its feet was considered strong, while delay return or remaining on its back was considered weak.

Quality	Scores
Good	06
Weak	00

2. Down and appearance

Chick should dry and clean(free from adhering dried yolk, shell and membranes.

Quality	Scores
Clean and dry	10

Wet 08

Dirty and wet 00

3. Retracted yolk

Chick was placed on its back on hand palm. The height of its abdomen is estimated. The consistency of its abdomen to touch was then estimated. Chicks that had bodies with large yolks and hard to touch was considered of poor quality.

Quality	Scores
---------	--------

Normal	12
--------	----

Large yolk hard touch	00
-----------------------	----

4. Eyes

Open, alert and bright were considered of good quality. Open but not bright were fair and closed were of poor quality.

Quality	Scores
---------	--------

Open and bright	16
-----------------	----

Open but not bright	08
---------------------	----

5. Legs

Chick was put on its feet and whether it could stand easily were observed. Toe conformation was assessed as was hock color.

Quality	Scores
---------	--------

Normal legs & toes	16
--------------------	----

One infected leg	08
------------------	----

Two infected legs	00
-------------------	----

6. Naval

Naval closure and coloration of the skin around the naval was observed. Skin color different from the chick skin color was considered poor quality.

Quality	Scores
Completely closed and clean	12
Not closed & not discolored	06
Not closed and discolored	00

7. Remaining membrane

Remaining membrane was categorized as very large, large and small.

Quality	Scores
No membrane	12
Small membrane	08
Large membrane	04
Very large membrane	00

8. Remaining yolk

Remaining yolk adhered to the skin and down were categorized as very large, large and small.

Quality	Scores
No yolk	16
Small yolk	12
Large yolk	08
Very large yolk	00

Grading at farm:

At farm separate low weight birds and feed them separately and provide a bit large amount of ration than the heavy weight chicks. The feed of heavy weight chicks is maintained so as to get a uniform body weight among all the chicks.

1.24.c. Packing of day old chicks:

1. The chicks are packed in chick boxes of standard size.
2. They are soft at the time of packing so leave them for 4-5 hours to become hard.
3. Attach label of sex, breed, date of hatch, and grade of chicks on the chick box.

1.24.d. Dispatch:

Generally day old chicks will be dispatched during late in the evening or early in the morning according to the distance of poultry farm from the hatchery. Use only new boxes with the punched holes open; adapt the number of chicks per box to the climate conditions (in summer less than in winter). Put the boxes on racks or trolleys while waiting for delivery. When plastic chicken boxes are used, clean and disinfect them thoroughly, and use paper in bottom of the box.

The following data should be recorded and attached to the chick delivery report which will be helpful to both hatchery man and poultry farmer as well.

1. Breed
2. Number of eggs set
3. Number of quality chicks hatched
4. % age of total hatchability
5. Number of “grade outs”
6. % age of “grade outs”
7. % age of extra chicks given to customer.

1.25 Disinfection and fumigation of hatchery equipment – biosecurity in hatchery

Hatching eggs must be produced by healthy breeding stock; eggs should be incubated under sanitary conditions. The chicks should be delivered in clean vehicles. The hatchery should be regarded as potential source where disease can spread. There are two classes of diseases that originate from the hatchery. The first includes those diseases that are transmissible through eggs. The second includes diseases that transmitted by contact with disease producing microorganisms introduced other than eggs after the chicks are hatched. To avoid the spread of diseases from hatchery the following precautions or bio security measures may be taken.

Disinfection

The chemicals used for disinfecting are the cresols and cresylic acid, phenols, iodine, chlorine, Quaternary Ammonium Compounds and formaldehyde.

Formaldehyde: Formaldehyde is commercially available at 40% solution in water known as formalin and as powder containing 91% formaldehyde. It is quite toxic with tolerance level of 5 ppm in air inhalation should be avoided.

Fumigation:

Fumigation is accomplished by the use of formaldehyde gas, which may either be liberated from a chemical reaction or simply released from an aqueous suspension. Potassium permanganate method of fumigation is most commonly practiced.

Before fumigation it is necessary to know the volume of the incubator, which is obtained by multiplying the height, width and depth of incubator. Two parts of and one part of potassium permanganate will result in complete expulsion of gas when mixed together. Formaldehyde gas is produced by mixing 20 grams potassium permanganate (KMnO_4) with 40 ml of formalin (37.5% formaldehyde) for each m^3 of space (1 X concentration) in the fumigation structure. The ingredients are mixed in an earthenware or enamel ware container with a capacity of atleast 10 times the total volume of the ingredients. The gas within the structure or room is allowed for circulation for 20 minutes and then expelled.

Biosecurity in hatchery

1. Only clean eggs should be collected for hatching in clean filler flats and boxes.
2. Hatchery should not be located near poultry farms, poultry processing plants or other hatcheries.
3. Incubators should be located in separate rooms with 'No Admission' sign at door.
4. The hatchery building and all the equipment should be thoroughly cleaned and fumigated before hatching season starts during every year.
5. All the eggs placed in incubators must be fumigated.
6. Secure disease free hatching eggs.
7. Use new or disinfected chick boxes.
8. All personnel must shower and change into clean clothing prior to entering the hatchery.
9. Fumigate and disinfect everything in the hatchery between hatches.
10. Have only one entrance and exit to the hatchery.

1.26 New breeds/strains developed for backyard poultry.

Rural poultry farming involves rearing of improved chicken varieties under free range, semi intensive or intensive conditions. Rearing method largely depends on the type of the bird reared, availability of resources and the preference of the local population for meat or eggs. Specific varieties of birds are available for rearing for meat or eggs and few varieties for both (dual purpose). Having realized the importance of backyard rural poultry farming (RPF) in India, several research organizations developed different backyard chicken varieties which are discussed in detail.

Different improved breeds of backyard Poultry in south India:

Vanaraja, a dual-purpose variety for free range farming in rural and tribal areas was developed and improved further. In *Vanaraja*, males weigh about 1.2 to 1.5 kg at 10 wks and females lay about 120-140 eggs in laying year. The bird is hardy and has better immunocompetence. Because of its multi coloured plumage and brown eggs, it is well accepted by the rural people across the country including Andaman & Nicobar islands, Jammu & Kashmir and the north-eastern region.



Vanaraja birds

Gramapriya, a layer type variety was developed for free range farming in rural and tribal areas. The bird has the production potential of 230-240 eggs in a year and can lay 160-180 eggs in free-range conditions with minimum supplementary feeding. The males weigh around 1.2 to 1.5kg at 15 wks of age and suitable for *tandoori* preparations. The bird has coloured plumage and lays bigger (57-59g) and brown eggs. It is hardy and livability is high. The rural and tribal farmers of many states are being profited by this variety.



Gramapriya

Krishibro, a broiler cross developed by this institute ranked third among 9 broiler crosses from both private and public sector in the 24th Random sample poultry performance test (RSPPT) for broilers held during 2005 at Gurgaon. *Krishbro* weighed 1.44 and 1.92kg at 42nd and 49th d and 7th wk of age, respectively with the corresponding feed efficiency of 2.05 and 2.13. Dressing percentage was 72.6%.



Krishibro

Krishi layer, This variety has the potential to lay about 280 eggs/year on hen housed basis.

Srinidhi – A new promising dual-purpose variety for rural poultry

Directorate of Poultry Research (DPR) has evolved Srinidhi, a new promising dual purpose variety for rural poultry production. Srinidhi has optimum body weight and better egg production. It has been selected from the six test crosses developed at PDP. It was evaluated twice for full length of production cycle of 72 weeks at the institute farm. Its juvenile body weight at 6 weeks of age was 650 g and males weighed 2353 g at 15 weeks of age. The age at sexual maturity was 161 days. The egg production upto 40 weeks of age was 90 eggs and the annual egg production was 228 eggs under intensive system of rearing. The survivability was more than 95%. Subsequently, the variety was evaluated under field conditions in Tripura, Jharkhand and Andhra Pradesh. In the backyards, the juvenile body weight at 6 weeks of age was 500-550 g, the age at sexual maturity was 170-175 days. The egg production up to 40 weeks of age was 55-60 eggs and the bird has potential to lay 140-150 eggs per year under backyard.

Salient features under rural backyards

- Multi coloured plumage

- Longer shanks
- Coloured and bigger eggs (53-55 g)
- Juvenile b.wt. : 500-550 g at 6 weeks
- Early maturing (175 days)
- Annual egg production: 150 eggs



Srinidhi

CARI Shyama (Kadakanath Cross)

- It is locally known as "Kalamasi" meaning the fowl having black flesh. Jhabua and Dhar districts of Madhya Pradesh and the adjoining districts of Rajasthan and Gujarat spreading over an area of about 800sq. miles is considered to be its home tract.
- These are mostly reared by tribals, adivasis and rural poor. It is considered to be a sacred bird and offered as sacrifice to Goddess after Diwali.
- The colour of the day old chicks is bluish to black with irregular dark stripes over the back.
- The flesh of this breed though black and repulsive to look at, is considered not only a delicacy but also of medicinal value.
- The tribal uses Kadakanath blood in the treatment of chronic disease in human beings and its meat as aphrodisiac.
- The meat and eggs are reckoned to be a rich source of protein (25.47% in flesh) and iron.
- Body weight at 20 weeks (g) 920
- Age at sexual maturity (days) 180
- Annual egg production (number) 105
- Egg weight at 40 week (g) 49
- Fertility (%) 55

- Hatchability FES (%) 52



CARI SHYAMA (Kadakanath Cross)

1.27 Backyard poultry management

Poultry farming in India has transformed into a techno-commercial industry from the status of backyard farming since three decades. India stands as third largest egg producer and fifth chicken meat producer in the world with about 60 billion eggs and 2.2 million metric tons of chicken meat. This production is achieved generally by commercial poultry operations; however a significant contribution comes from rural poultry also which contributes nearly 30% of revenues in the poultry sector. Rural farmers rear *Desi* type chicken with low egg and meat production in backyard system. For developing the rural poultry farming, improved backyard poultry like Vanaraja/Gramapriya birds rearing is of utmost important. These improved birds can rear in both intensive and free ranging system. Birds can be reared for egg production in small numbers (10-20) in free range conditions if plenty of natural feed resources are available.

Rural Poultry is a good occupation for the rural masses for economic sustainability and nutritional security. Many countries have adopted Poultry as a micro enterprise with women empowerment as a model for rural economic sustainability. Rural Poultry involves Chicken Farming, Duck Rearing, Turkey, Quail and Guinea Fowl Farming with minimum available infrastructure and open range farming.

Management :

Rural chicks need brooding care during the initial 6 weeks of age. After 6 weeks, they can be let free for scavenging in the backyard. The excess males can be reared separately and

marketed for meat purpose. The birds need to be initially habituated to return to the nest in the evening for night shelter. The night shelter should have good ventilation and protection from predators and plenty of clean water should be made available. The birds must be vaccinated against Marek's and Ranikhet diseases. There should be periodic de worming at 3-4 months intervals.

Feeding :

The rural type chicks need balanced feed during the initial 6 weeks of age under brooding. In the brooders, the chicks are reared on standard chick starter ration. For the Grower birds in the second phase, besides the feed material available in the free range, natural food/greens like waste grains germinated seeds, mulberry leaves, azolla, drumstick leaves and subabul leaves (high protein sources) may be provided. The need for extra feed depends on the free range available, intensity of vegetation, availability of waste grains, insects, grass seeds. The average body weight of 1.3 to 2.4 kgs will be attained by 120 days and if required should be provided with supplemental calcium sources like lime stone powder, stone grit, shell grit at 4 to 5 gms /bird/day. This approach yields successful results with high rate of survivability and good egg production.

Brooding: Brooding of chicks is very important operation in the early age of the chicks. Chicks are provided with required temperature by artificial means. The details of various brooding methods are presented below.

Preparation of poultry shed/house:

After liquidation of old flock the following operations are required to be created for clean and healthy environment in the poultry house. Remove all the movable equipment from the shed. Soak in water and clean thoroughly in tap water and finally dip in disinfectant solutions. Finally wash in clean water, sun dry and store. Litter should be removed from the shed and transported away from the farm in closed containers or in gunny bags and disposed off properly. Lightings and feed and water pans should also be taken out of the shed and cleaned properly. Accumulated dust and cob web formed on the wall, ceiling, mesh etc., should be removed. Insecticide is to be sprayed over the litter, walls, mesh, roof etc., Shed should be washed using a pressure washer. All the repair works of the shed including cages, equipment and mesh should be carried out. Water tank, pipeline and water channel in the shed be cleaned thoroughly. First drain the water, fill the water lines with de-scaling and

disinfectant agent overnight. Flush with water for 2-3 times to remove all dirt and debris. Sheds should be pressure washed with suitable disinfectant solution. Flame guns should be used inside and outside of the houses. Walls should be white washed and metal surfaces should be painted if needed. The equipment and fitting should be re-assembled and the curtains be tied. Spray an insecticide to kill the insects. Sheds should be kept under vacant for a minimum of 2 weeks.

On arrival of chicks:

While placing chicks in the brooders, count the number of chicks placed in each portion cell to ensure proper stocking density. Fill waterers with clean water or operate water system. during the first six weeks, operate feeders to provide feed more than twice daily. Check brooder temperatures. On placing chicks, trigger water cups to encourage drinking.' Provide the feed in mash or crumble form. Crumble/pellet feed will ensure more uniform growth. Provide adequate light continuously during the first two days. Electrolytes/antibiotics supplementation in drinking water will reduce transportation and environmental stress and also reduce initial chick mortality.

Floor Brooding:

Spot brooding: This conventional method of brooding depends overhang on spot heating either by using electrical bulbs or gas brooders. In this system one (over hanging or standing) is provided for every 300-600 chicks. Hovers are reflectors which provide warmth to chicks using electrical bulbs or gas brooders. The air temperature under the hover is kept at a required level. Hovers are made up of metal, wood or bamboo baskets fitted with electrical bulbs, infra red bulbs or heating elements and gas heaters.

Brooder guard:

Brooder guards should be 2 to 2½ foot away from the hover, which are provided to prevent chicks straying away from heat source, feed and water. Brooder guards are generally made up of G.I sheet with foot height. For first 2 days, feed is sprinkled on the paper and after that chick feeders are provided. Chick waterers should be provided first day onwards. Feeders and waterers are arranged in cart wheel manner, so that chick need not have to walk long distance to access feed and water. Temperature: The temperature is regulated by adjusting the height of hover have with the number of bulbs/flame. During the first week,

brooding temperature under hover (2 inches above litter at the top of the hover) should be 32-34 (90F-95F) with a weekly reduction of 5° till it reaches 27 (80F).

The correct temperature of brooder is known by the behavior of the chicks. When the chicks are comfortable, they will spread out evenly within chick guard area. If the hover temperature is too low the chicks will huddle together under hover, whereas when the brooder temperature is high they tend to move away from hover. The brooder should be started 8-10 hours before arrival of the chicks.

Floor Space:

The chick should be provided sufficient hover and floor space. Growth and feed conversion ratio (FCR) are proportionate to floor space available for chicks, apart from the genetic potential of the bird. Overcrowding results in stress and mortality. A chick requires 8 square inches of hover space. In deep litter brooding 0.3 sq. ft. floor space per chick is to be provided during the first week. During the 6 week, 1 sq. ft. floor space per chick is essential.

Feeders:

During the first day, feed may be sprinkled or provided in the trays for encouraging the new born chicks to pick up feed. From day two onwards feed is provided in trough type of feeders. As the chick grows bigger suitable feeders are used. The feeders should be at proper height for the birds to eat properly. As chicks grow the feeder should be lifted up by adjusting their height to the back level of the bird. The level of feed in feeder has a direct correlation with feed wastage. As a thumb rule, 10 percent feed is wasted if the feeders are two thirds full compared to 3 percent wastage if they are half full and only 1 percent if they are one third full. Therefore, feed should be offered more frequently with small quantity at each time and helps to gain weight more uniformly. Feeder space allowance: Trough feeders 2.5cm – up to 2 weeks and 5cm – up to 6 weeks.

Waterer space:

Clean and fresh water should be provided to the chicks. Waterers from day old chicks should be conveniently placed close to the hover and alternatively to feeders. Water may be provided using troughs, bell shaped drinkers and caps. With these drinkers 0.75 inches (2 cm) of water space per bird is recommended. Water should be provided before the chicks are released under the brooders. Bell type chick drinkers are essential during first three days of brooding

irrespective of type of brooding. In deep litter brooding drinkers should be evenly distributed. Height of the drinkers needs to be adjusted according to the chick height. One chick drinker is enough for 100 chicks up to 2 weeks of age and regular bell drinker is sufficient for 50 birds from third week onwards chick feed/grounded maize should be provided 2 hours after chicks are placed under the brooder. During first week, frequent feeding of small quantity should be practiced to stimulate feed consumption.

Beak trimming:

Trimming of beak is an important managerial practice. This is done to prevent cannibalism and wastage of feed. Beak trimming is a sensitive operation and it should be done by trained people. The beak trimming is done at 3rd week One third of the beak should be trimmed. There are different, methods, cutting and cauterization with hot iron method is popular. Cauterization helps in arresting and destroys the tissue responsible for generating beak growth. Proper care should be taken not to burn the tongue of the chick. Use electrolytes and vitamin (K and C) in the water two days before and after beak trimming. Deeper feed should be provided for several days.

Litter Management:

Litter management place a vital role in controlling the disease in the flock. When birds are housed on deep litter, placing of waterers and their maintenance should receive due attention to keep the litter dry. The litter should be stirred at regular intervals depending on the environmental temperature, humidity, ventilation fecal moisture content, quality of water system. In case of humid coastal areas, add about 0.5 kg of superphosphate / hydrated lime may be thoroughly mixed up with litter spreading in 15 sq.ft. floor area. Birds are allowed to feed ad libitum during the first few weeks of age. To ensure proper development of feathers skeletal growth and immune system birds should be provided feed all through the initial 4 and 5 weeks.

Grower Management:

The importances of growing systems are to provide growers an ideal environment to obtain optimum body weight at sexual maturity so as to perform better during laying phases and production phase. The main objective of the grower management is to achieve target body weight and flock uniformity. Generally the stock remains in the same building during

brooding and growing. A floor space of 2.75 and 2.80 sq. ft. per bird is required. The second beak trimming is done between 12-14 weeks of age.

Pre - lay management:

Objective of this period is to ensure optimum skeletal development body conformation and leg strength to sustain reproductive ability and fitness throughout the laying period. Growth during this period greatly influences uniform sexual maturity. Uniform flock will ensure to get all the birds into lay at the same time. The rate of body weight gain increases every week. This is achieved by giving weekly feed increments from 17 to 20 weeks.

Lighting:

Light affects the physical activity, metabolic rate and other physiological functions. Total lighting required during lay is up to 16 hours. Birds growing during the period of increasing day length (January to June) mature earlier and perform better than those grown during decreased day length (July to December).

Health care and Bio-security:

Bio- Security:

Bio-security is the system used to prevent and control of infectious diseases in poultry. Consider that people, vehicles, equipments, birds etc., entering the farm may carry infections agents, hence measures to be taken for restriction of their movement. Disinfection of sheds, equipments and internal shed surfaces should be done following flock depletion.

Suggested vaccination schedule for the rural layer birds:

Age	Vaccine	Route
1 day	Marck's disease	Subcutaneous
7 th day	ND, Lasota (live)	Eye drop
14 th day	IBD	Eye drop
6 th week	Fowl pox (live)	Subcutaneous
8 th week	R ₂ B	Subcutaneous

1.28 MANAGEMENT OF DUCKS, QUAIL, TURKEY AND GUINEA FOWL

DUCKS

Ducks are next to the chicken in the table egg production in the country. Any brooder house suitable for chicks can be adopted for ducklings. A 500 capacity chick brooder is suitable for 200-300 ducklings. The temperature under brooder should be 29°-35°C for the first week, to be reduced by 3°C every 4-7 days until the ducklings require no further heat, usually 2-3 weeks of age. The behavior of ducklings must be a guiding factor for adequacy of temperature. To prevent them from wandering too far from the source of heat, the brooder guard must be used for the first week.

The layer ducks can be reared by free range, Semi intensive or intensive system. Ducklings after 3 weeks of age can be allowed on free range. The free range system saves feed cost but it involves large areas of land. Hence, semi intensive and intensive systems are more popular. Under semi intensive system, 0.135m² of covered area and 1.35 to 1.80 m² run space are needed for each duckling. Wire net fences or partitions not more than 60 cm height are adequate for control. Watering and feeding arrangements may be made in run also.

The intensive system may involve either floor house or cage house. The floor house may be deep litter or wire floored house. Wire floored house is more hygienic for ducks because the deep litter can become frequently wet due to more watery faeces and splashing of water from waterers. The space requirement of wire floored house is about 70% of deep litter house.

Feederers and waterers should be placed nearby. The duck should never be off from waterers and in it the water level must be enough to allow the immersion of their heads. Otherwise their eyes become scaly and in extreme cases, blindness follows. They also like to clear their bills from feed.

Laying nests are essential for clean egg production. For every 3 ducks 1 nest has to be provided. Light influences the reproductive behavior of ducks and during laying a light of 14-17 hours may be given. Ducks are very regular during laying. Since 95-98% of eggs are laid before 9.00AM, they should be kept confined until atleast 9.00AM. Eggs should be collected as soon as laid to prevent excessive loss of moisture and increase in bacterial load. Mating ratio of 1 male to 8 females in egg laying strains and only 7-5 females in meat strains gives satisfactory fertility.

Good ventilation and sanitation are necessary at all times. At least once a week the house should be washed, the litter changed and floor disinfected. Duck manure is rich in nitrogen and good compost.

TURKEY

Turkeys are kept only for meat and are considered as a festive food. Cage system of rearing turkeys is not much popular. Rearing in confinement in deep litter has an edge over the range system of rearing because of low labor cost, better management and disease prevention. Rearing in confinement also gives full protection against predation and unfavorable weather conditions. When birds are housed in the floor for mating, The space of about 1 m² for each bird and about 0.81 m² for each bird of small breeds is required. Floor space may be reduced to half, if only debeaked hens are housed separately and ample ventilation is provided mechanically. Under range system, the floor space is reduced to almost one third since only some shelter is required to protect from sun and rain. Due care should be taken at the time of brooding. As a thumb rule turkey poults require double the hover space as compared to the chicken. Turkey poults are also not self reliant like chicken, hence should be guarded in the beginning. Feed must be kept under bright light, Sometimes it may be necessary to put colored marbles in feed and water to attract the turkey poults. Turkeys require more of protein, mineral and vitamins than poultry to meet fast growth. Turkey rations are costlier than the chicken rations. Energy and protein requirement of turkeys has been presented in the table.

Age in weeks							
Male	0-4	4-8	8-12	12-16	16-20	20-24	Adults
Female	0-4	4-8	8-11	11-14	14-17	17-20	
ME (Kcal/kg)	2800	2900	3000	3100	3200	3300	2900
Protein	28	26	22	19	16	14	14

Turkeys must always be fed on trough or hoppers and never on the ground. Turkeys are relatively more resistant to some of the diseases compared to chicken. Although effective drugs are available for prevention and treatment of most of the diseases, greater emphasis

should be placed on prevention through management. The birds should be protected against fowl cholera and erysipelas by vaccination.

QUAIL

Quails are hardy and easy to handle, and within reasonable limits can adapt to varied environments. The incubator used for chicks can be used for quail eggs, but the setting trays need to be modified to hold the small sized quail eggs. The hatching eggs should be stored at 13°C at 80% relative humidity for 7-10 days. Eggs can be transferred to hatcher on 14th day or earlier.

Both battery and floor system of brooding and rearing can be employed with satisfactory results. Battery brooding up to 3 weeks of age, appears to be better than floor brooding due to small size of chick. The floor should be covered with corrugated paper so as to provide better foothold. The starting temperature should be 37°C and gradually reduced to 22°C by the end of the third week. For each chick 75cm² of hover and 75cm² of run space is allowed in battery brooder for better performance. The feeder and water space requirement during this period are 2-3cm and 1-1.5cm respectively. Floor, feeder and water space should be increased with advance in age.

Males and females should be separated. Females are housed in laying quarters around 6 weeks of age.

Continuous light should be provided for first 48 hours. This can be continued if birds mature earlier. Otherwise 12 hours of light and 12 hours of darkness may be followed during the growing period. Quail broilers are marketed around 5 weeks of age. Eight hours of light and 16 hours of darkness at least 7-10 days before marketing help to improve the condition of quail broilers. For feeding quails efficiently and economically, they can be classified as starter (0-3 weeks), grower (4-5 weeks) and layer or breed (6 weeks) depending on their growth rate, efficiency of feed utilization, production and reproduction performances. The starter period is the most crucial period and needs special managerial and feeding care.

The quails are very sensitive to abrupt environmental changes, particularly during the first two weeks of their life. They need better care during brooding age. The hygiene at all stages of quail production is of greater significance. Hygiene and sanitation of litter and premises are essential.

GUINEA FOWL

Guinea fowls have been domesticated in the recent past as meat producing birds. Guinea fowl are raised in backyard as free range, the birds move freely around the house during the day and scavenge on insects, earthworms, waste grain and food left over. In lean seasons cheap grains and greens are provided as food supplements. Some farmers feed the birds regularly in the morning and in the evening to encourage their return home in the evening.

Guinea fowls use shelter only during the night. This keeps away from the predators. Under free range system of rearing there is always difficulty in catching the birds as they exhibit the wild feral behavior and fly away. This can be overcome by clipping if the flight feathers.

Guinea fowls are poor mothers, resulting in heavy loss of baby keets. Hence, the keets are hatched using chicken hens as foster mother. Use of chicken hen also prevents the broodiness in guinea fowl and favors the production of more eggs.

The incubation period is about 27 days. The eggs are kept for 24 days in the incubator at 37.7°C and 55-60% relative humidity and for 3 days in hatcher at 36.2°C with relative humidity of 98%. If guinea fowls are to be raised in intensive system, chopped straw 10cm deep, serves as best litter material. Rice husks can also be used with satisfactory results. Wood shavings should be used as litter material only when it is non dusty. In the hot weather, water is usually sprinkled on litter to make it damp. This helps to control temperature and dust.

The parasitic infestation and feeding of young keets are the major problems under intensive system of management . Young guinea fowls are also very nervous type. They usually crowd up when approached, resulting in pile ups, suffocation and death. Therefore, one should exercise absolute caution to avoid panic among keets.

The improved guinea fowls require about 12 kgs of feed from day old to 28 weeks of age and 31 kg thereafter. The average consumption is about 100g per bird per day during the laying period.

Feed usually given in the form of crumps during starter period and as pellets of 2.5mm size thereafter. Guinea fowls require more sulphur containing amino acids than

chicken for optimum growth. High amount of vitamin E should be added initially to prevent perosis.

Most of the losses in guinea fowl are due to managerial lapses. High temperature, excessive humidity and inadequate ventilation of the guinea fowl houses are the usual causes of high mortality. Bacterial and helminthic infections are usually associated with poor hygienic conditions. Administration of antibiotics in feed or in drinking water during first 2 weeks reduce the mortality considerably.

Deficiency diseases can be avoided by providing well balanced feed. Guinea fowls under natural environments are vegetarian, hence green fresh leaves are recommended as a part of their feeding. Viral diseases are very rare and most of the guinea fowls are raised without vaccination.

Short type answer questions

1. What is meant by poultry
2. What is the total poultry population in India
3. What is the egg production and per capita availability of eggs in India
4. What is all-in and all-out system in poultry
5. What is Ante-mortem and post-mortem inspection
6. What is meant by broiler and cock.
7. What are designer eggs
8. What is meant by offal
9. Write about names of organs in male reproductive system of fowl
10. Name the various breeds of American class of poultry
11. Name the various breeds of Mediterranean class of poultry
12. What are the good qualities of litter material
13. What is culling in poultry
14. Write the objectives of de-beaking in poultry

15. Explain about All-in and All-out system in broilers
16. Write the importance of handling and transportation of poultry
17. Write the incubation periods of chicken, duck, turkey, quail and guinea fowl.
18. Explain about vent-sexing in chicks
19. Write about fumigation in hatchery
20. Name any five important breeds of backyard poultry
21. Write about vaccination schedule of rural poultry layers

Long type answer questions:

1. Write about chicken meat and egg production in India
2. What is the role of poultry production in Indian economy
3. Describe external body parts in fowl
4. Draw the diagram of female reproductive system in hen and write about the formation of egg.
5. Write about various parts of an egg with the diagram
6. Describe about Aseel and White Leghorn breeds of poultry
7. Write about advantages and disadvantages of cage system in poultry
8. Explain about different poultry housing systems.
9. Write the difference between good and poor layers in poultry
10. What are the various management practices for breeder layers.
11. Write briefly about artificial brooding of chicks.
12. Write about vaccination schedule and various precautions to be taken during vaccination of commercial layer
13. Write about summer management of poultry
14. Enumerate the daily routine farm activities in layers
15. Write about functions involved in incubation and hatching
16. Explain in brief about feeding and management of ducks

UNIT- 2

SWINE PRODUCTION

Structure

- 2.1 Role of swine production in Indian economy
- 2.2 Common terms used in swine production
- 2.3 External body parts of pig
- 2.4 Restraining of pigs
- 2.5 Important exotic and indigenous breeds of swine
- 2.6 Reproductive system sow and boar
- 2.7 Systems of breeding in pigs
- 2.8 Selection and culling of pigs
- 2.9 Housing for different classes of pigs
- 2.10 Care and management of different classes of pigs
- 2.11 Swine farm routine
- 2.12 Dentition and ageing of pigs
- 2.13 Identification of pigs
- 2.14 Weaning
- 2.15 Castration
- 2.16 Slaughter and dressing of pigs

2.1 ROLE OF SWINE PRODUCTION IN INDIAN ECONOMY

As per All India Livestock census, 2012, the pig production in India is 10.29 millions. Assam ranks first in pig production in India. Majority of pig population in India is of indigenous [76%] with low productivity. Indian government has laid great emphasis on the improvement of the productivity of pigs by implementing crossbreeding programme with exotic breeds of swine to develop animals of large sized litter, efficient feed conversion, higher dressing percentage and better quality pork.

Advantages and contribution of Pig Farming

1. Pigs are efficient converters of feed into pork. The feed conversion ratio is 3:1
2. Pigs are prolific breeders, grow rapidly, mature quickly and can be managed to produce 2 litters in a year with 8-12 piglets in a litter
3. Gilts can be bred at the age of 9- 10 months
4. Gestation period is less [114 days or 3 months, 3 weeks, 3 days]
5. Pigs can attain a live body weight of 90 kg in 6-8 months
6. Large acreages of unutilized land in the country can be utilized for raising pigs
7. Pig farming requires moderate investment than other farming
8. It creates profitable work for the available labor on the farm as it can be successfully combined with dairy and other agricultural activity
9. Pig utilizes the waste product very efficiently. Table garbage, bakery waste, hotel and kitchen waste and unmarketable fruits and vegetables can be fed to pigs
10. Pigs aid in maintaining soil fertility by production of manure of good biological value. Pig manure contains Nitrogen 0.7%, Phosphorus 0.68% and Potassium 0.7%
11. The protein of pork provides all of the essential amino acids including lysine and methionine, along with minerals and vitamins. Human beings digest 97% of the pork protein and 96% of meat fats.
12. Swine enterprise provide relatively higher returns from labour in comparison to other types of livestock production and the labour requirement is uniform throughout the year

13. Swine are better adapted than any other class of livestock for converting several wastes and agricultural byproducts that are not suitable for human consumption into high quality animal protein suitable for human consumption

14. Supplements other enterprises:

Skins: Pig skin is used for shoe manufacture, belt and other leather goods

The fats: In the manufacture of soaps, animal feeds, binders, lubricants, fertilizers, shaving cream etc

Hair: Pig bristles are used for making brushes, mattress, and insulation boards

Hoofs: Hoofs are converted into fertilizer and plaster retarder

Blood: Used in the refining of calico and for making shoe polish

Bones: Bones are converted into fertilizer, glue, knife handles etc

Endocrine glands: They are used in the manufacture of numerous pharmaceutical preparations. Thyroid, parathyroid, pituitary, pineal, adrenal, pancreas etc. can be used

Collagen: Made into glue and gelatin that is used in ice creams, capsules, photography, culture media and for making explosives

Constraints / Problems in Pig Farming

1. Pig rearing was confined with the traditional pig keepers who were socio-economically weaker sections of the society
2. Social taboo for pork consumption due to religious inhibitions
3. Negligence of indigenous breeds and letting them loose for subsistence through scavenging
4. Poor and primitive system of rearing pigs in unhygienic conditions without any sanitary measures
5. Absence of marketing facility and low consumer demand for pork products
6. Constraints like inadequate number of high quality stock for distribution among pig breeders
7. High feeding cost accounting for about 70-80% of total cost of pig production

2.2. COMMON TERMS USED IN SWINE PRODUCTION

Bacon: The meat from back and sides of a pig, preserved by curing with brine.

Barrow: A male hog whose testes are removed before reaching breeding age and before development of secondary sex characters

Boar: A male hog with sex organ intact and generally used for breeding (the un castrated male of swine)

Bristles: Stiff wiry hairs of the pigs obtained from back and neck parts

Cad: The smallest pig of a litter last to be farrowed, also called as Rit, Crit, Criting or Ratling

Creep: An area of access to piglets separate from the sow lying area

Creep feed: The first solid and palatable feed provided to the young ones and is usually offered in creep. It is fortified with proteins, minerals, vitamins and antibiotics

Drove: A group or group of pigs taken from place to place

Finishing pigs or Fattening pigs: The pigs weighing 45 kg and above, fed for slaughter purposes to produce carcass of desire finish

Farrowing: Parturition /birth of piglets in sow

Farrowing crate: A steel crate used in pig pen to contain a sow and prevent it from lying on and killing the piglet, while allow them access to her teats

Farrowing index: The number of piglets produced per sow per year

Farrowing rate: The number of sows actually farrowing as a percentage of sows served initially

Farrowing interval: The average time for a sow or a group of sows between one farrowing and next farrowing.

Guard rails/ Farrowing rails: They are fitted a short distance from walls and floor of pen. The loss of piglets from crushing can be reduced by use of guard rails. It is usually small less active pig that is crushed. A pipe or rail 20- 25 cm above the floor and 20-25 cm from the

side / walls of the farrowing pen will be sufficient. A 5 x 5 cm satisfactory which can be installed

Gilt/Hilt/Yelter: A young female pig kept for breeding purpose which has either not conceived as yet or going to farrow for the first time.

Gravid sow/Gilt: Pregnant sow /gilt

Ham/Gammon: The thigh of a hog, prepared for a food. The hind leg of a swine from hock upwards on the live animal OR Salted meat from the hind legs of pigs

Hog: It is a general term used to denote the entire swine family or it is synonymous with swine or A pig above 55kg body weight

Lard: The fat from the pig carcass after it has been tendered i.e., melted down

Litter: A group of piglets born to a sow/ gilt in a single farrowing

Needle teeth: Four pairs of small needle like brown colored teeth found in newly born piglets, have no practical value. These may irritate the udder of sow therefore clipped off shortly after birth of piglets

Piglings/piglets: A small pig

Pork: Fresh, frozen or salted meat from pig carcass

Rig: A male pig or sheep with one undescended testis

Sausage: Product prepared from the fresh minced pork, free from bones and skin, usually having shoulder piece and meat trimmings cut from other portions of the carcass. It also includes 13% fat trimmings or also added with wheat flour. This material is filled in intestines of pig or sheep or in synthetic casings

Sow: Female pig kept for breeding purposes, which has farrowed at least once or more number of times

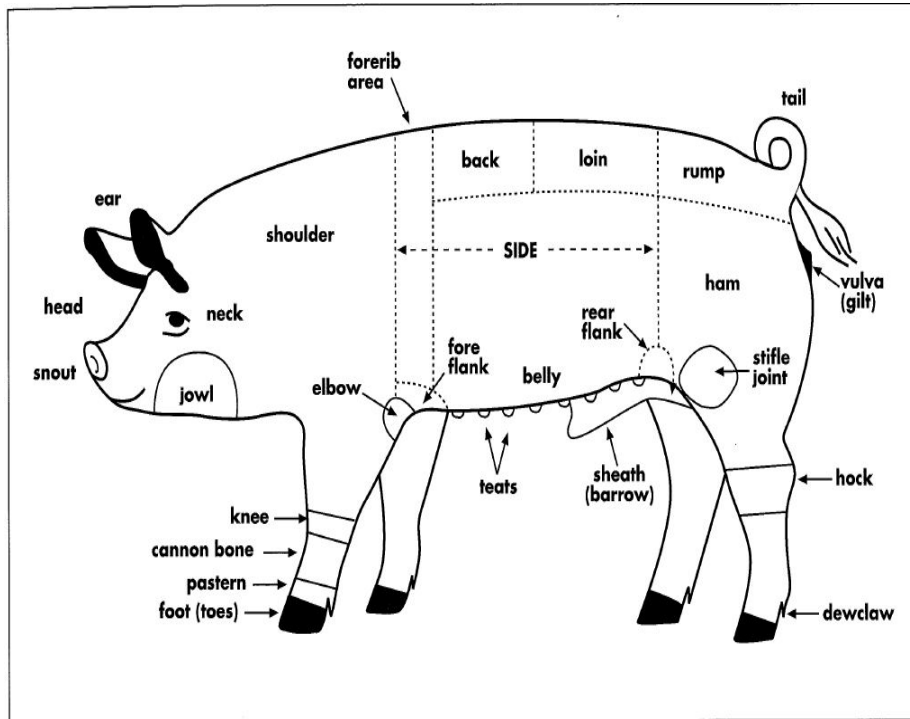
Stag: A male pig usually castrated after puberty

Sty: House of pig/ living place having one or more pens for pigs

Suckling pigs: Very young pigs which are nursed by sows

Weaner: Piglet separated from mother for the purpose of independent rearing. These are 2 months old

2.3. EXTERNAL BODY PARTS OF PIG



2.4. RESTRAINING OF PIGS

There is a need to approach and handle the pigs either in single or in groups for routine farm operations like medication, dressing, vaccination, castration, weighing etc. Careful approach and handling is required for safety of animal as well as operator. Avoid exciting the pigs.

- Pigs are temperamental animals, have rooting violent habit and are aggressive.
- Pigs should be handled very gently; rough treatment may cause them to become very vicious.
- Care should be taken while approaching savage boars and broody mothers.
- Young pigs are handled by securing their hind legs over the hock.
- During castration young pigs are held upside down by holding the hind legs and head

is

secured between the knees of the attendant with the pigs back facing towards the person who is handling the pig.

- Adult pigs are secured by using a running noose slipped over the upper jaw behind the tusks. A strong pig net or pig catcher can be used.
- Never handle pigs by tail.
- Simplest method of moving the pig forward is by using a wooden board with a handle near the top. This board can be used to apply pressure on the sides, rear or front to indicate the direction of movement.
- Pigs are taken from one pen to other pen or to the weighing scale platform by driving the pigs from behind and directing them to the way by opening and closing doors.

House design should facilitate hauling of the pigs and avoid stressful handling.

Pig catcher

It secures tusks of pig. It is a metal rod of 2ft long and square in cross section. At one end, there is a handle and at the other end, a metal cap through which a loop of wire passes. The loop is applied over the snout and behind the upper tusks. It is tightened and fixed by means of a ratchet. A simple and efficient pig catcher can be made from a bar of iron of about 3 ft long with a handle at one end and the ring at the other end. Slip the ring round the upper jaw behind the tusks. The bar should be bent downwards to afford the best restraint.



PIG CATCHER

Casting of pigs

Casting is throwing down the animal and securing the limbs for various purposes like surgical operation, castration or any other ailment that requires handling for sufficiently long periods.

Requirement

Long ropes, small ropes and two men

Procedure

- Apply a twitch to control pig before casting
- Tie two fore legs and two hind legs with small ropes
- Long rope is fastened to the rope joining the fore legs, leave the free end backward direction. Similarly, with another long rope tie the area that join hind legs and leave the free end to front side of pig.

- Instruct two men to pull ends of long ropes on each side to make the pig lie down and then secure the limbs to control the animal
- Tie fore legs at fetlock region
- Relieve the animal from knots sequentially soon after the purpose of casting is over.

2.5 IMPORTANT EXOTIC AND INDIGENOUS BREEDS OF SWINE

Exotic breeds of swine

The pigs of different breeds are recognized by the color, size, ear carriage and carcass quality. There are 10 recognized breeds classified according to the color.

- 1) White breeds : Yorkshire, Chester white and Landrace
- 2) Black with some white : Hampshire, Berkshire and Poland china
- 3) Black and white breeds : The Spotted
- 4) Red breeds : Duroc - Jersey and Tamworth
- 5) Red with some white : Hereford

Large white Yorkshire

- Origin: England
- It is very adaptable breed and found everywhere and more popular in India.
- It has large body, long snout, ears are big and triangular
- Body is covered with fine white hair, free from curls.
- Skin is pink in color free from wrinkles
- Line of the back is straight, hams are thick and well hung
- Neck is long and full to shoulders, chest is wide, deep extending below the elbows
- It excels all other breeds in litter size and possesses good mothering quality
- Tail is set high. Pasterns are strong and straight with clean feet

- Mature boars weigh 300-450 kg

Berkshire

- Origin: England
- Body medium, good width, length and depth with broad back.
- Black color, six white tips-one at end of each leg and one each on snout and tail
- Short snout, characteristic upturned nose, small prick ears
- Body is sticky, low on the ground
- Low prolificacy, produce good quality meat, least tendency to deposit fat

Landrace

- It is Danish breed and found everywhere.
- Long body, recti-linear profile head
- Back tends to be slightly convex
- It is excellent for lean meat
- Reduced chest capacity seems to be additional handicap in its ability to cope with heat

Hampshire

- Breed was developed in Kentucky from pigs imported from England
- It is not so stocky, color is black with a white saddle extending front and includes both front legs and feet
- It is smaller breed compared with meat breeds
- Sows are prolific and can be managed well on pastures
- It is short legged and sound on their feet
- Mature boar weight about 300 kg and sow about 280 kg

Tamworth

- Origin: Ireland
 - It has brown coat on white skin appear on shades from light to dark and hair coat is golden red in aged animals
 - Face is slender, ending in a long fine snout
 - Ears carried horizontally and forward
 - Sows are prolific, good bacon quality
 - The crosses with Berkshire are good

Duroc-Jersey

- It is bred in America from many crosses including red pigs.
- Head is slightly concave, horizontal ears
- Body coat is red brown
- Fecundity is good, excellent milkers
- Popular in south - East Asia

Poland China

- It is developed in USA from Russian breed and white pig of China.
- It has long head and droopy ears
- Black and white spots on body are due to introduction of Berkshire blood
- Produces excellent lean carcass

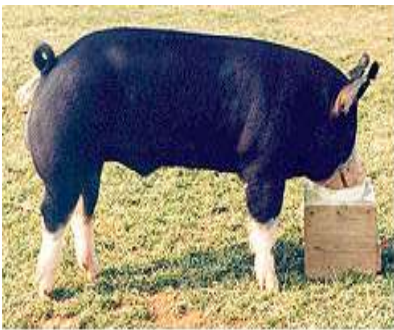
Hereford

- Origin: United States
- Color: Ideal marking for a Hereford are white head including ears, feet, underline, switch of tail. The remainder of the body is red in color.

Chester White

- Developed in USA from other breeds like Yorkshire, Cheshire and Lincolnshire
- It has white hair and skin.
- It is medium breed with all good qualities

BERKSHIRE



HAMPSHIRE



TAMWORTH



LARGE WHITE YORKSHIRE



LANDRACE

HEREFORD





Indigenous pig breeds

Ghungroo

- An indigenous strain of pig from North Bengal.
- High prolificacy and ability to sustain in low input system.
- Produces high quality pork utilizing agricultural byproducts and kitchen wastes.
- Mostly black coloured with typical Bull dog face appearance.
- Both sexes are very much docile and easy to handle.

Niang megha

- From Garo, Khasi and Jaintia hills of Meghalaya reared for pork and bristle purpose.
- The animals have typical wild look with erect bristles on dorsal midline and small erect ears extended vertically.

GHUNGROO

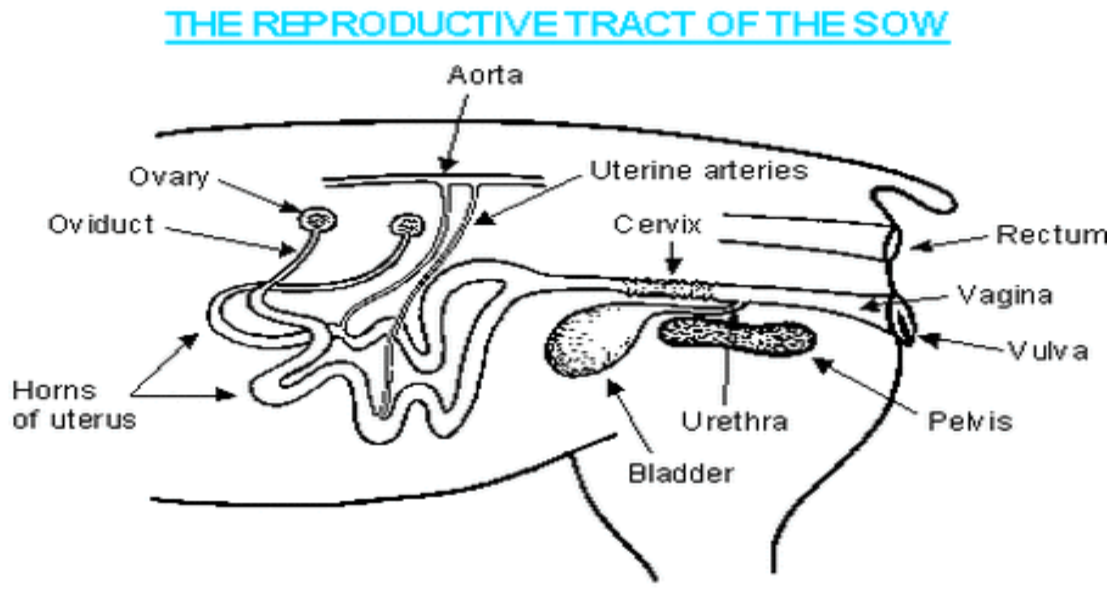


NIANG MEGHA



2.6 REPRODUCTIVE SYSTEM OF SOW AND BOAR

Reproductive system of sow



An understanding of the sow's reproductive system is essential for a successful mating program, whether AI or natural service is used.

The primary structures of the female reproductive tract are the [ovaries](#), they have two major functions:

- (1) to produce ova, the female germ cells
- (2) to produce the hormones progesterone and estrogen.

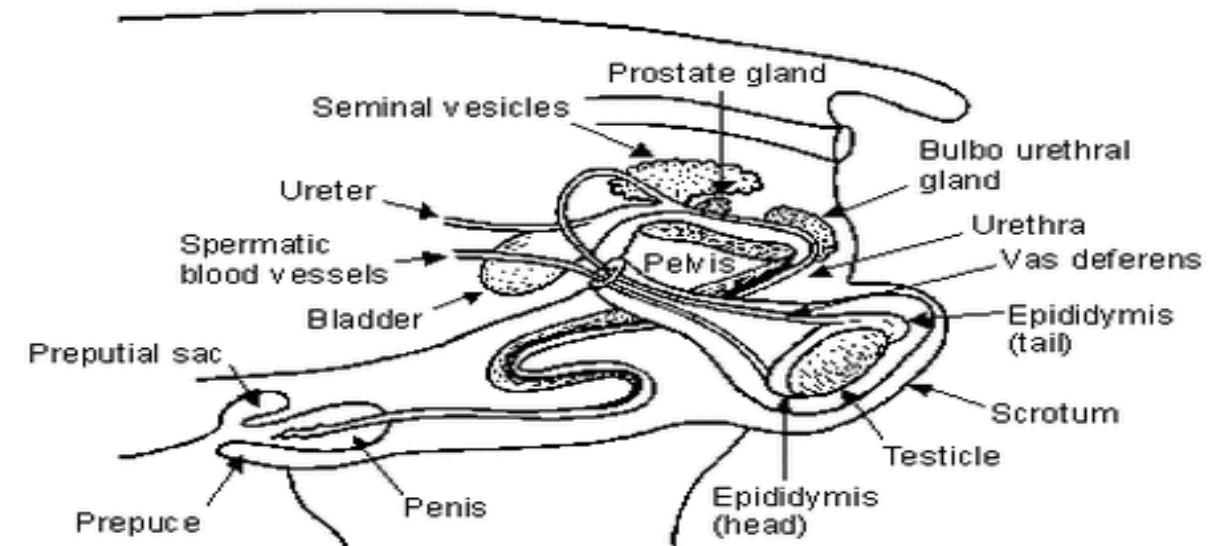
Each ovary is surrounded by a thin membrane called the [infundibulum](#) which acts as a funnel to collect ova and divert them to the oviduct. The [oviduct](#) is about 6-10 inches long and acts as the site of fertilization.

There are two [uterine horns](#). Each is 2-3 feet in length in the non-pregnant sow. They act as a passageway for sperm to reach the oviduct and are the site of foetal development. The [uterine body](#) is located at the junction of the two uterine horns. The [cervix](#) is a muscular junction between the vagina and uteri. It is the site of semen deposition during natural mating and AI. It is dilated during heat (estrus) but

constricted during the remainder of the estrous cycle and during pregnancy. The [vagina](#) extends from the cervix to the vulva and serves as a passageway for the piglets at birth. The [vulva](#) is the external portion of the reproductive tract. It often becomes red and swollen just prior to estrus and this swollen condition is usually more pronounced in gilts than in sows.

Reproductive system of boar

THE REPRODUCTIVE TRACT OF THE BOAR



The boar reproductive system consists of six different structures (testes, epididymis, deferent ducts, urethra, accessory sex glands, and penis) and the main function is the production and the ejaculation of semen. The two testes are the male gonads and their functions are sperm production and secretion of hormones. The main functions of two epididymis are sperm transport, sperm maturation, and sperm storage. The sperm maturation is a complex process after which sperm acquire progressive motility and fertilizing ability. Male accessory sex glands are the seminal vesicles, the prostate, and the bulbourethral glands (Cowper's glands). These exocrine glands release their secretion into the urethra and their secretory activity is androgen-dependent. The non-cellular fraction of the ejaculate (seminal plasma) is mainly composed of fluids from the accessory sex glands.

2.7 SYSTEMS OF BREEDING IN PIGS

I. Inbreeding : It involves mating of related animals for following purposes:

- (a) To increase homozygosity in progeny.
- (b) To develop inbred lines.
- (c) To keep animals pure bred.

This system is not adopted commercially due to the following adverse effects .

1. Decreases mean litter size with increase in age of pigs.
2. Causes slight decrease in post weaning weight.
3. Causes decline in milking and mothering ability of sows.
4. Delays sexual maturity in pigs.
5. Decreases sex libido in boars.
6. Reduce fecundity and prolificacy.

II.Out Breeding: It consists of mating of unrelated animals and systems of it are being extensively used for achievement of good results with regard to performance of pigs. The systems of out breeding are:

Out Crossing: This is the common method of breeding and multiplying pure bred swine which involves mating of unrelated animals of the same breed. Compared to inbreeding this system is better for crossing in breds for following advantages

1. Keeps animals pure bred.
2. Slight gain in litter size.
3. Helps to regain the vigour in animals.
4. Some increase in livability and growth rate.

Limitations:

1. Poor performance of inbreds.
2. Higher cost involved in development of inbred lines.

Grading-up: The non-descript indigenous pigs form the bulk of the pig population in the country. It involves use of boars of improved breeds with indigenous hogs. It will be advantageous to grade up bulk of indigenous hogs by successive use of boars of large white Yorkshire or Landrace breed. These two breeds were used in All India Coordinated Research Projects in the country. Following are the merits of this system:

1. Causes improvement in productive traits of vast population of non-descript pigs in India.
2. Suited to areas where high quality pure breeds cannot be maintained due to poor management and feeding conditions.
3. Increases fertility and prolificacy in successive stages.

Crossbreeding : For commercial swine production programme it is common method used in areas around bacon factories. It involves mating animals of two different breeds, i.e. crossing of Landrace sow with Yorkshire boar or vice-versa. Following are the merits of this method

1. Fewer embryonic losses.
2. Causes increase in litter size and uniform birth weights and weaning weight.
3. Crossbred sows wean larger litters/more weight at weaning.
4. Greater resistance to environmental stress.
5. Increase in growth rate.
6. Early age of maturity.
7. Increases livability of pigs and high vigour.
8. Regularity in breeding.
9. Increased efficiency of feed conversion.
10. Good mothering ability and higher milk production.

2.8. SELECTION AND CULLING OF PIGS

Selection of boar: The boar influences conception rate, litter size and contribute one half of the genetic makeup of his progeny. Boar selection is very important because the boar becomes the parent of more offsprings than the female as the normal boar: sow ratio is 1: 15 to 20 sows.

The following are the important criteria for selection of boars for breeding purpose.

1. They must be offsprings of better producing gilts and sows and should be a good representative of the breed with pedigree and conformation.
2. They must belong to a litter with size and weight of not less than 8 and 72 kg respectively at weaning.
3. They should have signs of masculinity with good testicular development and at the same time should possess good temperament and docility.
4. They must possess traits of meaty hog ie. body length, depth, height, skeletal size, muscle size and shape.
5. They should be free from physical defects and must possess soundness of feet, legs, underline, and body capacity and should have mating ability.
6. They should have high average daily gain and high feed conversion efficiency.

Boars satisfying above stipulations are subjected to preliminary selection at 5 months of age, provided they attain a body weight of at least 60 kg. Final selection of boars should be undertaken at 7 months provided it has attained a body weight of at least 90 kg. An irritable boar difficult to drive and one, which is inclined to fight may transmit a nervous disposition to the piglets. This may make them poor mothers.

Selection of sow/gilt: The sow productivity has improved very much in recent years due to careful selection and culling pressure. The sow also contributes half of the genetic material to its progeny and the mothering ability of the sow can make difference in raising viable piglets out of the total farrowed. The important criteria for the selection of sow and gilts are

1. They should be selected from mother pigs having good mothering ability as shown by large litter size and weights at birth and at weaning of piglets.

2. They should have well-developed udder with 12-14 functional teats and at least 6 teats in each row evenly distributed on belly side.
3. Teats of sow must be free from all abnormalities like inverted teats and blind teats.
4. They should have good mothering ability with quiet disposition.
5. The sow should have good reproductive soundness and normally developed reproductive external genitalia.
6. Select sows that are already bred at least once with minimum back fat thickness.
7. The sow must be able to produce numerous viable young ones each year.
8. Sow must be ready for re-breeding towards the end of lactation.
9. Gilts should have sound feet and legs as defects interfere with normal breeding, farrowing and nursing functions.
10. Select the fast growing lean gilts, which are sound and from large litters.

Sows that fail to rebreed, which have small litters, fail to nurse or having farrowing problems should be culled.

Culling of Boars: 20% of the breeding boars are annually culled and replaced with young stock. The parameters for culling are - Boars of over 5 years of age, those with irritable nature and nervous disposition, those not true to the breed, infertile ones, those which are over fat and too heavy, those with weak limbs and cryptorchids, apart from genetic merit.

Culling of Sows : One third of the older sows are annually culled. Gilts and sows not settled after the breeding period, nervous and irritable ones, those which produce small litter, sows with defective teats like inverted and blind teats and poor milkers and those with small external genitalia are culled. Gilts and sows that do not meet the standards of meaty hogs are also culled.

2.9 HOUSING FOR DIFFERENT CLASSES OF PIGS

Ideal conditions for locating the pig farm are

- Should be nearer to market
- Provision for good water supply, transport and electricity .
- Requires good drainage facility for effective disposal of waste material
- The structure should be at least 45m away from dwellings and factories, 30m away from dairies, poultry houses and storage structures, 45m away from a fire source and 1km away from garbage dumping ground, slaughter houses, hide curing centers and tanneries.
- The boundaries of the site should be at least 50m away from the nearest transit road and should be properly fenced.
- Provide adequate space between buildings for future expansion and better biosecurity.
- Strict bio security measures to be adopted

Floor space requirement of pigs

Type of animal	Covered floor	Typical dimension	Open yard
Animals/ pen	area/animal (m ²)	(m)	area/animal (m ²)
Boar	6.25-7.50	2.5x2.5 (or) 2.5x3.0	8.8-12.0
Farrowing sow	7.50-9.00	2.5x3.0 (or) 3.0x3.0	8.8-12.0
Dry sow/gilt	1.80-2.70	0.8x 1.2 (or) 1.2x 1.5	1.4- 1.8
Weaner/fattening pigs	0.96-1.80	0.8x1.2 (or) 1.2x 1.5	8.8- 12.0

Feed Space and water space requirements of swine

	Boar	Farrowing Sow	Weaner/fattening Pig	Dry sow/gilt
Feeding space (cm)	60-75	60-75	25-35	60-75
Water space (cm)	6-7.5	6-7.5	2.5-3.5	6-7.5
Manger/ Water trough (cm)				
• Depth	20	20	15	20
• Width	50	50	20	50

PIG HOUSES FOR DIFFERENT CLASSES

Pig house is known as sty. Each sty may have one or more pens and in each pen one or more animals can be housed depending on sex, age etc. In large scale commercial piggeries different type of sheds like boar sty, farrowing sty, dry sow sty, fattening pig sty, sick animal sty may be constructed for better management.

Boar house: Boars should be housed single to avoid fighting. Each boar sty should not have more than 24 pens under one roof and each pen should not have more than one boar. Cooling device like sprinkling, fogging or wallowing is mandatory in the breeding boar pen.

Dry sow house: Non lactating sows are housed. Yard is shared by several sows. Each sty should not have more than 40 pens and each pen should accommodate not more than 5 -10 pigs depending on the stage of pregnancy.

Farrowing house: Pen size is 2.5m x 3.0 m with 1.6m alley. Place guard rails 25 cm above floor level and 20cm from the pen wall. The guard rails should provide comfort to sow and expose both row of teats. Provide infrared lamps for warmth of piglets. Provide bedding

material like straw in the farrowing house for comfort. To keep the piglets well away from the mother and to avoid possible crushing the young ones by the movement of mother, one compartment (creep box) with dimension 2.5m (length) x 0.75m (breadth) x 1.2m (height) may be provided along the inner walls of the farrowing pens. About 2 or 3 openings may be provided with dimensions of 2.5 ft to the wall of compartment to facilitate movement of piglets. Each farrowing sty should not have more than 40 pens and each pen may accommodate one sow with its litter.

Farrowing crate: Farrowing crate is a tubular crate made of GI pipes, prevent the sow flopping from the standing position directly on to her sides. It forces the sow to lie down on her belly first before rolling over onto either side and at the same time provide enough space for the sow to stand up and lie down but restricting lateral movements.

FARROWING CRATE



Fattening Sty: Each fattening sty should not have more than 30 pens under one roof and each pen may accommodate 15-30 pigs for fattening.

Weanear pig sty: Piglets that are weaned are housed in these pens up to 6 months of age. Each sty should not have more than 30 pens under one roof and each pen may accommodate not more than 30 piglets in each pen.

Grower/Finisher Housing: Design central feeding alley on either side of pens with feeding trough on lengthwise. Pen of 5m length X 4.25 meter width is suitable for accommodating 15 pigs up to body weights of 40 kg and 10 pigs between 40-90kg. During summer thin the herd.

Sick animal sty: The number of pens under each sty would depend upon total no of pigs kept. Accommodation for 5% of the total stock should be provided.

Wallowing tank: It is a water pool where hogs enter into water and cool their body in summer. It is essential to reduce heat stress. A wallow of 3m length, 2m width and 45cm depth will easily hold a herd of 20 hogs.

Different components of indoor piggery

1. Resting area / covered area.
2. Feeding or watering space.
3. Dunging or exercising area/ open area.
4. Drainage
5. Feeding Passage: A feeding passage of 1.3 m in width is essential.
6. Waste disposal area: (manure pit) Minimum 100 m away from pen.
Two rectangular pits of 3m x 2.5m x 2 m will be sufficient for 50-60 adult pigs for disposal of dung & other waste.
7. Feed store room: depends on animals & quantity of feed obtained.
8. Equipment & tools room
9. Medicines and first aid
10. Slaughter house & weighing room

Details of house construction

Floors

- Provide slope of about 3 cm for every 2m to allow easy cleaning
- Should act as insulation against cold and damp.
- Should be ideal for footing and non slippery .It must be of cement concrete with surface made of balloon type or corrugated
- Should with stand to rooting and digging by pigs. Follow pucca flooring even in low cost housing.

Roofing: The roof should be water proof and materials should be bad conductor of heat. Roofing materials can be asbestos sheets, G.I. corrugated sheets or tiles.

Walls: Depending upon the climatic conditions raise the wall for protection of pigs. Wall must be strong. Construct the wall up to a height of 1.2 meter with brick and cement. Width of the door may be 75-90cm and height 90cm.

Height of shed: Height of shed must be sufficient to expel foul odour and allow as much fresh air as possible into pen. The optimum height of shed at eaves must be 200-250cm.

Drainage: The sties should be provided with proper drainage. The minimum width of the drain should be 0.25 meter with a slope of 2.5cm for every 10 meter

2.10 CARE AND MANAGEMENT OF DIFFERENT CLASSES OF PIGS

Care and management of breeding stock: House the boar individually in separate pens. The boar should be provided with adequate space and ventilation and should be given proper exercise. Maximum number of services per boar are 3/day, 12/week, 40/month. Gilts should be bred at age of 8-12 months of age weighing around 90-100kg on their 2nd or 3rd heat period. Introduce boar to the gilts 10-15 minutes every day. This is more useful in gilts exhibiting weak oestrus. Keep the house clean with controlled environmental conditions to avoid stress on animals. Flush the gilt or sow two weeks before breeding so as to gain about 500g body weight per day. For this feeding of good ration with 16% of CP balanced with minerals and vitamins is adequate. Flushing helps in shedding of more number of ova, increase in ovulation rate and thus increases litter size and minimizes embryonic losses.

Signs of heat:

- Sow becomes restless and goes off feed. Frequent urination can be observed.
- Swelling and reddening of vulva. Sow mounts on other animals.
- It shows male seeking behaviour. When pressure is applied on the back of animal the animal stands still without any movement. This posture is called wooden horse posture. This condition is called standing heat. Lardosis- arching back sign.

Estrus period in sows lasts for 2-3 days. Ovulation occurs 38-42hrs after start of estrus. So sow should be mated on second day of heat preferably 2 services at 12-

24hr interval. Female if not bred will repeat heat at 21 days interval. Record the dates of mating, expected farrowing keeping in view the gestation (pregnancy) period of 114 days.

Important reproductive parameters of swine:

PARAMETER	AVERAGE VALUE
Age at puberty of gilts	6-7 months
Breeding age of gilts	9-12 months
Breeding weight of gilts	90-100kg
Breeding age of boar	18-24 months
Length of oestrus cycle	21 days (19-23)
Duration of heat	2-3 days
Mating time	2 nd day of heat
Gestation period	114 days (3 months 3 weeks 3 days)
Weaning	56 days
Average litter size at birth	10-14
Average litter size at weaning	8-10
Farrowing interval	6.5-7.5 months
Period of mating	15 days after weaning

Management of pregnant sows: Provide floor space of 3sq.m for each sow. Keep the sty clean, dry and non-slippery. Provide calm environment. Avoid rough treatment like pushing, kicking which spoil the temperament. Offer clean, safe, odourless water at all times in the sty. Provide bedding of 8-10cm chopped straw in the covered area. Increase the amount of feed during last month of gestation because major growth of foetus takes place in this period. Provide balanced ration. Allow free access to leguminous greens like cowpea, lucerne.

Management practices during and after farrowing: Farrowing is one of the most critical stages in the whole reproductive cycle of pigs. Problems at this stage lead very quickly to high mortality rates and reduced efficiency of both sows and piglets. Deworm the sow 2-3 weeks prior to farrowing with broad spectrum anthelmintics like Albendazole, Fenbendazole @ 10mg/kg BW. All equipment must be thoroughly cleaned and disinfected prior to their introduction into the pen. Move the sow to farrowing pen at least a week before farrowing .

Sows may be allowed to farrow in farrowing pens equipped with guard rails and creep boxes or in farrowing crates and provide a bedding of 8 -10cm of chopped straw under the covered area in the farrowing pen. Introduce farrowing crate into pen well in advance for sow acclimatization. It saves floor space and avoids injury to piglets. Keep the sow clean. The sides, underline, feet and legs of sow should be brushed and washed with soap water. Insecticides like Deltamethrin, Cypermethrin should be sprayed to prevent insects on body. Trim the overgrown long toe of sow to minimize crushing injuries. Restrict unauthorized persons into farrowing pen. Thorough biosecurity measures should be followed. Reduce the ration by 1/3rd till farrowing. Provide bulky ration and withdraw feed 12hrs before farrowing. Provide plenty of fresh drinking water to avoid heat stress. Avoid constipation in sow before farrowing. Bran, any green stuff or extra fat supplementation in diet facilitates easy farrowing in case of constipation . Provide warm condition in the pen when temperature drops below 50° F. Use heat lamps or pig brooders or infra red heat lamp. The bulb should be 250 watts. Place brooder 30” above the top of bedding.

Signs of farrowing: Sow shows increased restlessness and start making nest by rearranging the bedding .Milk letdown in teat is seen one day prior to farrowing.

Care is needed in case of difficult farrowing particularly gilts if the piglets are relatively large. An attendant should watch the sow during farrowing to prevent crushing of piglets by the mother, to remove the born piglets and also to clean mucus from the air passages of the piglets. It generally takes 2-4 hours for complete farrowing and dropping of placenta. A time gap of more than 30 minutes between presentation of piglets indicates dystocia. At this stage introduce hand (washed in disinfectant, later soap water) into birth passage and release stuck piglets .If necessary give oxytocin injection for aiding farrowing. Passage of after-birth (placenta) is only sign that farrowing is completed. Remove after birth membranes and soiled bedding and clean the sow with lukewarm water and allow her to

suckle young ones.

Provide feed to the sow 12 hours after farrowing. Feed half of the ration on the first day and to increase the ration to 200 to 300g daily until she is full fed. Feed sow with good ration to produce 3-4 kg of milk per day for nursing piglets. Provide plenty of water to sow to replenish about 8 liters of body fluid loss from uterus during farrowing. Failure to provide water can cause agalactia. Immediately after farrowing, sow should be examined for any disease problem particularly MMA syndrome (Mastitis-Metritis-Agalactia syndrome). If symptoms are seen treat animal with symptomatic treatment. Swab the sow's udder with a saturated solution of ferrous sulphate, zinc sulphate and copper sulphate to prevent nutritional anaemia in piglets.

Care and Management of piglets: Immediately after birth the navel cord should be cut at a distance 2.5cm from the body with a sterilized scissor and disinfect with tincture iodine. Clear the mucus from nasal passages and on the body and keep the piglets warm. The piglets should suckle the mother immediately after birth. Piglets obtain high energy colostrum by suckling first time within 45 minutes after birth. Assist the weaker and lighter pigs (less than 1 kg birth weight for exotic breeds) to move to suckling mother so as to receive antibody rich colostrum to protect from early infection. In case of poor mothering ability or orphan piglets an artificial milk feeder or cross fostering is practiced.

For better survival of piglets ensure:

Optimum environmental temperature

0-1 wk	25-30°C
1-5 wk	22-27°C
5-8 wk	19-24°C
< 50 kg	18-24°C

Cross-fostering: When sows farrow within a few hours of each other, transfer some of the piglets from large litter size to sow with small litter. It is advisable to transfer bigger piglets on to foster mother.

Split suckling: Piglet from large litter when had a good suckle of colostrum (approximately one hour at udder) they are shut in warm box, the next two hours give chance for

remaining smaller piglets for their share colostrums. This can be repeated twice in the first 18 hours.

Small and weak piglets can be fed on stored colostrum. It can be obtained by milking sows before they farrow, or during farrowing and stored in deep freeze. Piglets can be fed on this through bottle feeding. If milk is not available with sow, feed piglets on cow's or goat's milk.

Piglets under confinement system of housing must be given iron (infeon 1 ml) intramuscular injection on the 4th day after farrowing and thereafter 14th day to prevent piglet anemia. If injectables are not available ensure oral intake of ferrous sulphate. This is practiced by smearing the saturated ferrous sulphate solution on teats or it can be made available in the pen.

Piglets at birth have sharp corner and canine teeth (8 needle teeth) and cause injury to teat while suckling. Clip the needle teeth with the help of sterilized cutting plier without causing injury to gums.

CLIPPING OF NEEDLE TEETH



Piglets are identified immediately after birth by painting with silver nitrate solution and later by permanent identification methods like tattooing or ear notching. Ear notching is simple and effective method. Poly urethane ear tags are also used now a days.

Weaning piglets earlier than 5 weeks may cause problems like diarrhoea and diseases

in piglets.

Castrate the excess male piglets at 2-3 weeks age. It often avoids boar taint to meat.

Vaccinate healthy piglets as per the vaccination schedule and deworm the herd at least once in a month.

Creep feeding: Milk supply of sow reaches peak by about 3 weeks after farrowing and thereafter declines. It is necessary to introduce solid food to piglets to make up the shortfall in nutrients supply from milk. Creep ration is required for uniform higher growth rate of piglets within the litter. Reduces digestive upsets and acclimatizes the system and prepares for larger intakes of solids. It improves the sow condition and makes fit for rebreeding by reducing the drain of nutrients from sow.

Creep feed is specially prepared based on the nutrient requirements of pigs up to 8 weeks of age or at 2-5, 5- 10, 10-20 kg body weight. The ingredients must be easily digestible Eg: skim-milk powder, unsaturated fats and quality protein. Other ingredients are maize, soybean meal etc. Offer creep feed to piglets at one week age onwards in very small amounts and gradually increase as per the appetite up to weaning. Provide fresh water for piglets.

2.11 SWINE FARM ROUTINE

Time	Activity
08-00-10.00	<ul style="list-style-type: none"> • Cleaning pig sheds, farm premises, • Isolation of sick animals, • Offer feed to breeding animals when they are on limited feeding. • Offer <i>ad libitum</i> feed to growers and other stock depending on the need. • Isolation of in- heat pigs and their breeding

	<ul style="list-style-type: none">• Periodical weighing, clipping needle teeth of baby pigs, castration and vaccination, ear notching, sale of market stock.
10.00- 12.00	<ul style="list-style-type: none">• Daily-disinfection of sheds.• Bring back breeding herd from pasture and bring afternoon during winter• Disposal and conservation of manure.• Washing of pigs• Periodical de worming, treatment• Preparation of feed
12.00- 13.00	<ul style="list-style-type: none">• Lunch
13.00 – 17.00	<ul style="list-style-type: none">• Feeding• Cleaning off all sties• Transfer of near - parturition sows and gilts into farrowing pens.• Periodical-weaning of piglets• Weekly scrubbing, white washing of interiors of sheds• Attending to farm purchases• Marketing of finisher pigs

2.12 DENTITION AND AGEING OF PIGS: Adult pigs have 44 teeth. Of these 12 are incisors, 4 are tusks, 16 are premolars and 12 are molars (with half of each type of teeth on each jaw). The tusks or canine teeth are more prominent in males than in females.

The dental formulae of pig are

- Temporary dentition: $\frac{3}{3} \frac{1}{1} \frac{3}{3} \frac{0}{0}$ = Total teeth=28
- Permanent dentition: $\frac{3}{3} \frac{1}{1} \frac{4}{4} \frac{3}{3}$ = Total teeth=44

Eruption of the pig's teeth is peculiar in many ways. The corners erupt first, then the centrals and lastly the intermediaries or the second pair. Regarding the molars, the first tooth in each jaw immediately behind the tusks erupt by five to six months of age and remains throughout life while the next three premolars are represented in temporary dentition; the permanent ones replacing the temporaries in the normal way. The last three cheek teeth in each jaw are normal permanent molars. By about 5 months all the temporary teeth will be present. At the age of 6 months the corner temporary incisors are replaced by permanent teeth. The permanent centrals and permanent intermediaries will replace temporary teeth by one and one and half years, respectively. By this age all the permanent teeth will have erupted.

2.13 IDENTIFICATION OF PIGS

Pigs are commonly identified by ear notching method.

Ear-notching

Purpose: It is required for identification of pigs. Follow any standard method to locate the numbers on both the ears. It is performed immediately after birth.

Equipment: Ear-notching plier, cotton swabs, antiseptics.

Method: Choose the number and identify the area for placing the marking on the left or right side. Hold pig on the table. Cut the edge of the ear(s) into 'v' shaped notch with the help of the sterilized plier or ordinary scissor. Notch should not be too superficial or deep. Apply antiseptic to the notch till healing takes place.

EAR NOTCHING



2.14 WEANING: Separation of young one from suckling mother is called weaning. Normal weaning age of piglet is 8 weeks. Young pigs weaned at an early age particularly at 3 weeks face stress. The stress can be due to psychological feeling of separation from its dam, social stress from other litter, stress while in the new pen, associated with diet change or may be sensitive to infection due to non availability of immune bodies from colostrums.

Management considerations

- Minimize handling of pigs just before weaning
- Encourage as much as creep feed intake to piglets and continue it at least 2 weeks after weaning. For high growth, young pigs are recommended *ad libitum* feeding.
- In case of scours, reduce the feed intake and treat with suitable antibiotics to bring back normalcy.
- Probiotics in feed can help to build immunity against stress and improves feed efficiency
- Group the pigs according to their body weight at weaning from different litters
- Supervise the group for at least few hours alternatively smear oil on pigs to avoid fighting.
- Provide optimum floor space, feeder and water space and environmental conditions to piglets
- Weak and small pigs are allowed to remain with sow. Practice technique of 'split

weaning' i.e. larger pigs are weaned first.

2.15 CASTRATION

Purpose: A pair of testicles is removed at 3-4 week age to avoid boar taint to meat and also for good conformation just at the time of maturity of pig. Often it is not practiced because the boars are sold prior to attaining the maturity.

Equipment: B.P. blade, scissors, cotton swab, artery forceps, antiseptics.

Method: Secure and restrain the pigs. Follow aseptic measures. Make an incision with a BP blade on midline and draw out the testicle and cord. Cut the cord leaving one or two inches. Similarly remove the other testicle and left it open or suture it. Apply antiseptic to the area till wound heals.

2.16 SLAUGHTER AND DRESSING OF PIGS

SLAUGHTER OF HOGS:

Management steps before butchering hogs:

1. Do not feed hogs 24 to 30 hours before killing but fresh clean water be offered free of choice for the following reasons :

- (a) Prevents fermentation and formation of gases in stomach and intestine.
- (b) Removes contents of stomach and intestine.
- (c) Helps in cleaning of organs.
- (d) Makes easier to get good bleed.
- (e) Saves feed.
- (f) Meat cures better because blood vessels are free of blood.

2. Animals before slaughter should not be excited or over heated because this may cause increase in body temperature which may cause pork to become sour.

Methods of Slaughter of Pigs:

- (i) Traditional methods (a) With pointed knife (b) With pointed rod
- (ii) Neck Cutting
- (iii) Scientific method or modern method of slaughter.

It includes following steps:

Steps for butchering:

1. Pigs are made insensible by such means as electric current, axe, gunshot, captive bolt stunner/pistol.
2. **Shackling** : Hogs are secured from the hocks of hindlegs and then hoisted on Overhead rails keeping its head down.
3. **Sticking** : Take a long double edged knife and insert just in front of the breast bones directly over midline.

When knife is inserted 15 to 20 cm. deep (according to size of the hog) it is given a quick turn and then withdrawn. This bleeds the hog to death. The animal is allowed to bleed for few minutes.

4. **Scalding** : Place the hog in scalding water in a vat for few minutes at the temperature of 65°C. It helps to loosen the hair and scurf.
5. **Scraping** : After scalding hog is lifted on to a platform for removal of hair by scarping with candle stick scraper, or the pig is elevated on to a dehairing machine to remove hair mechanically. Remaining hair on legs or body may be scarped out by knife.

Note : Some people prefer to remove skin of the hogs rather than scalding and scraping.

6. **Hoisting and overhead rails** : The scraped out hog's carcass is returned to overhead rails and hanged by inserting the gambrel stick in the tendons on the back of the hind legs.
7. **Dressing** : It includes following steps :
 - (a) Washing and singeing (burning bristles after killing)
 - (b) Removal of head.

(c) Opening the carcass and evisceration.

(d) Splitting the carcass with saw.

(e) Removal of fat.

(f) Exposing the kidney for inspection.

(g) Washing the carcass.

(h) Storing of pork at 1 to 2°C.

8. Dressing percentage: It depends upon age, sex, condition of hog, style and quality of dressing. In general the average dressing Percentage of pig carcass is 70%.

Short type answer questions

1. Explain the farrowing and creep feed terms
2. Explain bacon and pork terms
3. Write any eight external body parts of pig
4. Write any six names of exotic swine breeds
5. List out the parts of reproductive tract of sow
6. List out the parts of reproductive tract of boar
7. Explain culling of boars
8. Explain culling of sows
9. Explain management of pregnant sows
10. Write about signs of farrowing
11. Explain castration in pigs
12. Explain piglet anaemia
13. Write about weaning of piglets
14. Explain dressing per cent in pigs
15. Explain guard rails in pig housing

Long type answer questions

1. Write the advantages and contribution of pig farming
2. Write briefly about the restraining of pigs
3. Write briefly about any four exotic breeds of swine
4. Explain briefly about systems of breeding in pigs
5. Write about the various buildings in pig farm
6. Write about care and manage of different classes of pigs
7. Explain routine activities of swine farm
8. Write about the identification methods of pigs and weaning of piglets
9. Explain the slaughter and dressing of pigs

UNIT-3

RABBIT PRODUCTION

Structure

- 3.1 Common terms used in rabbit production
 - 3.2 External body parts of rabbit
 - 3.3 Important indigenous and exotic breeds of rabbit
 - 3.4 Housing for different classes of rabbits
 - 3.5 Selection and culling of rabbits
 - 3.6 Systems of breeding in rabbits
 - 3.7 Care and management of different classes of rabbit
 - 3.8 Rabbit farm routine and miscellaneous activities in rabbit farm
 - 3.9 Identification and weaning
-

3.1 COMMON TERMS USED IN RABBIT PRODUCTION

Doe – A mature female rabbit used for breeding

Buck- A mature male rabbit used for breeding

Kit – A young rabbit whose eyes are not yet opened

Bunny- A young rabbit below 20 weeks age

Fryer- 10-12 weeks old rabbits ready for market

Roaster – Culled rabbits

Kindling – Parturition

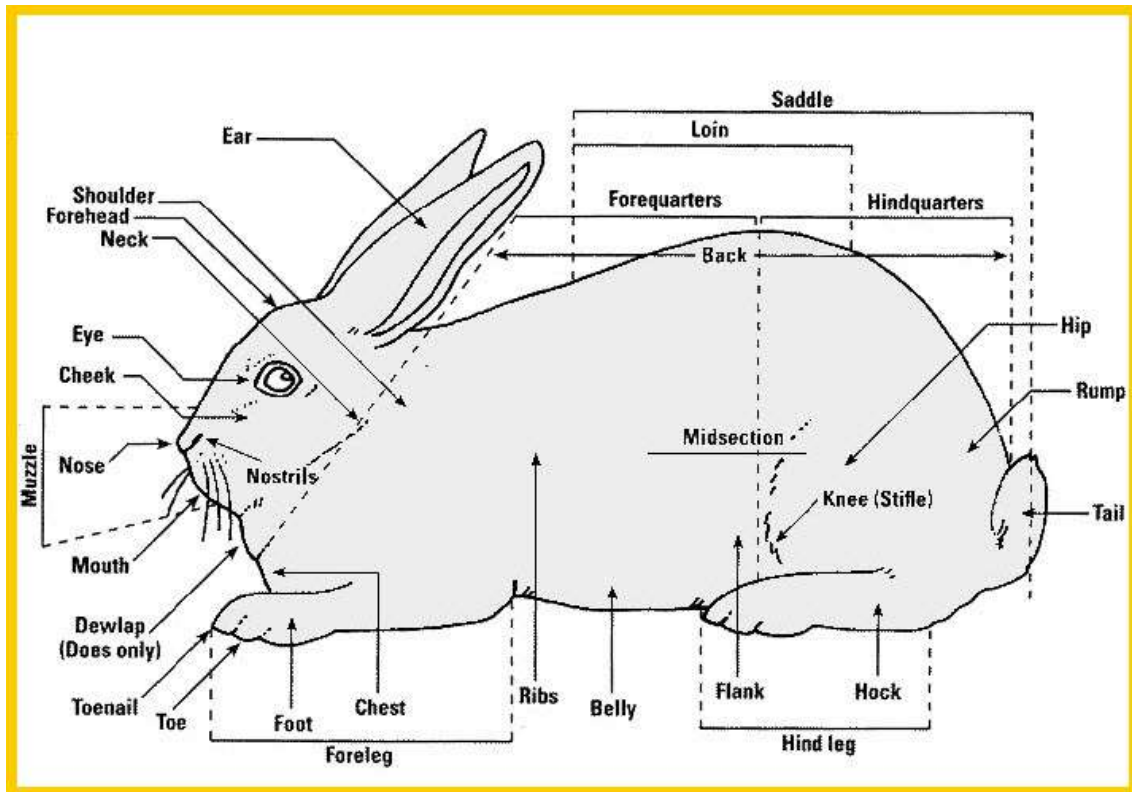
Litter- Kits born in a single kindling

Weaner- A newly weaned rabbit

Fur- Wool

Pelt- Skin

3.2 EXTERNAL BODY PARTS OF RABBIT



3.3 IMPORTANT EXOTIC BREEDS OF RABBIT

Rabbit breeds can be classified based on size and utility as follows:

I) Based on utility

- 1) Meat breeds
- 2) Wool breeds

II) Based on size

S.No	Size	Kgs	Breeds
1.	Large	>5 Kgs	Flemish giant, French lop, Chinchilla giganta White giant etc.
2.	Medium	3.5 – 5 Kgs	Newzealand white, Californian white, New zealand red etc.
3.	Small	2.0 – 3.5 Kgs	Dutch, Himalayan etc.

Large breeds

1. Flemish giant: Native of Belgium. Grey colored. These are the largest rabbit breeds in the world. An adult Flemish giant has a wide back and weighs 5 – 6 kg. Available in different colours.

2. French lop: Native of France. Ears are long, broad and drooping. French lop is a massive, cubic animal and weighs more than 5 kg.

3. Chinchilla giganta : Native of France. These are fairly large and grey in color. They mature early and have a good meat to bone ratio. It is an ideal meat and fur breed . Noted for its growth rate and good meat qualities. An adult chinchilla weighs about 5 kg.

4. The Blanc de Bouscat :Native of France. They are large white colored breeds weighing more than 5 kg. The fur is of excellent quality.

5. White giant: White in colour. Known for its prolificacy and fast growth.

Medium Sized Breeds

1. Newzealand white: The most popular medium sized rabbit breed used for commercial rabbit meat production. White fur and skin is albino. The eye colour is red due to the absence of melanin pigment. Native of Newzealand. An adult weighs 4.5-5 kg. Noted for their rapid growth rate, better feed conversion qualities, good carcass characteristics and their ability to adapt to different agro climatic regions.

2. Californian: Native of USA. The second most popular breed used for commercial rabbit meat production. This breed has a white body with black extremities i.e., black on the nose, ears, feet and the tail. Adult Californian rabbit weigh 3 to 4.5 kg. They have a better meat to bone ratio than Newzealand white.

3. Argente Champagne: Native of France and one of the oldest fur breed of rabbit. Color light to dark grey. Raised mainly for its fur. Body weight ranges from 3.5 – 4 kg.

4. The Beveren : Native of Belgium and appears blue in colour. They have a silky, dense and lustrous coat. Mainly raised for their fur qualities. They are also raised for their meat qualities and the adult weighs 3 to 3.6 kg.

5. Newzealand red: Native of USA with reddish brown color. Noted for their good mothering qualities and a good meat to bone ratio. An adult Newzealand red rabbit weighs 3 - 4.5 kg.

Small / Fancy breeds:

In general the smaller breeds of rabbits are mainly used for fancy or as pets, though some of them are used for meat and their fur qualities.

1. Angora: One of the oldest domestic breed of rabbit which is native of Turkey. The Angora is the only wool producing rabbit in the world. They are white in color. Though it is a smaller breed weighing 2.5 – 3 kg it looks bigger because of fluffy appearance. The annual wool production is 150 – 250 g/year.

2. The Himalayan: One of the oldest fancy breeds originated from China. Although used to some extent for laboratory work, main utility is an exhibition animal. It makes an excellent pet, being very docile. Color is white and the extremities i.e, ears, nose, tail and feet appear either black, blue or chocolate. An adult animal weighs 2 – 2.5 kg.

3. Dutch: Native of Holland. Small compact, early maturing rabbit. It is noted for its very good mothering ability and hence a popular choice as a foster mother. 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. Mainly used as exhibition breed. Have good carcass traits. Hence they are crossed with large breeds, for meat production. An adult Dutch weighs 2.5-3.5 kg.

FRENCH LOP



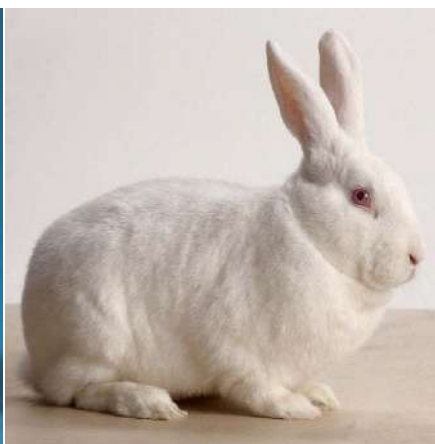
CHINCHILLA



CALIFORNIAN WHITE



NEWZELAND WHITE



ANGORA



DUTCH



3.4 HOUSING FOR DIFFERENT CLASSES OF RABBIT

General guidelines for housing of rabbits

Rabbits need to be housed to protect them from running away. The essential features of rabbit housing include

- Sufficiently large with right dimensions for the purpose for which it is intended.
- Comfortable and escape proof
- Sanitary and capable of being cleaned easily
- Convenient for the easy handling of stock
- Well constructed of sound materials but as cheap as possible
- So constructed that the animals hurt neither itself nor the hutch
- So designed to allow free air but to prevent drafts
- Well lit to facilitate easy feeding and watering.

Rabbit hutches

Rabbits are housed in cages called hutches. The hutches can be made of wood and wire netting or with wood or wire mesh alone depending on the availability and cost considerations. The cage floors should be made of 14 or 16 gauge thick wires with a mesh size of 19 mm x 19 mm. The walls and roof can be constructed of lighter wire (16-20 gauge)

with a mesh size of 25 mm x 25 mm. Aluminium is the best material but metal which has been galvanized after welding is also resistant to corrosion.

Hutch door: The hutch door should be large enough to allow every part of the hutch to be reached easily by hand and should therefore measure about 40x 40 cm.

The hutches may be made to hang from the roof ceilings supported by iron bracket, from the side walls or supported from the ground by iron frames. Whatever the arrangements the hutches should be at least 50 cm above the ground and 90 cm away from the walls to facilitate proper ventilation.

Arrangement of cages inside the rabbit house

Inside the building the hutches can be arranged in different ways, depending on the size of the building and the system of manure collection.

1. Flat deck system: In this system cages are all on one level. They open at the top.

Merits:

- Convenient supervision and handling of animal.
- More animal comfort
- Facilitates better ventilation

The main drawback of the system is the low animal concentration per square metre of building which increases the investment per animal.

2. Compact batteries: Here the cages are closely packed one above the other and the wastes are removed by conveyor belt or vats can be installed beneath the cages. Cages open from the front. Main advantage is that the maximum animal density reduces the cost per animal housed.

Drawbacks:

- Problems related to ventilation, access and supervision of cages
- Quicker wear and tear of materials
- Poor distribution of light for breeding does

The nest boxes:

These are one of the important equipments in rabbit production. The purpose of the nest box is to reproduce conditions in the burrow of a wild doe and protect young against attacks from the outside environment. The recommended dimensions of the nest box are 40 cm x 30 cm x 30cm (height)

The important hutches that are to be kept in a commercial rabbitry includes hutches for

- (a) Does with litters
- (b) Young females reared as replacements
- (c) Breeding bucks and
- (d) Colony hutches for fattening purpose.

The breeding hutch:

These are used for housing does from a few days prior to kindling upto weaning time.

Size of rabbit	Dimensions of hutch (cm)		
	Length	Breadth	Height
Large (over 5kg)	140	75	60
Medium (4-5 kg)	120	75	55
Small (2.5 – 4 kg)	100	75	50

If the doe is removed at weaning time the breeding hutch can accommodate a litter of up to 10 young rabbits until they are ready for slaughter.

Colony hutches:

These are used to house the young rabbits from weaning until they weigh 2 kg each. As a rule of thumb a floor area of 0.2 m² should be provided for every kg weight of rabbit housed. The dimensions of the colony hutches are as follows.

Number of rabbits kept together upto 2 kg weight	Dimensions of colony hutch floor	Area of colony hutch floor
5 rabbits	2m x 1m	2 m ²
10 rabbits	2m x 2m	4 m ²

15 rabbits	2m x 3m	6 m ²
20 rabbits	2m x 4m	8 m ²

3.5 SELECTION AND CULLING OF RABBITS

Selecting the does

Select the new breeding does when they weigh 2 kg

A doe selected for breeding must have at least eight teats, so that she can feed eight bunnies

The doe should be in good physical condition, good health and growing well and it should not be too fatty

The dam of the selected does should possess the following commercial characteristics

Young born per litter	6-12
Young reared per litter	6-8
No. of litters per doe per year	5-6
No. of young reared per doe per year	25-40
Live weight gain(no. of weeks to reach 2kg body weight)	8-10 weeks
Dressing percentage	50-55%
Feed conversion ratio	4:1 to 3:1

Selection of Bucks

1. Choose the bucks when they weigh about 2 kg
2. The buck selected should have 2 well developed testicles
3. Bucks with damaged testicles should not be selected for breeding
4. The buck should be in very good in physical condition, health and libido
5. The buck should not be fatty
6. It is better to buy a good breeding buck from another breeder. This will help to avoid inbreeding

3.6 SYSTEMS OF BREEDING IN RABBITS

The breeding system to be selected for a rabbitry depends on the system of rabbitry, level of production and feeding, housing and other facilities available

Extensive breeding system: In this system of breeding the does are mated only after complete weaning of the bunnies. Generally backyard rabbit farmers with limited resources resort to this mating system. There is not much stress on the does and the level of production is also low. Does are mated during the week after weaning. The complete breeding cycle (from one mating to the next) would take about 80-87 days and usually 4 litters are aimed in year

Semi- intensive breeding system: This method of mating is mainly followed by small scale commercial rabbit farmers and this system is aimed at producing 5 or 6 litter per year. The young ones are weaned at 5 weeks, and the doe is mated the week after weaning. Each breeding cycle takes 66-73 days in this system

Intensive breeding system: This type of mating is followed in very large scale commercial rabbitries with stock rates of over 500 does. The post partum estrus is utilized and this type of mating aims at producing 10-11 litters per year. A very high standard of feeding and management is required for this mating system. The young ones are weaned at 3 weeks of age and hence should be supported by high quality creep rations.

3.7 CARE AND MANAGEMENT OF DIFFERENT CLASSES OF RABBIT

Breeding animals: Young does will come to heat for the first time at about 3-6 months of age, but they should not be mated until they are fully grown. After weaning the young male and female rabbits must be kept separate to prevent mating. The age at which rabbits are mature enough to be used for breeding depends on

- a) Breed: Small breeds mature earlier than large breeds
- b) Nutrition: Well fed rabbits mature earlier than poorly fed rabbits

The age and body weight at which the different breeds can be mated as follows

Breed	Approximate weight when ready for mating	Approximate age when ready for mating
Small	2.5kg	4-6 months
Medium	3-4 kg	6-9 months
Large	5 kg	9-12 months

Estrus cycle and heat signs in rabbit: Does will become pregnant only if they are mated while they are 'on heat'. Adult does are on heat for 12 days then they have four days when they are not on heat. After this they are on heat again forming a 16 day cycle

Signs of heat include restlessness, the vulva may look red and swollen and the doe will allow the buck to mate .

Mating: Always take the doe to the buck for mating .When a buck is put in a doe's cage it may fight with the buck to protect her cage. The buck will also be interested in exploring the surroundings of the new cage rather than mating the doe. Early morning and evening hours are the suitable times for mating. When the doe is on heat, it will raise the tail and let the buck to mate. The buck will fall off after mating.

Frequency of using the buck: Bucks should not be over used neither should they be under used as either could result in infertility. A young buck can be allowed for one or two matings per week. A mature buck may be used up to 6 times a week, but more than twice in the same day.

Breeding problems in rabbits

Sometimes the doe will not become pregnant after mating. The most important causes are

- Age : The buck or doe may be too young or too old. Hence it is not fit for mating
- Off heat: The doe may not be on heat. Try mating again in about 4 days
- False pregnancy: if the doe starts to pull its fur out 16-20 days after mating, it has probably developed a pseudo pregnancy
- Physical condition: a rabbit which is too fat or too thin is less likely to breed than a normal rabbit. Hence change the feeding accordingly

- e) Disease or injury: A rabbit showing any signs of disease or injury should not be used for breeding. It should be treated or culled depending on the condition
- f) Moulting: rabbits in the moulting phase will not breed successfully. Try again when they have finished moulting
- g) Sterility: occasionally a buck or a doe may be permanently sterile. Such rabbits should be culled
- h) Hot weather: When the temperature is above 30°C combined with a relative humidity (more than 60%) breeding can be impaired. These conditions cause stress and can cause a temporary sterility in male rabbits

Management of pregnant animals: Duration of pregnancy in rabbits is 29-30 days.

Signs of pregnancy:

1. Test mating the doe: This is not very reliable since some does will accept the buck even when they are pregnant.
2. Palpation : It is more reliable method in which the developing embryos are felt by hand . This is done after 2 weeks of mating.

False pregnancy:

If a doe does not become pregnant when mated, it may develop a false pregnancy where the doe will start to pull out its fur and try to make a nest 16-20 days after mating, whereas a pregnant doe usually starts to pull out her fur about 25-28 days after mating

Soon after this the doe will come to heat again and can be mated

Care of the pregnant doe: When the previous litter has not been weaned, it can go back to them and continue to suckle them until a week before its next litter is due. At least one week before kindling the pregnant doe should be shifted to a breeding hutch where it is going to kindle. A nest box with soft materials for making nest such as grass hay or straw should be provided on or after 25th day after mating. Do not use saw dust in the nest box since it will get into the eyes of the bunnies. The day before kindling the doe will pull out her fur from the rump, sides and around the teats for nesting.

Feeding the pregnant doe: Feeding the doe should be gradually increased during the last 10-14 days of pregnancy because the growth of the embryos and the development

of doe's mammary gland will be taking place during this period. Better feeding during this time will increase the birth weight of the young rabbits and milk yield of the doe

Kindling: Usually kindling takes place at night. It is to be ensured that predators are kept away at this time because if the doe is upset or frightened, she may kill or abandon the litter.

The bunnies are born naked and blind and weigh about 30- 80 grams depending on the breed, age and nutritional status of the doe. The litter size may vary between 2-12.

Sometimes a doe may kill the young one for no apparent reasons. When the doe has not done it before, mate it again in 4 or 5 days. When the habit of cannibalism is noticed twice, the doe can be classed as a bad mother and should be culled

Care of young rabbits: The litter should be inspected every day to make sure that the young rabbits are well fed and comfortable. When they are hungry they may be restless and start trying to climb out of the nest box. When they are well fed and comfortable they will be sleeping quietly. After 10-12 days the eyes will open and the hairs will start growing. At about 21 days the young rabbits will start to come out of the nest box.

Fostering: Fostering is the transfer of young bunnies to another doe for rearing. This may be done when the doe dies after kindling or if the litter size is too large (more than 8) for the mother to feed all the bunnies. The following methods should be followed if fostering is to be successful

1. Rabbits to be fostered should be less than one week old
2. The age of the bunnies to be fostered should be nearly the same foster mother's own litter (not more than 3 days difference in age)
3. Always transfer the heavier and stronger young ones to the foster mother and allow the weaker ones to suckle from its own mother.

3.8 RABBIT FARM ROUTINE AND MISCELLANEOUS ACTIVITIES IN RABBIT FARM

FARM ROUTINE

Time	Activity
08-00-10.00	<ul style="list-style-type: none">• Cleaning at rabbit hutches, farm premises
.	<ul style="list-style-type: none">• Spotting of sick animals• Offer feed• Periodical weighing
10.00- 12.00	<ul style="list-style-type: none">• Disinfection of sheds• Disposal of manure• Periodical de worming, treatment• Preparation of feed
12.00- 13.00	<ul style="list-style-type: none">• Lunch
13.00 – 17.00	<ul style="list-style-type: none">• Feeding• Cleaning of all sheds• Weekly scrubbing, white washing of interiors of sheds• Attending to farm purchases• Marketing of rabbits

MISCELLANEOUS ACTIVITIES

Handling Rabbits:

The ears alone should never be used as the sole means of holding the rabbit. The best method is to grasp the ears and the skin close to the head with one hand while the other hand takes the full weight of the rabbit at the hips. For young rabbits up to

about 3-4 months old, a suitable method is to grasp the animal across the loins.

HANDLING OF RABBIT



Sexing: Apart from the sex organs, physically the buck is usually smaller than the doe and often has a broader head. In the buck, a protruding sex organ appears as a rounded tip, while in the doe the organ is slit-like or v-shaped, and will slope slightly downwards towards the anus. When the bucks are mature the penis and testicles are easily observed.

Weighing: In rabbits, males weigh lesser than females. These are weighed at weaning, at sexing and adult stage. The animals are weighed by placing them on the electronic weighing machine and the weights are recorded.

Records: Keep proper records of all the rabbit unit activities such as breeding records, growth records, sales and expenses

3.9 IDENTIFICATION AND WEANING

Identification or marking : Ear tattooing, ear studs, leg bands or stains and dyes are used for marking rabbits as young rabbits grow relatively quickly, it is important to select the correct size of leg bands to avoid discomfort as they grow. The most satisfactory method is tattooing. In some 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. Ear studs should be applied close to head on ear. Stains and dyes are applied on the body surface.

Weaning: It means separation of the young ones from their mother. It is a stressful period and requires careful handling. Weaning is done between 4th and 6th week. Sex of the young rabbit can be determined one week after kindling by an experienced person. Young rabbits should not leave the nest box until they are about 3 weeks of age. Weaning of bunnies can be done by 4th to 6th week of age. The doe should be removed from the cage and the young can be retained for the next 4-5 weeks. Abrupt change of feed is to be avoided during weaning so as to reduce the mortality in weaners.

Short type answer questions

1. Explain kindling and bunny terms of rabbits
2. Explain Fryer and roaster
3. Write any eight external body parts of rabbits
4. Write any six names of rabbit breeds
5. Explain breeding problems in rabbit
6. Explain signs of pregnancy in rabbit
7. Explain fostering
8. Explain weaning and weighing
9. Explain sexing in rabbits
10. Write about Intensive breeding system

Long type answer questions

1. Write about the classification of rabbit breeds
2. Write about large and small fancy breeds of rabbits
3. Write about the housing for different classes of rabbits
4. Write about the selection and culling of rabbits

5. Write about the care, feeding and management of different classes of rabbits
6. Explain the rabbit farm routine activities
7. Explain handling and identification of rabbits
8. Explain care, feeding and management of the pregnant does
9. Write about the systems of breeding in rabbits

UNIT-4

PET ANIMAL MANAGEMENT

Structure

- 4.1 Common terms used in pet animals
- 4.2 External body parts of dog and cat
- 4.3 Important breeds of dogs and cat
- 4.4 Housing for dogs and cats
- 4.5 Care and management of different classes of dogs
- 4.6 Care and management of different classes of cats
- 4.7 Grooming, nail trimming and washing of dogs and cats
- 4.8 De worming and de ticking
- 4.9 Vaccination schedule for dog and cat

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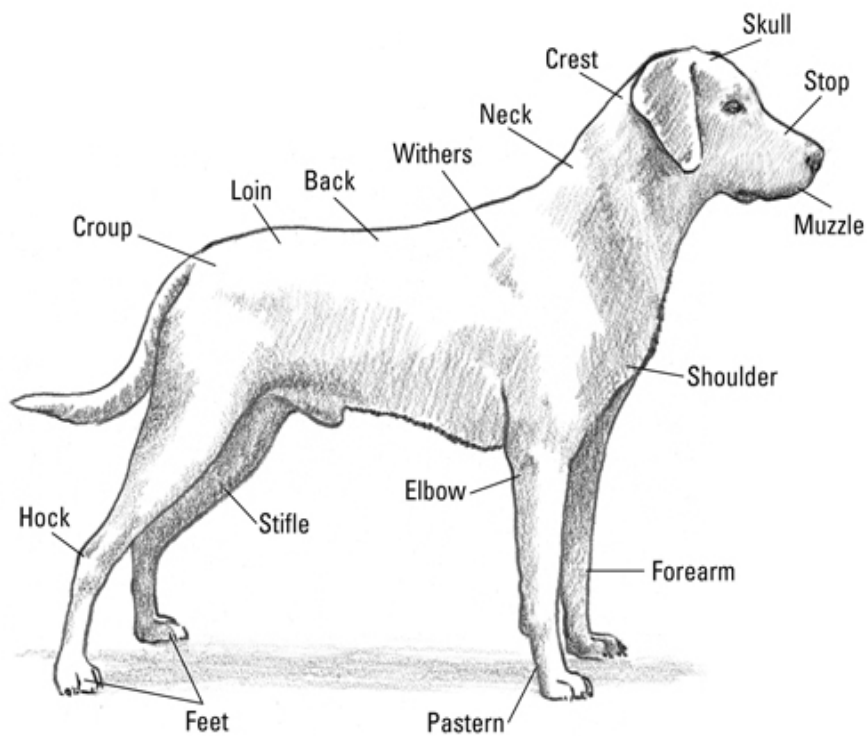
4.1 COMMON TERMS USED IN PET ANIMALS

Canine	- species of dogs
Dog	- uncastrated adult male
Bitch	- adult female dog
Pup	- young of either sex under 1 year age
Copulation	- act of mating in dogs
Whelping	- act of parturition in dogs
Pack	- group of dogs
Feline	- species of cat
Tom	- uncastrated adult male cat
Queen	- adult female cat
Neuter	- castrated male cat

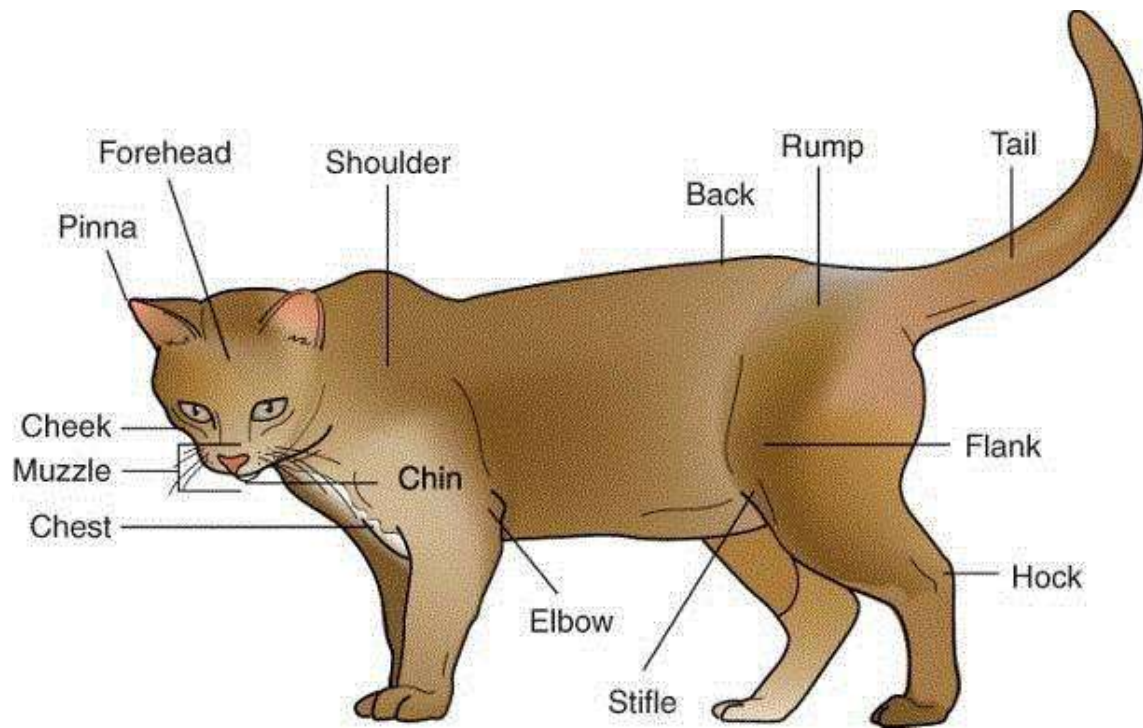
- Kitten - young one of either sex
- Queening - act of mating in cat
- Littering - act of parturition in cat
- Bevy - group of cats

4.2 EXTERNAL BODY PARTS OF DOG AND CAT

EXTERNAL BODY PARTS OF DOG



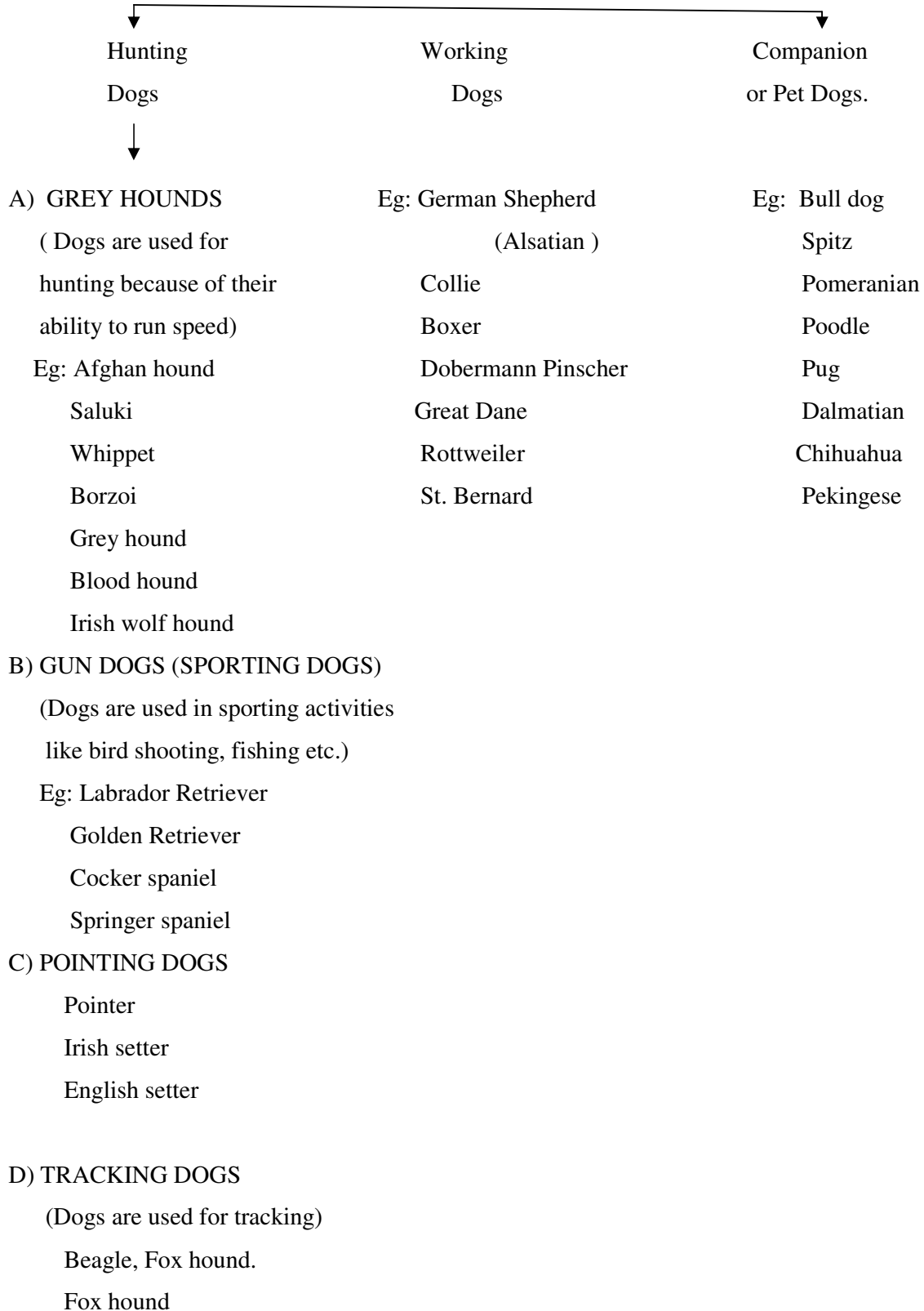
EXTERNAL BODY PARTS OF CAT



4.3 IMPORTANT BREEDS OF DOG (*Canis familiaris*) AND CAT (*Felis domesticus*)

Familiarization with dog and cat breeds helps us in selecting the true breeds of ideal shape, size and purpose. The dogs based on utility and physical characteristics can be grouped as follows:

BASED ON UTILITY



E) EARTH DOGS

(Parallel to the earth)

Basset hound

Dachshund

Irish Terrier

Fox Terrier

Bull Terrier

The Irish wolfhound (Great Dane) is the tallest (36”) and Chihuahua (5”) is the smallest. St. Bernard is remarkable for its heavy weight (55kg) and Pomeranian weighs below 2 kg.

Breed	Origin	Breed characters
German Shepherd / Alsatian	Germany	<p>Very popular breed of dog known for its intelligence, beauty, loyalty and nobility. It is well proportioned and very strong with erect ears.</p> <p>The coat most often comes in black with tan, sable or all black with black nose. It has a sturdy, muscular, slightly elongated body with a light but solid bone structure. Ears wide at the base, pointed, upright, and turned forward. The eyes are almond-shaped, never protruding, dark, with a lively, intelligent expression. Tail is bushy and reaches almost to its hocks and hangs down when the dog is at rest.</p>
Pomeranian	Germany	<p>It is a tiny, fluffy dog with a wedge-shaped head and pointed erect ears.</p> <p>It has bright, dark, almond-shaped eyes with an intelligent expression. The nose is either dark or the colour of its coat. It has a feathered tail that fans forward over the back. There is an abundant ruff around the neck and chest area. The profuse stand-off double coat usually comes in solid colors, the most common are red, orange, white or cream, blue, brown or black.</p>

Doberman Pinscher	Germany	It is an elegant, muscular and very powerful dog. It has a well proportioned chest, a short back and a lean, muscular neck. The short-haired, close-fitting coat comes in black, black & tan, blue-gray, red, fawn and white. Eyes are dark with a lively, intelligent expression.
Dalmatian	Austria	It is a symmetrical, muscular medium-sized dog with short, hard, dense coat of pure white with black or liver coloured spots randomly splashed over it. The feet are round with well-arched toes and the nails are either white or the same colour as the spots. The eyes are dark brown, amber, or blue, with an intelligent expression. The ears are soft, narrowing toward the point, carried with a slight upward curve.
Bulldog	England	It is small in stature, but wide and compact with a thick, massive head. The coat is red, fawn, brindle, pale yellow or washed-out red, or white, and can combine any of these colors. Head is broad with cheeks that extend to the sides of the eyes. The skin on the skull and forehead fall in dense folds. Muzzle is short, nose is broad and black with large nostrils. Upper lip is pendent and its lower jaw is undershot. The tail is short and carries low. Legs are stocky and set squarely at each corner of its compact, muscular body.
Dachshund	Germany	Dachshunds are scent hound dogs which were bred to hunt badgers and other tunneling animals, rabbits and foxes. Available in wide variety of colors black, red, chocolate etc. except white. Short limbed animal with compact long body. Ears are long and thick. They are in two sizes: Standard and Miniature each in 3 varieties (Smooth, Wirehair and Longhair) .
Golden Retriever	England	Beautiful, sturdy, well-proportioned dog with cream to golden coloured coat. Coat is flat and wavy. The nose is black and the eyes are brown with dark rims. The tail is feathered and straight. Adult body weight 27-36kg

Pug	China	It has a square, thick set, stocky compact, body, with a sleek, soft coat that comes in apricot, fawn, black and silver – all with a short, flat, black muzzle and velvety ears. Rose shaped ears are preferred. Moles on the cheeks are considered beauty spots. The eyes are prominent, expressive, dark and lustrous. The back is short, with a level topline. The tail lays in a tight curl. Their limbs are straight and strong which gives them a jaunty, rolling gait that is quite distinctive.
Boxer	Germany	The body is compact and powerful and the shiny, close-fitting coat is in fawn, brindle, white and various shades of red, with white markings. Lower jaw extends beyond its upper one, curving upward. The nose is large and black with very open nostrils. Eyes are dark. The neck is round, strong, and muscular, without dewlap. The body is square. The tail is carried high.

INDIAN BREEDS

Bhutia(Himalayan Sheep dog)

Rampur hound

Rajapalayam

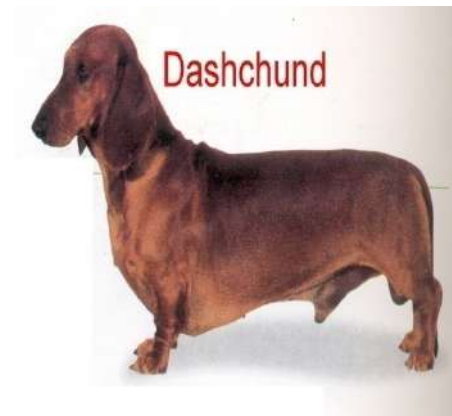
Pandikona

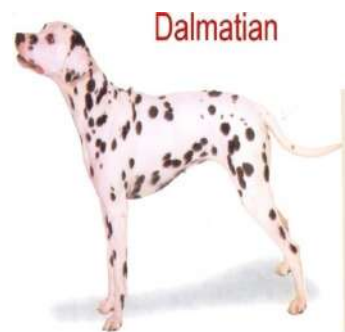
Mudhol hound

Daravan hound

Breed	Origin	Breed characters
Rajapalayam	India	It is an Indian sight hound. It is a large dog, usually measuring about 65–75 cm at the withers. Colour is black, brown and white. It is mainly used for hunting wild boar and as a guard dog. It needs open spaces and is very loving and devoted to his owner. They do not get along with other pets like cats, due to

		their strong hunting instincts.
Rampur hound	India	Thin, slender dog of bony appearance, coat short and close. Colour preferably fawn to brown colour. Ears small and half curved, chest broad and waist narrow with raised croup. Adult body weight is 25-40kg. Tail long, straight and tapering.





Rajapalayam



Rampur hound

BREEDS OF CATS

The cat breeds are classified into two categories based on their hair coat

I. LONG HAIRED BREEDS

Eg.: Birman

Norwegian forest cat

Himalayan and Kashmir

Turkish Angora

Persian

Maine Coon

II. SHORT HAIRED BREEDS

Eg.: Siamese

Abyssinians

Manx

Rex

Bombay

American short hair.

Singapura

Breed	Origin	Breed characters
Turkish Angora	Turkey	It is a small to medium sized cat with a long, slender graceful trunk on a light frame. The ears are large and erect. The breed was originally bred only in white, but many colours and patterns exist today. The fur is medium in length and silky. The eyes are large, almond shaped and show radiant, deep colour.
Persian	Persia	Persians with their long coats and open pansy like faces are the number one breed in popularity. They come in astonishing colours of solids, silver & golden, tabby.
Siamese	Thailand	Have a light body coat without patches. Most outgoing even with strangers. Affectionate and seek attention.

Singapura	Singapore	It is a small breed. It has rounded head with large eyes and ears. The nose is blunt on a broad muzzle with a slight stop below eye level. The main characteristic is its ticked coat. The colours are usually yellow or ivory with light brown hairs interspersed. There are darker bars on the inner front legs and back knee. The eyes are described as being extremely beautiful and expressive.
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Singapura



Siamese



Turkish angora



Persian



4.4 HOUSING OF DOGS AND CATS

Housing of dogs: A house for dog is known as kennel.

Normally special housing is not arranged for one or two pets. Pet dogs are provided a bed in a corner of the house. The sporting breeds and guard dogs are generally kept at an isolated place in a clean and comfortable kennel usually in the remote corner of a bungalow (building) protected by boundary wall. Movable plastic pens are available. They can be kept at a suitable place in the house and the pet is trained to use it as its retiring room.

In indoor dog clinics and at breeding centres several dogs of different breeds are required to be housed. For such conditions kennels of variable size are constructed depending on the number of bitches to be bred and the kind of dogs. Kennels must be designed, constructed and maintained in a way that ensures the good health and wellbeing of the animals while preventing their escape or injury to humans. Materials for the construction should be selected for ease of maintenance and cleaning, durability and non-toxicity. Flooring must be impervious material to assist cleaning and drainage. Floor must be sloped to enable wastes and water to run off. A collection drain must be provided to take away water after cleaning. Pens must be separated by either solid partitions, galvanized chain wire or weld mesh wire dividers.

In totally enclosed buildings where forced ventilation is the only form of air, an air exchange rate of 8-12 changes per hour is required to prevent the build up of foul odors. Dogs kept in poorly ventilated kennels tend to cough due to build up of dust and ammonia fumes.

The size of the pens vary with the breed, age and breeding status of the dogs. The average size of the pen for non-breeding dogs are as follows

Toy or small breeds: The pen should be 1m long, 75cm wide and 70cm high and covered with wire gauge. Front door should be well ventilated and sliding or dropping type.

Medium breeds: The pen should be 1.5m long, 1m wide and 1m high.

Large breeds: 2.5m long, 2m wide, 1.5m high.

Each pen should be provided with a 15cm high wooden bench for resting a bowl for clean drinking water and a dish for feeding. Pens should be open in a forced run for exercise the height of the fencing should be sufficient to prevent escape of dogs during breeding

season when they are highly active. The height of fencing should be sufficient to prevent escape of dogs, during breeding season when they are highly active. The minimum height of fencing should be 1.8m and must be constructed of brick, concrete timber or iron. Solid material such as or chain mesh manufactured from 3.15mm wire to with a maximum mesh spacing of 50mm. for large sized exporting dogs the height of licensee should be more than 25m.

Brood bitches: The area for brood bitches should be at least double that for non breeding bitches .the bitch should be placed by the side of the wall and the open space should be blocked to prevent the entrance of pups beneath the bench.

A cardboard box should be placed around whelping area for the rest of new born pups. Each pen of a brood bitch should have an enclosed run for the exercise of pups.

The floor should be kept clean, dry and free from sharp objects.



Housing of cats:**Recommended Minimum Space Requirements for Cats**

	Minimum floor space area per cat(sq.mt)		Minimum height(m)
Adult cat	1.5	1.7	0.75(cage) 1.75(pen)
Kitten 12 weeks age	1.5	0.75	

Housing is a major factor for a cat's well-being. Sufficient space, comfortable housing that considers physical and mental stimulation, cat-to-cat socialization and human contact are all important elements of good housing. Cats that live in groups are more comfortable and less likely to become stressed if they are not housed in cages. Indoor cats, in particular, need mental and physical stimulation and settle better in pairs. When deciding on how many cats should be kept in a home, the following factors should be considered:

- The size of the living space
- Access to an outdoor area or garden
- The safety and security of any open or high spaces.

For small breeders, the cats may simply live in the house, with no specific confinement, other than providing a separate room or area for queens with kittens. The cattery must be well-maintained and clean, providing a healthy environment for housed cats. The primary enclosure should provide sufficient space to allow each enclosed cat to turn freely and to easily stand, sit and lie in a comfortable position. Quality of space is more important to cats than increasing space. Use vertical space for enrichment. Resting perches and a hiding area should be provided, as well as easy access to food, water, litter, and bedding.

Cats housed in groups must be watched for submissiveness, fighting, and rejection of members because of the cat's natural instinct for territorial and personal defense. Extra resting boards placed at different levels within an enclosure allow cats

to establish a “mini-territory” within the group housed together and minimizes the chance of aggression. Cats refuse to eat if litter trays and food dishes are in close proximity. Litter pans, at least one pan per cat, shall be located away from bedding and food and water.

Housing and living spaces should incorporate the following desirable characteristics

- ☐ Enough space for activity, rest or sleep, defecation and stimulation of a wide range of normal behaviours
- ☐ A private quiet space
- ☐ Toys and items that stimulate play
- ☐ Vertical spaces for climbing
- ☐ A place to scratch
- ☐ Separate places to eat and drink; feeding areas can be varied to simulate a hunting environment
- ☐ A litter box area that is private and clean and stays in the same place
- ☐ A secured outdoor area or access to windows and natural light.

4.5 CARE AND MANAGEMENT OF DIFFERENT CLASSES OF DOGS

Care of Newborn Pup

- Pups should be carefully examined after birth about their general condition and health.
- Remove the surrounding fetal membranes and clear the mouth and nose from mucus using a dry towel for proper respiration.
- If the pup fails to respire, gentle compression of the chest results in the establishment of respiration. Birth weight of the pup should be recorded immediately after birth.
- The umbilicus of the pup is normally taken care by the bitch. If the bitch fails, a ligature should be applied approximately 3 cm from the abdomen and cut distal to the ligature. Application of iodine helps in healing.
- Suckling normally occurs immediately after birth. At the intervals of 2 to 3 hours for the first few days colostrum and milk feeding should be given.
- Colostral feeding is important for passive immunity and survival of the pup.
- Hypothermia is a major cause of pup mortality in cold climatic areas. Temperature of 77-86⁰ F will be required for the first few days of pups life. Circulating water blankets provide warmth to the pups.
- Body weight should be recorded daily. Normal puppies increase in body weight by 5-10% per day. Neonatal pups are unable to stand at birth but they move using their limbs to crawl.
- Standing may be seen from 10 days after the birth and most puppies should be able to walk at 3 weeks of age. Pups are born with their eyes closed.
- Separation of the upper and lower lids and opening of the eyes occurs approximately 10-14 days after birth. The cornea at this stage may appear slightly cloudy but this will disappear over the first 4 weeks.
- In the first few weeks of life the dam will provide all the care for its pups. The dam normally licks the perineal region of each puppy to stimulate urination and defecation for the first 2-3 weeks after birth.
- Pups defecate and urinate voluntarily at 3 weeks of age.
- The common bedding materials used include shredded paper, newspaper with blankets or newspaper with synthetic rugs for easy wash and disposal.

Weaning of the pups

- Puppies are normally weaned off at about 6 weeks of age. In addition to the milk, solid foods may be offered to the puppy by the time it is 3-4 weeks of age and the puppy can be shifted completely onto solid foods by the time it is 6 weeks old.

Feeding schedule for growing pups

- | • Age | Meals |
|-----------------------|-------|
| • 1-2 months – | 5 |
| • 2-3 months – | 4 |
| • 3-6 months – | 3 |
| • 6-9 months – | 2 |
| • 9 months and over – | 1 |
- . Adequate proteins, vitamins and supplements especially calcium must be given to growing puppies.

Management of breeding animals

Average values of breeding behaviour

Age of puberty- 6-12months

Age of breeding- 12-18months

Length of estrus cycle- 6months

Length of estrus (heat) – 6-13days

Return of heat after whelping – 16-20weeks

Gestation period- 55-75(65) days.

Average pup born- 4-8

Birth weight- 65-500gm (depending on breed)

Breeding span- 8-12 years

Life span- 10-15 years.

Bitches become sexually mature when they exhibit their first heat period usually between 6 and 16 months of age, depending on the size and breed. Most bitches come into heat twice a year.

Mating

Both the bitch and the male dog should be 18 to 24 months of age, by which time the bitch should be in her second or third heat period. Since ovulation usually occurs on the second day of estrus it is highly effective to breed the bitch as soon as she is sexually receptive to the male dog and again two days later.

The bitch is normally brought to the male dog for breeding. Courtship behavior begins with the male dog sniffing at the bitch's face and flank and licking of the vulva. When ready, the bitch presents her hindquarters to the male dog and stands still with her tail toward one side. The male dog then clasps the flanks of the bitch with his forelegs, inserts his penis into the vagina (intromission) and begins to thrust. The enlargement of the bulbus glandis occurs at this time, resulting in the coital tie. With the penis firmly in place, ejaculation begins. Then with their genitalia still "locked," the male dog will dismount by placing both front feet to one side and lifting one hind leg over the bitch's back so that they are facing in opposite directions. The enlarged bulbus glandis of the male dog prevents separation from the bitch for about 5 to 60 minutes. Separation occurs naturally afterwards. When artificial insemination (AI) is properly performed, conception rates are equal to those attained by natural breeding.

Care and management during pregnancy

Restrict the movements of the pregnant bitch. Minimize the stress and excitement. Avoid the movements of the stranger.

Do not make abrupt change in feeding schedule. Feed small quantity of foods at frequent interval. Do not provide excessive calcium preparation since it may produce uterine inertia, by inhibiting parathyroid function. Provide adequate drinking water.

Do not use any powder containing acaricides. Do not use any anthelmintic preparation. Do not give any vaccine.

Keep a watch on mammary development secretion of mammary gland should be wiped up with antiseptic. Clip hairs around the mammary gland to make the nipples readily available to the pups. Place the bitch in whelping area. There should be adequate bedding preferably with thick bed of newspapers.

Monitor the rectal temperature 3 times a day, normal temperature is around 100.5F (38⁰C). A decline of temperature below 99.5F (37.5⁰C) will suggest parturition within 24hrs. If parturition does not take place following decline in temperature within 48hrs it will indicate that normal parturition will not be possible and dystocia is imminent due to uterine inertia. Such case may require caesarean section.

About a week before the estimated date of parturition, the bitch should be introduced to the whelping area and the whelping box. The whelping area should be dry, warm, draft-free, secluded and quiet. The whelping or nesting box may be constructed of a variety of materials but should be designed to accommodate the bitch fully stretched out on her side and have room to spare for the pups. The whelping process usually does not require assistance. However, in emergencies veterinary aid may be required.

Postpartum care of bitch: When the last pup has been born, the bitch should be taken out for short run to pass urine and faeces. When the bitch is away from whelping box, soiled newspapers in the whelping box should be replaced with fresh. At the same time the puppies are examined for defects. On her return the bitch must be offered milk.

Feeding of nursing bitches - a) first 2 days should be given light diet (milk preparations, meat broths, cooked fish or cooked chicken) in the quality she desires. b) by the 3rd day she can resume her normal diet. c) during lactation bitch should receive about 50% more food than usual in first week. d) 100% more food than usual in 2nd week. e) 3 times more than the normal in 3rd week. f) divide the ration into small quantities. g) provide fresh water always. h) calcium should be supplemented to avoid acute calcium deficiency (eclampsia). This is manifested as stiffening of legs, body spasm, convulsions.

Pup's nails should be trimmed to avoid injury to mammary glands. Accumulation of milk in mammary gland should be relieved by expulsion of milk through massage. If bitch feels pain in mammary gland even after expulsion of milk, may indicate mastitis, such cases should

be treated, otherwise the pups may die due to ingestion of infected milk. The hair around the mammary gland should be trimmed

As pups start eating, reduce the mother's ration. As the weaning period approaches the bitch should be encouraged to leave whelping box for longer period. This is to make pups not depend on bitch.

4.6 CARE AND MANAGEMENT OF DIFFERENT CLASSES OF CATS

Care and management of kitten:

Kitten must be provided with proper food, place to sleep, scratching post or pad, litter box or litter. When a new kitten is bought from a breeder or from some other owner give the same feed what it was eating previously with previous owner and it can be changed slowly. For sleeping purpose provide a cardboard box, lined with soft towel or a small blanket and the cloth should be washable. To develop relation, play with kitten with interactive toys. Playing will develop bonding between kitten and owner, agility, stamina and muscle tone. The play can be individual and interactive. Keep kitten always inside the house, otherwise there is problem of predators, vehicle accidents or stealers.

Scratching post should be provided to make its claws sharpen. For scratching the kitten should be trained to use a corrugated cardboard or grooved wooden post either in erect position or lying position or a wooden horse. Scratching also gives relaxation, helps to mark its own territory and provides exercise.

The cat has instinctive character to dig the litter material and then it urinates or defecates and covers it. The kitten should be given training to use the litter box. The box should be kept in private, easily accessible place

Grooming should be done regularly to avoid hairball in digestive tract, to avoid dental and mouth problems, physical distress due to fleas and mites, to eliminate stray hair, which is responsible for causing hairball, to check parasites, skin disorders, eye and ear problems.

Sprays are used for flea control, which can kill larvae and eggs. These should be sprayed on back of the neck. The drug is collected in the hair follicles of neck and later spreads to other parts of body. Timely vaccination and deworming should be done in kittens.

Care of adult cat

The amount of food to be given depends on cat's age, weight, breed, condition and amount of activity. Two meals are recommended per day. Pregnant and nursing cats should be fed number of times per day.

Provide a card board box with soft blanket for sleeping. Scratching post should be provided like kitten. The scratching post should be tall enough, that the cat stands on its back legs and scratches with front paws on the post. The post is tall enough that the cat should not reach top of post. Keep the scratching posts in places where the cat likes. The post material should tear while marking. Correct toileting is important. The litter box should be big enough because the cat digs 5-6" away from the old spot in litter box. The litter material should absorb the moisture and easily cleanable.

Exercising: The amount of exercise varies depending on the breed and location of its house. Apartments need to be furnished with toys for playing which give exercise.

Grooming: especially long haired breeds need more attention . If neglected the hair will mat.

Grooming of Long haired breeds: A wide tooth comb for all areas of body. Fine toothed one is used if cat is free of mats. The skin should also be brushed along with fur. The comb is also called flea comb. If hairs are matted scissors should be used to cut them out

Short haired breeds: Fine toothed or flea comb is used. In many cases hand grooming is sufficient to remove dead hair. Combing should be done against the direction of hairs

Bathing a cat: Generally the cat should accustom to bathing at the age of 4 months. Occasionally bathing is necessary. Show cats should be given bath regularly. Warm water should be used. A shampoo can be used for cleansing

Ears should be checked for mites. If mites are present, we can see dark crumbly residue inside ear. Ear mites can be controlled by eardrops. Any discharge from eyes indicates illness. White cats especially Persian cats may show staining around eyes. This staining can be removed while bathing. Teeth and gums should be observed during regular grooming for plaques, tartar, gingivitis, broken teeth. Tooth should be cleaned with paste 2-3 times / week. If claws require trimming, one should be careful about the pink area of claw and it should not be cut. Cats that are using a scratch post will probably never need their

claws to be trimmed. Neutering of male cats and spaying of female cats are required to avoid some managerial problems and diseases

Care of breeding animals: The age at which a queen come to heat varies from 5-10 months. The heat period lasts for 9-10 days .If cat is not bred during heat period, it will come back to heat in 15-21 days.

Symptoms of heat: Restlessness and usually friendly. Rubbing up against objects, furniture and the owner's legs. A repeated monotonous howl or call is made. Rolls around on floor. Any touch to the back of tail, makes cat to have crouch position, which is the receptive position to a male. In response to the call of female, the toms also emit courtship cries.

Ovulation occurs about 24 hrs after mating i.e., cats are induced ovulators. Pregnancy in cats averages about 65 days. At 3 weeks of pregnancy; mammary teats become pink, hair on teats recedes slightly. At 6 weeks of pregnancy abdomen shows increase in size. About 2 weeks before kittens are due; the female becomes restless and searches for a quiet place to give birth. If one offers a well prepared box, she will accept it for giving birth.

After labor begins with the contractions of abdominal muscles, the amniotic sac and enclosed kitten in membrane expelled. The mother removes the membranes covering and licks to clean. She severs the umbilical cord by her teeth. The placenta is expelled and the mother eats it. The rest of the litter follows at about 15 minutes interval.

Assistance to queen

If female doesn't attempt to remove the membrane covering, assistance is required .If female doesn't show interest , one must sever the umbilical cord. Rub the kitten to dry and stimulate it to breathe. Then kitten must be placed to the mother's udder. The kitten will begin to nurse and arouse maternal instincts.

4.7 GROOMING, NAIL TRIMMING AND WASHING OF DOGS AND CATS

GROOMING

Objectives:

- 1) Well groomed dogs are much healthier because it keeps them clean.
- 2) It keeps the coat glossy.
- 3) It stimulates circulation to the skin
- 4) Removes loose hair, external parasites, dirt and matting of hairs.

5) During moulting period grooming removes the dead hair.

6) It improves the relationship between the owner and pets.

Method: Grooming should be done every day but it is advisable to comb and brush twice in a week. It can be started in the opposite direction of the root of hair and then in normal way.

Schedule of Grooming	Time allotted (min)
Initial Inspection	1
Deticking	5
Massage with fingers	6
Brushing	10
Combing	2
Cleaning of eye, ears, teeth and anus	3
Setting of hair	2
Final Inspection	1
Total time	30 min

GROOMING OF CAT



Brushes :

1. Double sided brush with a handle having wire pins on one side and nylon tufts on the other side is ideal.
2. Soft brushes for kittens.

Combs:

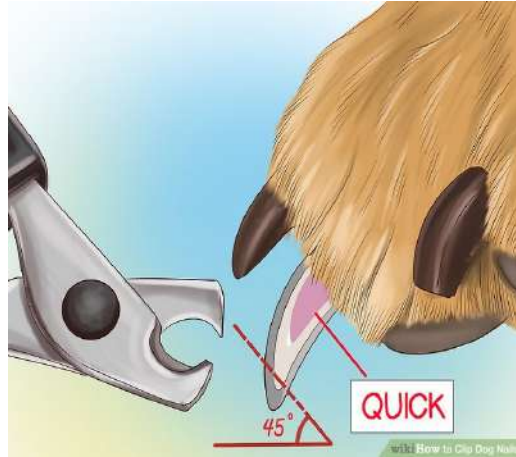
- 1) A chromium plated metal comb
- 2) A comb with fine and coarse teeth in equal proportions.
- 3) For small dog breeds (Terriers) and cats smaller combs with medium teeth is ideal.
- 4) A comb with coarse and extra strong teeth with handle is ideal for heavy coated and double coated dogs such as Alsatian.

NAIL TRIMMING

Nail trimming is the process of cutting away excess nail of the dog. Trimming of nails will be carried out once/twice in a week. Indoor dogs require more frequent nail trimming than outdoor dogs. Outdoor dogs or those taken for regular walks on hard surfaces usually require less trimming since the friction of their nails against hard surfaces helps to control nail growth.

Procedure

- Restrain the dog carefully.
- Spread each foot and inspect the area between the toes.
- Hold the dog's foot with the thumb on top of the toe, and two or more fingers below along the pad of the foot.
- There is a blood vessel in pet dog nails called as the "quick." The quick is usually visible to the eye except for dark-colored nails.
- Insert the nail into the clipper, and clip below the quick at a 45 degree angle. The "quick" can be easily diagnosed as a dark spot in the centre of the nail when looking at it head on.
- A nail styptic powder may be applied if "quick" was cut to stop the bleeding.



Trimming of nail

WASHING

The less often the better. When the dogs are covered with mud or have been with unpleasant odour bathing is essential. Temperature of the water should be about 30°C (86°F) and never above body temperature.

Ideal Method: Basin may be filled up to dog's tummy. Pour water over dog gently, starting always at the tail and working forward. Rinse thoroughly with at least two changes of water. Dry with a rough towel, then another rough towel or a blower dryer may be used.

Soap: Mild human soap is preferred. (Soaps containing Carbolic acid should never be used as they may cause irritation, reddening of skin and blisters.



Bathing of dog

4.8 DEWORMING AND DETICKING

Deworming puppies and kitten:

Puppies and kittens should be dewormed at 2,4,6,8, 12 and 16 weeks of age.

Deworm again at 6 months and 1 year of age.

Deworming adult dogs and cats

Dogs put everything in their mouth and need deworming twice a year to eliminate the parasites they pick up. Deworm outside cats twice a year for the same reason.

Cats that are strictly inside animals need deworming once a year.

Cats that like to hunt need deworming three times a year .

Deticking

Tick bite can cause skin infections. Ticks carry diseases such as Lyme disease, Ehrlichia bacteria and anaplasmosis.

Ticks can be removed by using tweezers or insecticides. A fine toothed comb can be used to search for ticks on dogs and cats. Grab the head of the tick with tweezers and place the tick in a jar containing alcohol to kill it. Flea and tick sprays can also be used to kill the ticks.

1.9 VACCINATION SCHEDULE FOR DOG AND CAT

Sl. No	Vaccine	Type of vaccine	Age	Booster	Repeat
1.	Canine Distemper and Measle virus	Modified live virus	6-8 weeks	12- 16 weeks	Annual
2.	Infectious Canine Hepatitis virus	Modified live virus(CAV-1 or CAV-2)	6-8 weeks	12- 16 weeks	Annual
3.	Rabies virus	Modified live virus or Inactivated virus	8 weeks	1 year	3 years Annual
4.	Canine Leptospirosis	Killed Bacteria (bacterin)	9 weeks	12-16 weeks	Annual
5.	Parvo virus	Inactivated	6-8 weeks	12 weeks	Annual
6.	Tetanus	Tetanus toxoid	12 weeks	18 weeks	Annual

Short type answer questions

1. Explain whelping and bitch terms in dogs
2. Explain Queening and littering in cats
3. Write any eight external body parts of dog
4. Write any eight external body parts of cat
5. List any six breeds of cats
6. Write about weaning of pups
7. Explain grooming of dogs
8. Explain bathing in dogs
9. Explain deworming in dogs
10. Explain deticking in dogs

Long type answer questions

1. Write in detail about the classification of dog breeds
2. Explain in detail about any four breeds of dogs
3. Write briefly about housing of dogs and cats
4. Write about the care and management of different classes of dogs
5. Write about the vaccination, deworming and de-ticking in dogs

DAIRYING

Paper - III

FEEDS & FEEDING OF LIVESTOCK

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UNIT- I**FODDER PRODUCTION****Structure****1.1 Study of soils for fodder production****1.2 Importance of green fodder feeding****1.3 Crop rotation****1.4 Study of different forage farm equipment-Ploughing, Harrowing, Planking etc.****1.5 General principles of irrigation, fertilizers requirement in fodder production.****1.6 Cultivation practices of common fodder crops****1.7 Silvi Pasture – Hortipastures**

1.1 Study of soils for fodder production:

Soil can be defined as the mixture of organic and mineral matter at the land surface of the earth. It is capable of sustaining plant life. It carries most of the available plant nutrients. The fertility of the soil is increased by manuring, liming and drainage. Soil profile is divided into top soil, sub soil and parent material. Top soil contains more humus and large number of micro organisms. Top soil layer is about 8cm-45cm deep. It is the main zone of root development. Soil provides the plant nutrients, required moisture and aeration for proper growth of the plants. Soil microorganisms decompose the dead remains of plants and animals and the soil is enriched. Subsoil contains low organic matter as compared to top soil. It is finer in texture but contains little or no organic matter. Parent material lies below the subsoil. It is an intermediate stage in the formation of soil from the rock below.

Major soil types in India

1. Red soil: They are found in many parts of India, particularly in the eastern and south India. The red soils are in different shades of red colour due to presence of iron oxides in free states. This soil is substitute for growing all crops under irrigation.
2. Alluvial soils: Alluvial soils are found mostly in the Indo-Gangetic plains in Punjab, Haryana, U.P, Bihar, West Bengal, Orissa, Assam, delta areas of Godavari, Krishna and Cauvery rivers. These soils are very productive and suitable for growing all types of crops.
3. Black soils: They are also called as black cotton soils. They are found in large tracts in Maharashtra, Gujarat, Madhya Pradesh, Andhra Pradesh and certain areas in Karnataka. Black soils are low in nitrogen, phosphorous and organic matter. They are fertile and give good yields. They crack deeply during summer season. They have high water holding capacity. Water logging is common because of poor drainage of rain water.
4. Lateritic soils: These are found in Deccan, Karnataka, Kerala, south Maharashtra and central India and Eastern Ghats region. They are porous and well drained but fertility is low because of low plant nutrients.
5. Saline soils: These are found in certain coastal regions and in deltaic areas. The salinity of the soils is due to the action of sea water and the salts in sea water. The pH of saline soil usually less than 8.5.
6. Peaty or marshy soils: These are found in limited locations in the coastal areas of Kerala, where the drainage is poor. The pH of these soils is very low i.e. 3.9.
7. Desert soils: These are found along the coast as narrow belt. They may be sandy loams or pure sands. They are low in soil fertility, organic matter and water holding capacity.

Soil texture: It refers to the size of soil particles. The diameter of the different soil particles are given below

1. Coarse sand particles : 2 to 0.2 mm
2. Fine sand particles : 0.2 to 0.02 mm
3. Silt particle : 0.02 to 0.002 mm
4. Clay : below 0.002 mm

According to the soil texture, soils are grouped into sandy soils, sandy loams, loamy soils, clay loamy soils, silty clay and silty clay loams.

Sandy soils are called as light soils and contain less organic matter and plant materials. Addition of organic matter to these soils increases their water holding capacity. These are suitable for heavy rainfall areas.

Clay soils are called as heavy soils. These are hard and sticky and water holding capacity is also high. They swell on wetting. Addition of organic matter improves the drainage and aeration of the soils. These are suitable to low rain fall regions.

Loamy soils contain coarse and fine particles in equal proportions. It is not very hard or light. They contain sufficient organic matter, plant nutrients, water holding capacity. These are suitable for cultivation of all crops under all types of climatic conditions.

1.2 Importance of green fodder feeding:

All fodders are good source of energy, protein, minerals and vitamins to the ruminant livestock. Cereal fodders like maize and Jowar are good sources of energy. Legume fodder i.e. Lucerne, Berseem, Cowpea, Pillipesara etc. are good sources of proteins, minerals and vitamins. Green forages contain more carotene which is the main sources of vitamins to the ruminants. Green forages are cheapest source of nutrient to the livestock. These are important for increasing the milk production in dairy animals and growth rate in meat animals i.e. sheep and goat. Green fodder feeding maintains the normal reproduction and health of all ruminant livestock. Green forages are more palatable when they are harvested at proper stage. Nutrients are easily digestible and they are slightly laxative in action. Feeding of more quantity of legume and non-legume green fodder decrease the requirement of concentrate feeds. It results low feed cost and helps in economic milk production. The mineral content of forages depends on soil type, type of fodder, fertilizer application and stage of growth etc.

When the ruminant livestock are not fed with sufficient green fodder, the milk production will be decreased in dairy animals , growth rate will be decreased in sheep and goat. It also effects the reproductive efficiency and health condition of the animals. When the dairy animals are not fed with forages, it will also increase the feed cost and cost of milk production which decreases the profit from livestock rearing.

1.3 Crop rotation:

Cultivation of two or three crops in a sequence, one after the other on the same land in different seasons in a year is called as crop rotation or sequential cropping. It helps in maintaining the soil fertility, better conservation of water and soil and controlling some pests and diseases.

Eg: Maize (Kharif season) - Berseem (Rabi season)

Sorghum (Kharif) – Oats (Winter) – Maize (summer)

The availability of irrigation water is important to take up the sequential cropping system. All the types of inter cropping or relay cropping increases the fodder yield and quality in a unit area of land. Usually the cereal fodder crop is followed by leguminous forage in order to increase the soil fertility, fodder yield and nutritive value of the fodder.

Growing two or more crops simultaneously in the same piece of land is called as Intercropping. These crops are grown together for entire period or for part of their life cycle. There are different systems of inter cropping. When seeds of two or more crops are mixed and sown by broad casting without distinct spacing, it is termed as mixed cropping.

Eg: Maize + Cowpea or Jowar + Pillipesara

Sowing two or more crops in distinct rows with narrow ratio of 1:1 or 1:2 or 2:2 is called as row intercropping.

Eg: Jowar + Cowpea i.e. 1 row Jowar and 1 row cowpea

Sowing two or more crops in alternate strips with larger ratios such as 10:10 termed as strip cropping.

Eg: Guinea grass + Stylosanthus 10 rows.

1.4 Forage farm equipment for ploughing, harrowing and planking

Ploughing: It is opening of the compacted soil with the help of different ploughs. It is required to loose soil texture for absorbing rain and irrigation water, to control weeds, pests and diseases of crops, to remove stubles of previous crop and to form an ideal seed bed for germination of seed and growth of plants. Different types of Ploughs are used for primary tillage.

Indigenous plough or wooden plough : It is used for ploughing, covering seeds, incorporating manure and fertilizers. It is made of wood with an iron share point. It consists

of body, shaft pole, share and handle.”V’ shaped furrow is cut and opens the soil, but there is no inversion. Ploughing operation is not perfect because some unploughed strip is always left between furrows. There are three types wooden ploughs i.e Peddamadaka of Rayalaseema, dry land plough, and wet land plough. Peddamadaka covers 0.1 to 0.15 hectares, dry land plough covers 0.15 to 0.25 hectares and wet land plough covers 0.1 hectare in eight hours in a day.

B. Soil Turning Ploughs

Mould Board Plough

This type of plough leaves no unploughed land as the furrow slices are cut cleaned inverted to one side resulting in better pulverization. The parts of the type are frog or body, mould board or wing, share, landside, connecting, rod, bracket and handle. Two moulded board plough are attached to tractor where as simple one is animal drawn. It is used when soil inversion is necessary.

Disc Plough

It resembles mould board ploughs. A large revolving concave steel disc replaces the share and the mould board. The disc turns the furrow slice to one side with a scooping action. This is useful where there is much fibrous growth of weeds, as disc cuts and incorporated the weeds. No harrowing is necessary to break the clods of the upturned soil as in a mould board plough.

C. Subsoil Ploughs

Subsoil plough: This is designed to break up hard layers or pans without bringing them to the surface. The body of the subsoil plough is wedge shaped and narrow while the share is wide so as to shatter the hard pan and making only a shot on the top layers.

Chisel Plough :It is used for breaking hard pan and for deep ploughing with less disturbances to the top layers. Its body is thin with replaceable cutting edges so as to have minimum disturbance to the top layers. It contains replaceable share to shatter the lower layers.

Ridge Plough: It has two mould boards, one for turning the soil to the right and another to the left, with a common share, i.e., double winged. It is used to split the field into ridges and

furrows and for earthing up of crops. It is used to make broad bed and furrows by attaching two ridge ploughs on a frame at 150 cm space in between.

Rotary Plough or Rotary Hoe : It is used for shallow cultivation and weed removal.

II Harrowing : Harrows are secondary tillage implements used after primary tillage or ploughing. They are used for shallow cultivation in operations such as preparation of seed bed, covering seeds and destroying weeds. Harrows are two types i.e., disc harrow and blade harrow.

Disc Harrow : The discs cut through the soil and effectively pulverizes the clods.

Blade Harrow : It is used for removal of weeds and stubbles, crushing of clods, working of soil to shallow depth, covering the seeds, inter cultivation and groundnut harvesting etc. Blade harrows are two types.

(i)Indigenous Blade Harrows: It is known as “Guntaka” consists of a beam to which two pegs are attached at the ends. A blade is attached to these two pegs. Two shaft poles and a handle are other parts depending on the beam length and weight, this again have two sub types i.e., pedda guntaka and Guntaka.

III Planking : It is used to crush the clods and helps in micro levelling and for slight compact of the soil after sowing. Plank is made of wood. It is economically cheap. The various parts of plank are handle, beam and shaft. Planks can be made locally according to their own design.

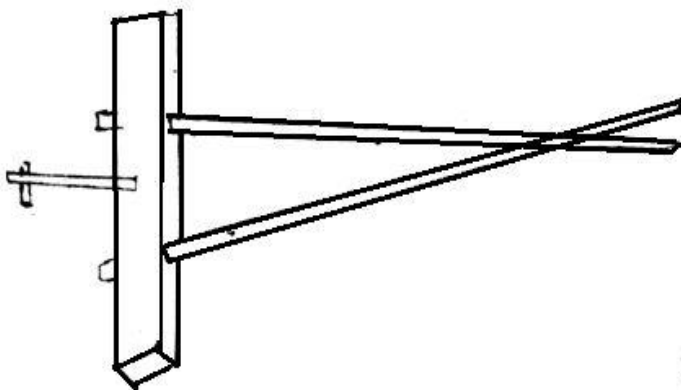


Fig. 1.1 PLANK

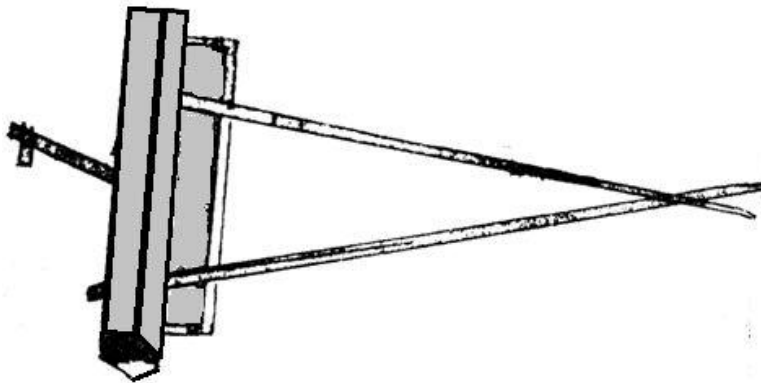


Fig. 1.2 HARROW

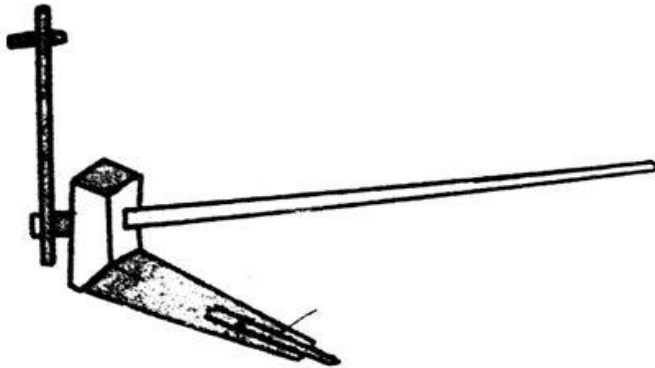


Fig. 1.3 WOODEN PLOUGH

1.5 General principles of manures, fertilizers and irrigation in fodder production:

Classification of manures: Manures are classified into two groups i.e. organic manures (natural) and inorganic manures (chemical fertilizers).

Organic manures: organic manures helps in the better absorption of rain water into the soil. It improves the soil structure and provides varying amount of all the nutrients required for plant growth. Organic matter provides humus forming material to improve the soil structure, water holding capacity, microbial population, base exchange capacity. It controls soil erosion. These are two types

1. Bulky organic manure: these are slow acting and contain large quantity of organic matter.eg: Livestock manure (FYM), compost and green manure
2. Concentrated organic manure: these are quick acting and contain high percent of major plant nutrients. Eg: Neem cake, castor cake etc.

Inorganic manures: These are very quick acting .chemical fertilizers are concentrated source of a particular single element or different elements. Eg: Nitrogen fertilizers, Phosphate fertilizers and Potassium fertilizers.

S. no	Manure/ Fertilizer	Nitrogen (%)	Phosphorous(%)	Potassium(%)	Others
	Manures				Macro and micro elements
1	Dung	0.5	0.2	0.5	
2	Poultry deep litter	3.5	2.0	2.0	
3	Caged poultry dropping	3.2	1.7	1.2	
	Chemical fertilizers				
	Nitrogen fertilizers				
1	Urea	46	-	-	-
2	Ammonium sulphate	20.6	-	-	
3	Ammonium chloride	25	-	-	
4	Ammonium nitrate	33-34			
5	Calcium ammonium nitrate (CAN)	20			
	Phosphatic fertilizers				
1	Single super phosphate	-	16	-	-
2	Double super phosphate	-	32	-	-
3	Triple super phosphate	-	46	-	-
4	Ammonium phosphate	20	20	-	-

	Potassic fertilizers				
1	Muriate of potash	-	-	60	-
2	Sulphate of potash	-	-	48	-
	Complex chemical fertilizers				
1	28 -28- 0	28	28	-	-
2	14 - 35 - 14	14	35	14	-
3	15 -15 -15	15	15	15	-
4	17 -17 -17	17	17	17	-
5	DAP(Di Ammonium Phosphate)	18	46	-	-

Procedure for preparation of Vermi-compost : Construct a cement tank or use a plastic tub. A wooden tank may be constructed using slender poles of Eucalyptus or Bamboo. Tie the poles in horizontal and vertical rows in the form of a tank. Keep the tank above the ground level so as to prevent infestation of predators. To prevent entry of ants, a layer of grease or oil can be applied all around the tank. A channel filled with waste oil can also be put around the tank for preventing entry of ants. Place a 2-3 S' thick layer of soil on the surface of the tank. Fill the tank with waste material such as leaves, coir from coconut tres, saw dust, rice husk, sugarcane trash, wheat straw, etc. over the top layer with loose dry litter or straw to prevent loss of moisture. The straw can be used as a bedding material in successive rounds of composting. Place a layer of kitchen waste and ½-1kg T-8 days old cow dung. Release about 150-200 earthworms on the piled up waste material. Cover the material with a moist gunny cloth and leave it for 2-3 months. Successive vermin-compost can be harvested after every 4 to 6 weeks. Push aside the compost in the tank and collect decomposed compost with any gardening spatula, shovel or hand. Separate unfed material, cocoons and worms. Dry the compost in shade for one or two days and pass through a sieve of 3mm. Transfer separated cocoons and worms back to culture. Sieve the compost again and dry in shade to remove moisture before packing. Prepared vermin-

compost is in the form of a fine loose powder or fine granular dark substance which can be easily separated from the material which is not fed by the earthworms.

Fig.1.4 Vermi- Compost

**Precautions while making compost**

- (i) The tank/plastic tub should be thoroughly cleaned with fresh water before use.
- (ii) Grease should be applied all around the tank to prevent the attack of crawling insects on earthworms.
- (iii) Proper moisture should be maintained in the bedding waste material during composting.
- (iv) Waste material should be placed layer by layer as described in the following procedure.
- (v) Water should be sprinkled once or twice a day on the gunny cloth till approx. 25-30% moisture is attained.
- (vi) When compost is ready for composting, sprinkling of water should be stopped.

Application of manures/fertilizers: These are applied in two methods i.e. basal dressing and top dressing.

Basal dressing: Bulky organic manures such as farm yard manure (FYM), compost and green manure are applied on the field before final ploughing. Neem cake and castor cakes are also applied as basal dressing. Chemical fertilizers also applied just before sowing / planting as split doses.

Top dressing: Top dressing of fertilizers are applied over the crops during the growth period once or twice or several times for fodder crops.

Irrigation: It is the application of water to land. Plant absorbs the nutrients from soil through the water and it needs water to meet its evapotranspiration losses. Different sources of water supply are tanks, wells, perennial streams, rivers and reservoirs. All these sources depend on natural rainfall.

Methods of application of irrigation water:

1. Flood method of irrigation: The water is supplied at one place of the field. It spreads as a layer over the entire field until sufficient degree of saturation is reached.
2. Bed system of irrigation: Field is prepared into small beds with small temporary bunds and irrigation channels are conveniently arranged.
3. Furrow system of irrigation: Water is allowed to pass through furrows and spreads in all directions.
4. Bed and furrow system irrigation: The field is laid into long furrows and then cross bunds are made at closer intervals enclosing 4-6 furrows in each bed. Water evaporation losses are less in this system as compared to flood irrigation.
5. Sprinklers or rain gun irrigation: It is a method of applying water to the soil in the form of a spray. Water is economically and uniformly distributed to the entire area. It is the most suitable method of irrigation in water scarcity areas, dry land and rain fed areas. The initial investment may be higher but more area can be irrigated with limited quantity of water.
6. Drip irrigation: It is a method of applying optimum volume of water to the plants. It minimizes the conventional water losses such as runoff, deep percolation and soil water evaporation. Water is delivered slowly to the soil surface near the base of the plants to maintain the required soil moisture. The water application efficiency is more as compared to surface irrigation and sprinkler methods. Particularly it is more useful for tree crops on even lands where plant spacing is more.

1.6 Cultivation practices of common fodder crops:

Classification of fodder crops: These are classified into non-leguminous fodders (annuals and perennials), legume fodders (annuals and perennials), pasture grasses, fodder trees, root crops and other forage plants.

Legume fodders:

Legume Annual (seasonal) legume fodders eg. Cowpea, Sunhemp, Pillipesara and Berseem

Legume Perennial legume fodders eg. Lucerne and Field beans

Non leguminous fodders:

Non Legume Annual (seasonal) cereal fodders eg. Maize, Jowar, Bajra etc.

Non Legume Perennial grasses eg. Hybrid napier, Guinea grass, Para grass,

Legume Pasture grasses: Legume pasture grasses eg. Stylo, Siratro etc

Non - legume (indigenous) pasture grasses eg. Anjan grass, Rhodes grass.

Common fodder trees eg. Subabul, Avisa, Hedge Lucerne etc.

Cultivation of fodders

Important agronomic practices for increasing fodder production :

1. Select high yielding variety of fodder crop
2. Land preparation for sowing/planting
3. Sow /plant the crop at optimum time of sowing/ planting
4. optimum seed rate/ plant population per acre/ hectare.
5. Removal of weeds
6. Provide irrigation as per need
7. Harvesting fodder at optimum stage to get good quality and quantity of fodder

CEREAL FODDERS

S.no	Particulars	Jowar (Sorghum bicolour)	Maize (Zea mays)	Bajra (Pennesetum typhoid)	Oats (Avena sativa)
1	Crop varieties	PC-6, PC-23, S-194, M. P.chari,	African tall, Vijay, Kisan, Ganga 2,5	Giant, Rajko	Kent, UPO- 94.
2	Sowing time	June- August. January to May with irrigation	June to August. January to May with irrigation	June- August. Jan-may with irrigation	Mid. September to mid November

3	Seed rate kg/ha	25-40	50-60	4-5	80-100
4	Row to row spacing(cm)	30	30	30	15-20
5	Nutrient doses (kg/ha) Nitrogen Phosphorus	80 30	120 60	90 60	100 40
6	Irrigation interval (days)	10-15	7-10	15-20	15-20
7	Stage of cutting	50% flowering (35-40) in multi cut varieties.	Tasseling stage for forage	50% flowering	1 st cut 60-75 days growth and subsequent cuts at flowering
8	Period of harvesting (days)	60 days for first cutting or 50% flowering stage. 45days for subsequent cutting.	70-75	55-60 (35-40)for subsequent cuttings	60-75 (subsequent 40-50days)
9.	Number of cutting	3 multi cut	1	2	2
10	Fodder yield Quintals per hectare. Green Dry	400-500 100-125	400-500 100-125	400-500 100-125	400-500 100-125
11	Crude protein (%)	6.8	7.2	6.9	9-10
12	Special features and tolerance to	Saline soil and calcareous soil	Acid soil	Calcareous soil	Saline soils
13	Remarks	Suitable for silage making. Young jowar	More suitable for silage		Suitable for hay making

		plants cause mimosine toxicity.	making		
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LEGUME FODDERS

S.no	Particulars	Berseem (<i>Trifolium alexandrium</i>)	Lucerne (<i>Medicago sativa</i>)	Cowpea (<i>Vigna Sinensis</i>)	Stylo (<i>Stylosanthes gracilis</i>)
1	Crop varieties	Mescavi Vardan	T-9, Anand 2	UPC-5286 EC-4216/NP3	S. hamata S. humilis S. scabra
2	Sowing time	October to November	October to November	June-July, February to January with irrigation.	June to August (Monsoon)
3	Seed rate kg/ha	25-30	15-20	30-40	20-30
4	Row to row spacing(cm)	Broadcast	20-25 or broadcast	45	30
5	Nutrient doses (kg/ha) Nitrogen Phosphorus	25 80	30 100	25 60	30 60
6	Irrigation interval (days)	3-4 weekly irrigations followed by 8- 10 days interval (winter) and 6- 7 days (hot weather)	2-3 weekly irrigation and thereafter 10- 12 days interval	12-15	20-30 -sown as irrigated crop
7	Stage of cutting	70 days growth	50-60 days growth	50% of flowering	75-80 days after planting

8	Period of harvesting (days)	70 (subsequent 35-40days)	50-60 (30 days subsequent cuttings)	55-60	75-80 days (35-40 subsequent cuts)
9	Number of cutting	4-5	6-7	1	2-3
10	Fodder yield Green Dry	700-950 140-180	600-700 180-200	300-350 75-100	350- rain fed 450 -irrigated 75-100
11	Crude protein (%)	17-18	20-21	17-18	18-20
12	Special features and tolerance to	Saline soils	Saline soils	Acid soils	Waste lands
13	Remarks	Prolonged winter is suitable	Prolonged winter is suitable	Usually sown in mixture with maize, Jowar and bajra etc.	s.humilius observed highly susceptible to anthracnose disease.

GRASSES

S.no	Particulars	Hybrid Napier	Guinea grass (Panicum maximum)	Para grass (Bracharia mutica)	Anjan grass (Cenchrus ciliaris)
1	Crop varieties	N.B. 21, IGFRI-10, BN-2, CO-1, IGFRI-6, CO- 2,CO-3, APBN-1	PPG-14, Hamil, Makueni, Reverse dale, Green panic, Gatton panic.	Local	Australian, Molopo, Gyandah, S- 3108, S-3106, CAZRI-75
2	Sowing/ Planting time	Feb –Aug. Any time in tropical and sub-tropical	Feb- Aug. Any time except winter and frost	Feb. & June – July more suitably, any time in	June- July, Jan- May With irrigation

		areas.	period	southern India	
3	Seed rate kg/ha	22-30 thousand cuttings 15-20 qtls. Stem cuttings or rooted slips.	30-40 thousand rooted slips	8-10 quintals stem cuttings	5-10 or 8-10 qtls. rooted slips
4	Row to row spacing(cm)	50-75	45-60	45-60	30-45
5	Nutrient doses (kg/ha) N P ₂ O ₅	150 60	150 60	150 60	60 30
6	Irrigation interval (days)	15-20 during winter, 8-10 during summer	15-20 during winter, 15 during summer	10-15 during winter, 8-10 during summer.	25-30 during summer
7	Stage of cutting	60-75 days after planting (1 st cut)	50-60 days after planting (1 st cut)	75-80 days after planting	Flower initiation
8	Period of harvesting (days)	60-75 (40-45 subsequent cuttings)	50-60 (40-50 subsequent cuttings)	75-80 (40-45 subsequent cuttings)	80-90 (45-50 subsequent)
9	Number of cuttings	5-6	3-4	6-9	3
10	Fodder yield Green Dry	1800-2500 450-625	500-600 125-150	800-1000 200-250	300-350 rainfed. 450-550 irrigated 100-120
11	Crude protein (%)	10.2	6.7	8	
12	Special features and tolerance	Saline soils	Acid soils and shade resistant	Moist soil and saline soil	Poor soil and arid area.
13	Remarks	—	—	—	—

FODDER TREES AND SHRUBS

S.no	Particulars	Subabul (<i>Leucaena leucocephalus</i>)	Hedge lucerne
1	Crop varieties	Peru, K-8, Cunningham	Dasrath
2	Sowing time	Feb- March(nursery) Jun-July(transplanting) Or direct seeding during June - August	June- August , any time of year with irrigation.
3	Seed rate kg/ha	8-10	
4	Row to row spacing(cm)	4m×3m (for seed and silvipasture) 1m×1m (for fodder)	1m
5	Nutrient doses (kg/ha) N P ₂ O ₅	45 60	30 50
6	Irrigation interval (days)	25-35 during winter and summer.	20 during summer and 35-40 during winter desirable
7	Stage of cutting	1-2 m height	1m height
8	Period of harvesting (days)	5-7 months after planting / sowing (subsequent) 35-40 days during monsoon and 50-60 days during winter and summer.	3 months (subsequent 2 months during winter 1 ½ months during monsoon)
9	Number of cutting	3-4	4-5
10	Fodder yield		

	Green	400-500	300-350
	Dry	100-125	75-85
11	Crude protein (%)	18-20	18-20
12	Special features and tolerance	Versatile	Saline soil
13	Remarks	Seed mature 5-6 months after planting during monsoon, cutting for the fodder leaving 39-40 cm stubble. Excess feeding may cause mimosine toxicity in lambs and kids.	Cutting for the fodder is taken leaving 15-20 cm stubble.

1.7 Silvi pasture-Hortipastures

Silvi pasture system of forage production involves growing of multipurpose nitrogen fixing trees with added fertility resources on waste lands along with grasses and legumes.

Grasses will conserve the soil and moisture the legumes benefit soil by nitrogen fixation and in the mixture they help growth of grasses and trees besides improving the forage quality. Trees and bushes besides providing fire wood and timber, supply fodder during lean period. The system work well with improvement land productivity by 2.5 times compared to the traditional system at use. After 5 years grazing could be allowed thus reducing the cost of the grass harvesting.

The trees selected for these system should be fast growing, hardy with multiple use with the rural population.

In areas no grasses are available in the fields are ploughed and grass seed may be spread and fertilizers are applied to encourage grass growth.

In areas where potential grasses are present introduce legume varieties.

Proper utilization is known to be the most important management factor influencing productivity and sustenance of a grass land. Therefore utilization and management has to be so manipulated that it allows sufficient time to the plants to rebuild their roots preserve as well as forage is available for longer periods continuous grazing or rotational grazing system may be followed depending upon the type of grass grown. Besides practicing grazing of grass lands their harvesting for stall feeding in lean periods is also important for the efficient

management of grass lands. In many studies it is reported that the grass lands can be harvested at every month interval at 10-15 cms height during growth periods.

The grasses should be of high quality highly productive, long duration with high palatability. The legumes should be hardy, palatable, nutritious with strong regeneration through roots or self seeds of semi-arid and dry topics species like acacia and subabul trees are recommended. In saline conditions species like *dichrostachys cinerea* and *prosopis juliflora* are recommended. Under grasses species like *Cenchrus ciliaris*, *Dichanthium annulatum* are recommended for dry areas and for saline areas *brachiaria mutica* is recommended .

1.7.1 Horti- pastures

Horti-pastures are one of the numerous agro- forestry systems aimed at utilizing the limited resources (land and water) more efficiency. In this system fruit trees such as mango, guava, cashew and other orchards species like coconut, rubber are cultivated with pasture grasses occupying the inter spaces. The important grass species that can be used for pasturing in orchards include anjan grass (*Cenchrus ciliaris*), guinea grass (*Panicum maximum* var. *trichoglume* *stylosanthes hamator* S.Seabra) etc., The pasture species should be chosen in such a way that their requirement for growth match with that of the orchard species, and at the same time they are not competitive to the trees. The recommended techniques and management practices should ne adopted to establish and grow the pasture species. Depending upon the growth of pastures and the conditions of the tree species. Depending upon the growth of pastures and the conditions of the tree species the grass can be either cut or allowed for grazing. In the present day circumstances, rearing of sheep with the help of the pasture component in horti-pasture systems appears to be more enterprising and economical.

Some suitable examples of horti-pastroval system are grass and stylos- in mango orchards grasses and clovers-in apple.

Blue panic grass+siratro OR *Cynodon*+*stylo* in cashew orchards

Deenanath grass+Horse gram- is also in cashew

Guinea grass of ruzi grass+ *stylo*- in coconut orchards

Stylos in citrus orchards etc.

Photographs of different fodder crops

CEREALS

Fig. 1.5 JOWAR



Fig. 1.6 MAIZE



Fig. 1.7 BAJRA



Fig.1.8 OATS



LEGUME FODDERS

Fig.1.9 BERSEEM

Fig. 1.10 LUCERNE



Fig.1.11 COWPEA



Fig. 1.12 STYLO



Fig.1.13 HYBRID NAPIER



Fig. 1.14 GUINEA GRASS

GRASSES



Fig. 1.15 PARAGRASS



Fig. 1.16 ANJAN GRASS



FODDER TREES & SHRUBS**Fig. 1.17 SUBABUL****Fig.1.18 HEDGE LUCERNE****Short Answer Type Question**

1. Write the names of the major soil types in India
2. Write about the importance of green fodder in live stock feeding
3. Define Crop rotation with suitable examples.
4. Write the names of organic and chemical fertilizers
5. Write the names of various fodder trees
6. What is selvi- pasture
7. Write the names of agricultural implements used in fodder production.

Long Answer Type Question

1. Write about the classification of fodder crops with examples
2. Explain the cultivation practices of Maize and Jowar
3. Explain the cultivation practices of Hybrid napier and Guinea grass
4. Explain the cultivation practices of Lucern and Cowpea
5. Write short notes on (a) Silvi Pasture (b) Hortipasture

UNIT-2

Fodder Conservation

Structure

- 2.1 Chaffing of fodders – Advantages- Disadvantages
 - 2.2 Improvement of low quality roughages and non conventional feeds – urea paddy straw Treatment
 - 2.3 Aims of Fodder Conservation – Advantages and disadvantages
 - 2.4 Importance of feeding silage to animals
 - 2.5 Design of silage pit
 - 2.6 Method of silage making
 - 2.7 Method of Hay making
-

2.1 Chaffing of fodders

Chaffing: Cutting the fodder stems and leaves into small pieces by manual or mechanical means is known as chaffing. Fodders are chaffed uniformly into fine (0.5cm) or coarse (1-2cm) particles. There are two types of chaff cutters.

1. Hand operated chaff cutter: It is useful for small dairy units with one or two animals.
 - a) Sickle type chaff cutter
 - b) Wheel type chaff cutter with two or three sharp blades.
2. Electrical chaff cutter: It is operated with 5 HP or 10HP motors. These are useful for medium to big commercial dairy farms.

Advantages of chaffing: The stems of grass is made into small pieces and the animal consumes the chaffed fodder without wastage. When the fodder is not chaffed, nearly 40-50% green fodder will be wasted. Chaffed material can be packed in bags. The chaffed fodder consumes less space for storage. It helps in good silage making. It improves the palatability and feed intake. It helps in the feeding of roughages and concentrates together in the form of complete feed or total mixed rations.

Disadvantages of chaffing: It requires separate chaffing equipment and initial investment is higher. Very fine chaffing may decrease the fat percent in milk. Hence, coarse chaffing of fodder is advisable in case of dairy animals.

2.2 Improvement of low quality roughages and non conventional feeds- Urea Paddy Straw Treatment

Chaffing, Grinding, soaking in water, alkali treatment and urea treatment of straws can be practiced for improving the nutritive value of poor quality roughages and their acceptability by the animals. Both chaffing and grinding increases the feed intake. Soaking of wheat straw increases the intake of dry matter by the animals but has no effect on the digestibility of the nutrients. Soaking of paddy straw removes some of the soluble oxalates and may improve the nutritive value of straw.

(a) Alkali treatment of cereal straws.

The straws do not contain any digestible crude protein and are poor in energy, minerals and vitamins. They contain large quantities of cellulose and hemicelluloses which are poorly digested because of the complex formed with the lignin. Therefore, many attempts have been made to improve their digestibility. Wheat and paddy straws are soaked with dilute solution of caustic soda(1.25per cent) overnight. The excess alkali is washed with water. There is a loss in crude protein, ether extract, total ash and nitrogen free extract content of treated straws, consequently the crude fiber content was increased. The digestibility of the treated straws will be improved. The digestibility of total carbohydrates may be improved by about 30-35 per cent. Consequently, the total digestible nutrients in treated straw will also be improved.

Urea treatment of Paddy straw:

2.3Aims of Fodder conservation- Advantages and Disadvantages

Importance of fodder conservation: There is a surplus fodder production during rainy season because of availability of high yielding fodder varieties and water facility. Surplus fodder is conserved as hay and silage. The conserved silage or hay can be fed to the animals during fodder scarcity periods particularly during summer season. Hay making is commonly practiced by farmers in India. But silage making is not very common. It is practiced in some of the large commercial farms.

Advantages :

1. It is less at risk from the weather than hay-making.
2. The ensiling process is the only means by which the entire forage plant can be preserved in a succulent form. The crops can be harvested and stored at the time of its development when it has the maximum nutritive value.
3. Retains higher performance of nutrients than hay because losses due to shattering and bleaching are minimized. Silage preserves 85 percent of feed energy. Hay under best condition preserves only 80 percent and under poor condition 50-60 percent.
4. Silage crops have more yield than other hay-crops. Earlier cuttings at higher levels of digestibility is possible and regrowth are quicker. Thus, more feed nutrients can be grown on an acre of crops used for silage than an acre used for most other purpose.
5. The crop can be preserved as silage more cheaply, more quickly and with less labour.
6. Mechanization from field cutting to feeding is easier with silage.
7. It requires less storage space than hay.
8. Fear of fire is voided.
9. Practically any forage crop is fit for ensiling. Weedy crops and crops with this stalks can be ensiled equally well.
10. Many by products can be economically used.
11. Where conservation is incidental to or integrated with grazing, silage making is more dependable as a method of cleaning up soiled swards and ensuring aftermath grazing.
12. Converting crop into silage clears the land earlier.
13. It is palatable and slightly laxative.
14. It is a better source of protein and carotene than hay.
15. There is a wider choice of feeding methods for silage.
16. Ensiling ensures better storage for a long time.

Disadvantages

- 1.Requires soil and special equipment.
- 2.Less amount of VitaminD in silage than hay.
- 3.Additional expenses are involved for preservatives.
- 4.Due to moisture content, tonnage and transporting charges are increased.
- 5.Wet silage can present difficult problem of disposal of effluent.
- 6.Smell from poorly fermented silage can create problems.
- 7.Wastage may be high when only small amounts are made at one time.

2.4 Importance of feeding silage to animals

Advantages of Silage

- 1.Silage can be stored in less cubic space than hay.
- 2.Silage supplies the green succulent roughages through out the year.
- 3.Nutrition loss in silage making is less than hay making.
- 4.Silage is more palatable than hay.
- 5.Silage can be made even in rainy season when they cannot be made.
- 6.All most all fodder crops can be converted into silage.
- 7.More number of animals can be maintained on a given area of land when silage is fed when compared to hay.
8. Many undesirable things present in a fresh-crop eliminated after ensiling.
9. Fear of fire is avoided.
10. It is less at risk from the weather than hay making.

Disadvantages of Silage: When once silo pit is opened it has to be used continuously till complete use of the material.

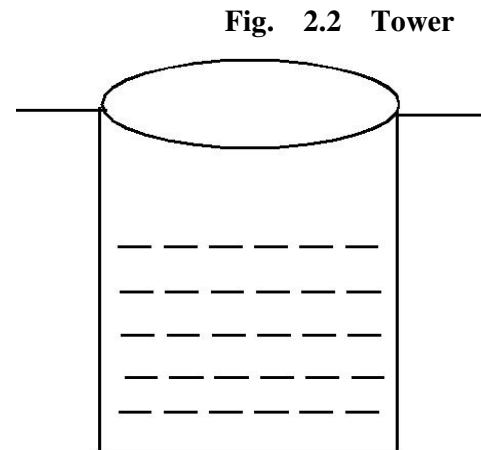
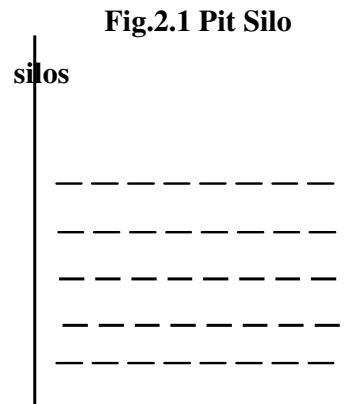
Characteristics of Good silage

- (a) A good silage should be yellowish green in colour.
- (b) It should not have strong objectionable odour.
- (c) It should be palatable to live stock.
- (d) It should have less than 75% moisture.

2.5 Design of silage pit (Silo)

There are two types of Silos: Pit Silo and Tower Silo

Pit Silo: A pit of 3X15X1 meter dimension is prepared (or) dug. For 100 quintals of green grass. The bottom and sides of the pits are covered with paddy straw. The silage pit is filled with green fodder up to about 2.73 above the ground level and covered top make silage.



Tower Silo: Tower silo is round. Cylindrical and is constructed above the ground level. The height varies from 5 to 10 meters with a diameter of 10 to 15 meters. The construction of tower silo is expensive. In tower silo the filling of fodder crop material and sealing is the same as in pit silo. The material is well preserved in this.

2.6. Method of silage Making

Selection and Harvesting of Crop for Silage : Crops suitable for making silage are Maize, sorghum, all green grasses, Lucerne, Berseem, cow pea, soya bean, Oats and Barley,

Almost all forage crops are suitable for silage making. Even some crops that are unsuitable as green fodder(or) hay due to bitterness or off flavor are suitable as silage as they appear to lose these qualities during ensiling.

Maize is a popular crop for silage it yields highly. Besides, at the stage of cutting for ensiling, it possesses the required dry matter percentage and available sugars. Thus normal fermentation is ensured without the addition of any preservation. The fodder can be harvest at 60-70 days cutting and yield 20-25 tonnes per acre. Three crops can be obtained in a year. Sorghum is another important silage crop. The sweet sorghum is better for silage than grain sorghum. It should be cut in the dough stage. Grasses and legumes when used for silage are usually referred to as hay crop silages. Ensiling them requires special methods.

Requisites of Silo:

- (a) The walls should be upermeable.
- (b) Should be sufficiently deep.
- (c) Must be located in an-elevated ground.
- (d) The size of the silo should be calculated on the basis of the number of animals to be fed and
length of the feeding period.

For 100 quintols of grass 3X1,5X1 meter dimension pit is required.

Silage making

Crops more suitable for silage making are maize and sorghum. All green grasses and legumes can also be used for silage making by using special methods. Maize is a popular crop for silage as it yields highly. It possesses the required dry matter percentage and available sugars at the stage of cutting for ensiling . Thus normal fermentation is ensured without the addition of any preservation. The sweet sorghum is better for silage than grain sorghum. It should be cut in the dough stage. The fodder crop to be ensiled should contain about 75% moisture. Molasses is added at 15 kg per ton of grasses or 500 kg of legume fodder. After the silo is filled and packed well, the top of the silo is covered with a one foot layer of wet paddy straw. This layer is then plastered with a clay or clay and cow dung.(10:1) and to keep the silo air tight and water tight, a polythene sheet is covered over the silo. This

will provide necessary compression to the top layers of silage. Air and water should not go inside the packed material. The silage will be ready in 6-8 weeks after covering the silo pit.

2.7 Hay Making.

Advantages of Hay: Hay making is less expensive and easy to prepare. It is nutritious and palatable as compared to straw. Sun cured hay contains more Vitamin-D.

Disadvantages of Hay: It requires more space as compared to silage. Vitamin A is less in hay when compared to silage.

Method of hay making: Preparation of hay by sun curing depends on the type of crop available and the climatic conditions. Thin stemmed crops like Lucerne, Oats and grasses are suitable for hay making. The stage of maturity of the crop at the time of cutting is very important as far as nutritive value of the hay is concerned. An early cut results more nutritive value but less yield. Late cutting on the other hand will result in less nutritive value but more bulk. Legume hays are made out of leguminous plants like Lucerne, berseem and sun hemp. They are rich in proteins, vitamins and minerals. The non-leguminous contain less proteins, minerals and vitamins. Hay may be prepared from thin stem grass.

The fodder crop is cut when 2/3 of the entire crop is in flowering stage. The harvesting should be done in cool hours of the morning . It is put in small heaps in shade, so that it is easy to take turning process. Later, It is stacked on an elevated ground. The heaps of the hay is put to a height of 7 meters. Around the heap a channel of 20 cm deep and 30cm wide is provided to drain the rain water. The hay can also be stacked in a well ventilated shed.

Characteristics of good hay: Hay must be leafy and green to brown in colour. It should have soft and pliable stems. It should be free from moulds, weeds and dust. It should be palatable and have pleasant smell and aroma. It should not contain more than 13-15per cent moisture.

Short Answer type questions.

1. What is Chaffing and advantages of chaffing
2. What is Hay with examples
3. What is Silage?
4. What are the aims of Fodder Conservation?

Long Answer type questions

1. Write about the advantages and method of silage making
2. Write about the advantages and method of hay making
3. What are the Characteristics of the good Hay and silage

UNIT-3

Common Feeds and Fodders

Structure

- 3.1 a) Classification of Nutrients and their role in Animal nutrition.
 - b) Importance of analysis(proximate) of feeds
 - 3.2 Classification of Feeds
 - 3.3 Importance of unconventional feeds
 - 3.4 Composition of Commonly used Feeds and Fodders.
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3.1 a) Classification of Nutrients and their role in animal nutrition

Water: It plays an important role in various physiological functions like digestion, absorption, metabolism, blood circulation and excretory system of the body. Water is present in the Blood (82%), muscles (72%) and milk (87%). It maintains body temperature of the animal through perspiration. Animals meet their water requirements from direct consumption and partly from fodders and feeds. Water requirement of animals depends upon climate, nature of produce from the animal and type of feed consumed. Water intake is more in summer season as compared to winter and rainy seasons. When animal is not taking sufficient water, it results low feed intake and milk production. Severe water loss from body leads to dehydration and death of animal.

All feeds contain some water, which is usually expressed as a moisture percentage of the total feed. The moisture percentage varies in different feeds. Green fodder contains 80-90% water and 10-20% dry matter, whereas cereal grains, bi-products and oil cakes may contain only 10-13% water and 87-90% dry matter.

Proteins: These are major components of blood, muscles and connective tissues in animals. These are responsible for the synthesis of hormones and enzymes for various body functions. These are required for the growth of young animals, milk, meat, wool and egg production. Excess proteins serve as a source of energy and fat. Proteins are classified into simple proteins, conjugated proteins and derived proteins. simple proteins contain only amino acids.

Conjugated proteins contains amino acids combined with non- proteins. These are divided into various classes as given below.

1. Lipo proteins: Proteins combined with lipids, e.g., serum lipo-proteins.
2. Glycoproteins: Proteins combined with carbohydrates, e.g., mucin.
3. Phospho proteins: Proteins combined with phosphoric acid other than nucleic acid, e.g., casein
4. Chromoproteins: Proteins combined with pigments, e.g., haemo-globin.
5. Nucleoproteins: compounds of proteins with nucleic acid.
6. Metalloproteins: Proteins combined with metals, e.g., cerulo-plasmin.

Derived proteins are produced from the degradation of naturally occurring proteins by the action of heat,enzymes or chemical agents like proteoses, peptides and peptones.

Amino acids are required by the animal body for performing various functions in the body. Essential amino acids are not synthesized in the body of mono gastric animals and they are to be supplied through the feed. Ruminants can synthesize these essential amino acids in the rumen. Essential amino acids are arginine, valine, histadine, isoleucein, leucein, lysine, methionine, phenylalanine, threonine, tryptophan. Non-essential amino acids are glycine, alanine, serine, cystine, tyrosine, aspartic acid, Glutamic acid, proline, hydroxy proline, citrulline.

Carbohydrates : These are the major sources of energy for the animals. Most of the energy for the metabolic activities of the cells in all organisms is derived from oxidation of carbohydrates. Blood glucose provides energy to all the cells in the body. These are stored as glycogen in liver and muscles in the body. The carbohydrates are classified into monosaccharides, disaccharides and polysaccharides.

Monosaccharides are glucose, fructose, manose and galactose.

Disaccharides are maltose (glucose+glucose), sucrose or cane sugar(glucose+fructose) and latose (glucose+galactose).

Poly saccharides are starch, glycogen, cellulose, hemicelluloses and lignin. Starch is present in the grains of plants. Glycogen is called as animal starch which is stored in the liver and muscles of animals. Cellulose is present in forages and straws .It is fermented in the rumen of the ruminant animals by the microbial enzymes and the end products are volatile fatty acids

like acetic, propionic and butyric acid. Lignin is present in wood substances which is not digestible in the animals.

Lipids : They provide 2.25 times more energy than carbohydrates and helps in the absorption of fat soluble vitamins (A,D,E and K). They are broadly classified in to simple lipids, compound lipids and derived lipids.

1. Simple lipids are esters of fatty acids with alcohol. The most abundant are the fats and the less abundant are waxes.
2. Compound lipids include the phosphorus containing phospholipids and the galactose containing galacto lipids.
3. Derived lipids include the hydrolysis products of first two classes and other compounds like steroids, sterols, fatty aldehydes and fat soluble vitamins.

Fatty acids are two types i.e saturated fatty acids and unsaturated fatty acids . Saturated fatty acids are butyric acid, caproic acid, caprylic acid, capric acid, lauric acid, myristic acid , palmitic acid, stearic acid and arachidic acid. Unsaturated fatty acids are palmitoleic acid , Oleic acid, linoleic acid, linolenic acid, elioleic acid, arachidonic acid and erucic acid.

Three fatty acids i.e linoleic, linoleic and arachidonic acids are considered to be essential to the mono gastric animals and poultry. Ruminant animals can synthesize the essential fatty acids with microflora in the rumen. Oil seed cakes contain more essential fatty acids.

Minerals: In general, some of the minerals are the constituents of skeletal structure, teeth, horns, wool and hair. These are also responsible for the synthesis of some hormones and enzymes for various body functions. They play an important role in the maintenance of osmotic pressure and acid base equilibrium .Some of the minerals are essential for various functions of nervous, muscular, blood circulation systems and reproduction of animals. These are required for the growth of young animals, milk , meat, wool and egg production. They are classified into

Macro(Major) minerals: Calcium, Phosphorus, Magnesium, Sodium, Potassium and Chlorine etc.

Micro(Trace) minerals: Iron, Copper, Cobalt, Iodine, Manganese, Zinc, Selenium, chromium, molybdenum and fluorine etc.

Mineral	Deficiency symptoms and problems	Feed sources for dairy cattle
Calcium(Ca)	Rickets in young animals, slow growth and poor bone development, easily fractured bones, reduced milk yield, milk fever in milch animals.	Alfalfa and other legumes, ground limestone, Di calcium phosphate steamed bone meal, shell grit and calcium carbonate
Phosphorus(P)	Fragile bones, depraved appetite i.e pica (chewing of wood, hair and bones), poor reproductive performance.	Di calcium phosphate, steamed bone meal, cereal grains, grain byproducts, oil seed meals and rock phosphate
Sodium(Na)	De hydration, reduced appetite, weakness, shivering and death	Common salt
Chlorine(Cl)	Reduced appetite and de hydration.	Common salt
Magnesium (Mg)	Magnesium tetany, lactation tetany, Irritability, increased excitability and convulsions	Grains, oil cakes, forages and mineral supplements
Iron	Nutritional anemia, weakness, stunted growth and thumps in piglets	Legume forages, meat meal, blood meal, fishmeal and bone meal.
Potassium(K)	Decrease in feed intake, loss of hair glossiness, lower blood and milk potassium	Legume forages, potassium chloride and potassium sulfate.
Iodine(I)	Goiter	Forages, grains, fish meal and iodised salt .
Copper(Cu)	Anemia and enzootic ataxia,	Forages, fish meal, cotton seed cake and trace

		mineralized salt .
Cobalt(C)	Anemia , lack of appetite, decreased milk production, sub fertility/infertility.	Legume forages, liver meal, meat meal, fish meal and trace mineralized salt and commercial supplements
Manganese(Mn)	Delayed estrus, poor conception and perosis in poultry.	Forages and Trace mineralized salt and commercial supplements.
Zinc(Zn)	Decreased weight gains, para keratosis, skin problems, slow healing wounds and infertility	Forages, fish meal, molasses trace mineralized salt, commercial supplements and zinc chloride.
Selenium	Infertility, stunted growth and white muscle disease in calves.	Fish meal, meat meal and rock phosphate.

Vitamins

Vitamins are organic compounds required in very small amounts for the maintenance and normal growth of animal life. Deficiency of vitamins leads to deficiency diseases specific with a particular vitamin. Vitamins are divided into fat soluble(vitamin A,D,E and K) and water soluble (B complex and C vitamins). Ruminants can synthesize B complex and vitamin K in the rumen.

Brief information about fat soluble vitamins in livestock

Vitamin	Deficiency symptoms and problems	Common feed sources for livestock
A	Night blindness, lacrimation, skin problems, blindness, low disease resistance, stunted growth in young animals and reproductive problems in adult animals.	Green forages, tree leaves, silage, hay, fish liver oil and synthetic vitamin A premix.
D	Rickets in young animals, osteomalacia in adult	Sun-cured forages, hays,

	animals.	fish liver oils, synthetic premixes.
E	Muscular dystrophy in young animals and encephalomalacia or crazy chick disease in poultry	Green forages and cereal grains.
K	Hemorrhages, sweet clover disease.	Green forages

Brief information about water soluble vitamins in livestock

Vitamin	Deficiency symptoms and problems	Common feed sources for livestock
Thiamine (B1)	Loss of appetite, stunted growth, diarrhoea in pigs and poly neuritis and paralysis in poultry.	Grains and grain by-products
Riboflavin(B2)	Curled toe paralysis in chicks, decreased hatchability in breeding hens and skin lesions & diarrhoea in pigs	Brewers yeast and leafy vegetables
Niacin	Poor growth, diarrhoea in pigs and black tongue in poultry	Brewers yeast ,Meat meal, fish meal
Pyridoxine (B6)	Anemia and reduced growth rate in pigs. Decreased egg production and hatchability in breeding hens.	Grains, leafy vegetables and meat meal
Pantothenic acid	Goose stepping, diarrhea and dermatitis in pigs. Decreased egg production and hatchability in breeding hens.	Grains, grain by-products and molasses
Folic acid	Nutritional anemia	Grains, grain by-products and leafy vegetables.
Choline	It is associated with perosis in poultry.	Grains, grain by-products
Cyanacobalamine(B12)	It is synthesized by the intestinal micro-organisms in pigs and poultry.	Grains, grain by-products

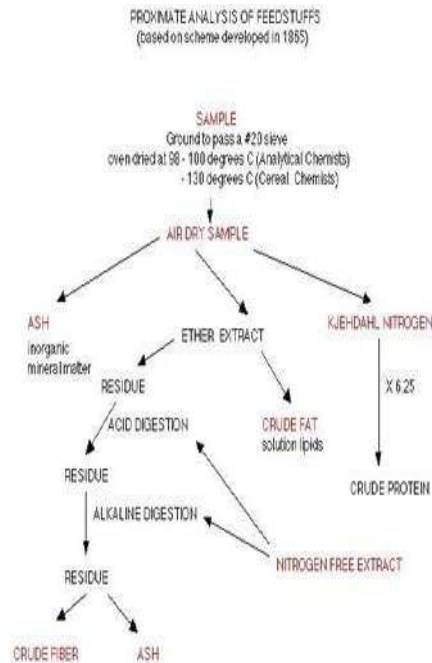
Vitamin-C (Ascorbic acid)	It is synthesized by the intestinal micro-organisms in animals and poultry.	Citrus fruits
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3.1(b) Importance of Analysis (Proximate) of feeds

It is necessary to know the information about nutritive value of the feeds to formulate and produce animal rations. Hennyberg and Stohmann proposed a scheme of chemical analysis of feeds and fodders at Weende experimental station in Germany. The proximate or weende analysis of feed is a quantitative method to determine various nutrients in feed and fodders. Feed stuff is analysed into six fractions i.e moisture (crude water), crude protein(CP), ether extract(fats or lipids, EE), crude fiber(CF) and Nitrogenfree extract(NFE) and ash.

- The feed sample is initially dried at 103 degree Celsius for 4 hours.
- The weight loss of the sample is determined and the crude water fraction is calculated.
- Ashing the sample at 550 degree Celsius for 4 hours removes the carbon from the sample, viz. all organic compounds are removed.
- Again calculating the weight loss of the feed sample from the dry matter to crude ash(CA) content mathematically determines the organic matter fraction.
- The nitrogen content of the feed is the basis for calculating the Crude Protein (CP) content of the feed. The method established by kjeldahl converts the nitrogen present in the sample to ammonia which is determined by titration. Assuming that the average nitrogen content of proteins is 16 percent multiplying the nitrogen content in % obtained via kjeldahl analysis with 6.25 gives an approximate protein content of the sample.
- Fats and lipids are extracted continuously with ether, after evaporation of the solvent the residue remaining is the Ether Extract (EE) fraction.
- The carbohydrates in a feed sample are retrieved in two fractions (CF, NFE) of the proximate analysis. The fraction, which is not soluble in a defined concentration of alkalis and acids, is defined as crude fiber(CF). This fraction contains cellulose, hemicelluloses and lignin. Sugars, starch, pectins and hemicelluloses etc are defined as Nitrogen-Free Extractives (NFE). This fraction again is not determined chemically it is rather calculated by subtracting CP, EE and CF from organic matter.

Fig 3.1 Proximate Analysis :



Estimation of Fibre Fractions

- Van Soest developed a procedure to detect the different components of the cell wall.
- This helps specify the CF and NFE fraction. Thereby the complete amount of the cell wall components is obtained by digesting (boiling) the feed sample in a neutral detergent solution and results in the neutral detergent fiber fraction (NDF).
- The residue after digestion in a solution with sulfuric acid is called the acid detergent fiber (ADF) and contains mainly cellulose and lignin.
- Finally the remaining sample is treated with a sulfuric acid with an even higher concentration resulting in a decomposition of cellulose leaving mainly lignin. This fraction is called acid detergent lignin (ADL).

3.2 Classification of Feeds

Animal feeds are generally classified into three general classes:

- Roughages
- Concentrates
- Feed supplements and additives

Roughages

Roughages are bulky feeds and contain more than 18 per cent of Crude fibre. They are low in energy. They are of two types i.e Green Forages/fodders and dry fodders.

A. Green forages/ Fodders

Succulent fodder crops have relatively high water content, approximately 75-90 per cent. Succulent feeds are further divided into following types:

1. Pasture grasses: Pasture land is covered with pasture grasses and animals are allowed to graze the

pastures. Pastures may be natural or cultivated, perennial or seasonal. It is the only natural way of feeding livestock at a minimum cost. The composition of pasture is highly variable. The crude protein and moisture content decreases as the grass matures. Eg. Dhub grass, Cenchrus and Stylo species etc.

2. Cultivated forage Crops: It is necessary to grow green fodder crops for economical feeding of the animals. Fodder crops are of two types i.e Leguminous and non- leguminous forages.

(a) Leguminous fodder: Leguminous fodder crops are rich in protein, carotene and mineral contents and increase milk yield. They are nutritious and palatable and used for formulating economic rations by replacing concentrates to a certain level. Eg. Cowpea, Pilli Pesara, Lucerne, Berseem, Horse gram, Sun hemp, Cluster beans and Stylo etc.

(b) Non-Leguminous fodder: They are low in protein and minerals as compared to legume forages. E.g. Maize, Jowar, Bajra, oats, Barley, Ragi and other millets. Napier grass, Guinea grass, Para grass, Sudan grass and Anjan grass etc.

3. Tree leaves: Tree leaves are usually used for feeding sheep and goats and sometimes are fed to cattle during fodder scarcity periods. These are also suitable for use as maintenance ration for livestock. The young leaves have a fairly high content of crude protein and less crude fiber. The tree leaves and shrubs are generally rich in calcium but poor in phosphorus. E.g. Subabul, Avisa, Glyricidia, Neem, Ber, Pipal, Babul, Bael, Jack, Banana and Mullberry etc.

4. Silage: Silage is a fermented chaffed fodder, which is made by storing green forages having a high moisture content (60-65%) in the pits under air-tight conditions. E.g. Maize, Jowar and other grass silages.

5. Root Crops and Kernels: Root crops have high moisture content and low crude fibre content. Roots are generally low in crude protein content. E.g. Carrot, Potato, Seed kernels of mango, jamun, Tapioca and Sweet potato.

B. Dry Fodder

1. Hay: Hay means grasses or legumes that are harvested, dried and stored at 85-90% dry matter. Hay prepared by processing the leguminous crops is superior in quality to the hay prepared from non- leguminous crops. Legume hay has a high protein and vitamin content . It is particularly rich in carotene and sometimes, vitamin D and E. The legume-hay is also rich in calcium and is palatable. The most common legume hay are Lucerne, berseem, cowpea and soybean. Non legume hays are oats, barley and thin stem grass hays.

2. Straw: Straw/stover is poor quality dry roughage. It is highly deficient in minerals, vitamins, proteins. It provides between 40 to 50% in digestible energy. Cereal crop straws may not provide sufficient energy to meet their maintenance needs. E.g. Paddy straw, Wheat straw, Maize stalks, Jowar stalks, Ragi straw, Bajra straw, Groundnut straw, Soybean straw, Gram bhusa.

3.2.b. Concentrates

The roughages alone cannot supply all the essential nutrients to the productive, growing and working animals. Therefore, the roughages are supplemented with concentrates. Concentrates are less bulky feeds and contains less than 18% crude fibre with low moisture. They are rich in energy and protein. They are divided in to

(A) Energy rich concentrates (crude protein less than 18%)

(B) Protein rich concentrates (crude protein more than 18%)

(A) Energy Rich Concentrates

1. Grains : cereal or millet grains contain high amount of carbohydrate with starch as its main component. Crude protein content of the grains and seeds vary from 8-12% and is deficient in two essential amino acids lysine and methionine.

a. Maize or corn: Maize is one of the palatable and popular grains for all kinds of live-stock. It contains 85% TDN and about 10% proteins. Yellow maize has more carotene (vit.A).

b. Sorghum (Jowar) : Sorghum grains are slightly higher in protein content and lower in oil content than maize.

C. Bajra : Bajra resembles the feeding value of sorghum. It contains 8-12% of crude protein. It is also rich in tannins.

d. Barley: It is palatable but fibrous (7% crude fibre) feed. Barley is usually steam rolled (flaked) or coarsely ground before feeding.

e. Oats : Oats has higher crude fibre (10-18%) and lower TDN(71%) than maize. It is usually rolled or ground before feeding.

2 .Mill/ Grain by-products

a. Brans : Outer coarse coat of grain separated during processing is called bran. Eg. rice bran, wheat bran and maize bran.

b. Polishings : These are by-products of rice, consisting of a fine residue that accumulates during polishing of rice grains after initial removal of husk and bran. It contains about 10-15% protein, 12% fat and 3-4% crude fiber. It is a good source of energy and vitamin B-complex. This is an excellent feed ingredient for cattle, buffaloes, sheep, swine and poultry.

B) Protein Rich Concentrates : Protein rich concentrates include oilseed cakes, pulse grains and animal by-products.

1. Oilseed Cakes: These are the by-products left after the extraction of oil from oil seeds. Oilseed cakes are good source of protein. They have a high phosphorus content and vitamin B complex, but are poor sources of carotene, vitamin A and calcium.

a. Groundnut cake: It is commonly used protein feed and can be fed to all livestock and poultry. It has about 45% protein and 72% TDN. It is liable to contain a poisonous factor called Aflatoxin, particularly in warm rainy season. It should be always stored in a dry place. It should not be stored longer than 6 weeks in the summer or 3-4 months in winter. It should be thoroughly dried under Sun before storage.

b. Sesamum or Til Cake: It is used for all classes of livestock including poultry. The protein content varies from 40-50% and is rich in Arginine, leucine and Methionine amino acids but is low in lysine.

C . Soya Bean Cake : It is used for all kinds of livestock including poultry. CP varies from 44-49% and had all the essential amino acids.

d. Coconut Cake: It contains 20-26% crude protein and 81%TDN.

e. Sunflower Meal: It contains 40-44% protein and 70%TDN.

f. Cotton seed cake: It contains 40-44% protein and 72%TDN.

g. Linseed Cake: It contains 30-36% protein and 65%TDN.

h.Mustard Cake: It contains DCP 27% and TDN 74%

3.2.C Animal Protein supplements

1. Fish Meal: It is a highly nutritious feed supplement obtained from dry fish.It contains about 10% moisture and 55% protein. It also contains vitamin A,D and B12. Sterlized fishmeal should be used for feeding the growing and producing animals.

2. Meat Meal: It is prepared by boiling and drying the meat obtained from dead animals and powdering it. It contains almost all the nutrients found in meat and is a rich source of animal protein.

3. Blood meal: It is prepared by drying the blood in vacuum pans. It contains about 70% protein. The practice of feeding blood meal in India is not common.

Feed Supplements and Additives

1. Mineral Supplements: Bone meal, Salt, Slaked meal

2. Vitamin Supplements : A, B2, D3,B-complex

3. Probiotics: Most commonly used products are based on *Aspergillus oryzae* and *Saccharomyces cerevisiae*. These probiotics can increase milk yield about 5-7%.

4. Antibiotics: Antibiotics are not classified under nutrients, but are considered as feed supplements. At lower intake, the antibiotics are known to be effective in controlling the subclinical infections and stimulating the growth of animals when added to their feed and drinking water.

3.2.d. Feed Additives:

Feed Additives and supplements play a very important role in enhancing the performance of dairy animals. Today they are necessary in any feed formulation and essential for the formulation of a balanced diet. The additives and supplements used are antibiotic growth promoters (their usage is not banned in India), prebiotics, probiotics, enzymes, mould inhibitors, toxin binders, anti-coccidial supplements, acidifiers, amino acids, by-pass fat, by-pass protein, non-antibiotic growth promoters, milk boosters, antioxidants, feed flavours and herbal preparations of Indian origin. A number of these products are imported from developed countries. These includes

Hormones

- Some of the hormones have growth promoting properties like oestrogens, androgens, progestogens, thyroxine and pituitary growth hormones.
- Iodinated casein is a commercial product which has given variable response.
- Synthetic oestrogenic hormones like stilboestrol and hexoestrol are being used in many countries as growth promoters. These are being used for poultry, beef and lamb production.

Probiotics

- Many microbial feed additives for ruminants have been used which include bacterial cultures from both ruminal and non-ruminal sources.
- Most commonly used products are based on *Aspergillus oryzae* and *Saccharomyces cerevisiae*. These probiotics increase in milk yield to about 5-7%.
- The mode of action is still not very clear.

Antibiotics

- Antibiotics are not classified under nutrients, but are considered as feed supplements.
- They are chemical substances produced by the micro organism and have bactericidal or acteriostatic action on the other microorganism.
- At lower intake the antibiotics are known to be effective in controlling the subclinical infections and stimulating the growth of animals when added to their feed and drinking water.

Other feed additives

- **Calcium Propionate** Increase blood glucose and calcium levels
- **Protected Choline** A methyl donor used to minimize fatty liver formation and to improve fat mobilization.
- **Enzymes** Increase fiber digestibility by reducing fiber (cellulose and xylanase enzymes) and DM intake.
- **Magnesium Oxide** Alkalinizer (raises rumen Ph) and increases uptake of blood metabolites by the mammary gland raising fat test.
- **Monensin** Improve feed efficiency for lactating cow, reduce ketosis and displaced abomasums in transition cows by shifting rumen fermentation and microbial selection.

3.3. Importance of unconventional feeds

The feed ingredients, which are not commonly used in the feeding of animals even though they have nutritive value, are known as unconventional feeds. These unconventional feeds are used

- To minimize the competition of livestock with the human race for conventional food grains.
- To minimize the cost of feeding, as these are available at low prices.
- Because of the limited availability of conventional foodstuffs.
- At present in India, there is a shortage of Dry fodder, green fodder and concentrates. To meet the shortage, unconventional feed ingredients are used in livestock feeds.

Important unconventional feeds are Sal Seed meal, Cassava Roots, Tapioca Starch Waste, Palm Flour, Tamarind Seed Powder, Babul Pods, Jackfruit Wastes, Niger Cake, Neem Cake, Rubber Seed Cake, Karanj Cake, Dhaincha Seed Cake, Safflower Seed cake, Sugarcane bagasse, sugarcane tops and sugar beet pulp etc.

3.4. Composition (Nutritive Vaues) of Commonly Used Fodders and Feeds in livestock feeding (Digestible nutrients kg. per 100 kg. of raw material)

S.No.	Item	DCP%	TDN%
Grasses			
	Hybrid napier	1.0	13.0
	Guinea grass	1.0	16.0
	Para grass	2.0	11.0
	Anjan grass	1.0	11.0
	Dhub grass	2.0	15.0
	Rhodes grass	1.0	16.0
	Sudan grass	0.5	11.0
Non-legume fodders			
	Wheat Straw	0	48.9
	Maize	1.0	17.0
	Jowar	1.0	16.0
	Bajra	1.0	15.0
Legume fodders			
	Lucern	3.0	12.0
	Berseem	3.0	12.0
	Cowpea	3.0	13.0
	Horse gram	3.0	12.0
	Velvet bean	2.0	12.0
	Cluster bean	1.0	10.0
Straws			
	Paddy Straw	0.0	44.0
	Wheat straw	0.0	44.0
	Jowar kadbi	1.0	50.0
	Groundnut straw	8.0	48.0
Legume hays			
	Lucerne hay	10.0	50.4
	Berseem hay	9.0	59.0

	Cowpea hay	9.0	45.0
Non-Legume hays			
	Dub hay	4.0	39.0
	Oat hay	2.0	54.0
	Jowar hay	0.5	46.4
Silages			
	Maize silage	1.0	18.0
	Jowar silage	0.5	15.0
Grains and seeds			
	Maize	7.0	85.0
	Jowar	7.0	74.0
	Bajra	4.5	44.5
	Oats	7.0	78.0
	Barely	7.0	77.0
	Wheat	6.0	83.0
Cereal by-products			
	Rice bran	6.0	60.0
	De oiled Rice bran	9.0	50.0
	Rice Polishings	8.0	80.0
	Rice husk	2.0	29.0
	Wheat bran	10.0	67.0
	Maize husk	4.0	67.0
Oilseed cakes			
	G.N.cake	42.0	71.0
	Til cake	38.0	78.0
	Cotton seed cake	35.0	72.0
	Sunflower cake	36.0	70.0
	Coconut cake	19.0	81.0
	Linseed cake	30.0	65.0
	Safflower cake	37.0	70.0
	Rape seed cake	28.0	74.0
	Mahua cake		

Other feed ingredients			
	Gram chuni	6.0	70.0
	Gram husk	0.0	55.0
	Molasses	0.0	54.0
	Tapioca waste	2.0	60.0
	Maize gluten	21.5	61.0

Short Answer Type Questions.

1. Write the deficiency symptoms of Calcium and Phosphorus
2. Write the deficiency symptoms of vitamin A and D
3. Write examples of vegetable protein supplements
4. Define concentrates
5. Write examples of unconventional feeds
6. Explain probiotics
7. Define Roughages

Long Answer Type Questions

1. Write briefly about various important minerals in livestock nutrition
2. Write briefly about important vitamins in livestock nutrition
3. Classify feeds with suitable examples?
4. Briefly discuss about various unconventional feeds
5. Discuss in detail various types of concentrate feeds?
6. Write briefly about proximate analysis of feeds

UNIT-4**FORMULATION OF RATIONS****Structure:**

- 4.1 Definition of Ration and Feeding Standards
 - 4.2 Desirable Characters of Good Ration
 - 4.3 Thumb rules of Feeding Cattle, Buffalos, sheep and goat.
 - 4.4 Principles Formulation of rations for different classes of animals
 - 4.5 Formulation of milk replacer and starter
 - 4.6 Formulation of concentrate feed
-

4.1 Definition of Ration and Feeding Standards.

RATION : Ration is the feed allowed for a given animal during a day of 24 hours. The feed may be given at a time or in portion at intervals.

Balanced Ration: Ration which provides the essential nutrients to an animal in such a proportion and amount they are required for the proper nourishment of the particular animal for 24 hours is known as balanced ration.

Maintenance Ration : This is the minimum amount of feed required maintain the essential body process at their optimum rate without gain or loss in body weight or change in body composition.

Production Ration: Ration given to an animal for production of milk, work, meat or egg is known as Production ration. It is in addition to the maintenance ration.

Feeding Standards : Feeding standards are those which give the quantity of nutrients required by an animal to remain healthy and highly productive. Feeding standards are set in accordance with productivity (milk, meat, wool, eggs), composition of the product (fat content of milk), and physiological condition (growth, foetal development).

Feeding standards differ for animals according to breed, age, and intended use. Consideration is also given to varying regional conditions. Modern feeding standards include the animal's total nutritional needs, expressed in feed units – digestible protein, calcium, phosphorus, and carotene. Standards of consumption of vitamins and trace elements

have been established for each animal type: for swine and poultry, standards have also been established for amino acids.

Table 1. Daily Nutrient requirements for Maintenance, Pregnancy and lactation for Cattle and Buffalo (Ranjhan 1991)

Body Weight (Kg)	DM	DCP	TDN	Ca	P
Maintenance of mature cows and Buffaloes.					
200	3.5	150	1.7	8	7
250	4.0	170	2.0	10	9
300	4.5	200	2.4	12	10
350	5.0	230	2.7	14	11
400	5.5	250	3.0	17	13
450	6.0	280	3.4	18	14
500	6.5	300	3.7	20	15
550	7.0	330	4.0	21	16
600	7.5	350	4.2	22	17
650	8.0	370	4.5	23	18
700	8.5	390	4.8	25	19

Body Weight (Kg)	DM	DCP	TDN	Ca	P
Maintenance of Pregnancy (Last months of gestation)					
250	4.9	270	3.0	14	12
300	5.6	290	3.4	16	14
350	6.4	320	3.7	21	16
400	7.2	350	4.0	23	18
450	7.9	400	4.4	23	20
500	8.6	430	4.8	29	22
550	9.3	465	5.2	31	24
600	10	500	5.6	34	26
650	10.6	530	6.0	36	28
700	11.3	550	6.3	39	30

Milk Production (Nutrients Required Per Kg of Milk Fat)		
Fat %	DCP (g)	TDN (g)
3.0	48	275
3.5	51	300
4.0	55	325
4.5	58	350
5.5	65	400
6.0	68	425
7.5	79	500

4.2 Desirable Characteristics of a Good Ration: The ration should be prepared properly balanced with all required nutrients. It should be palatable. There shall be variety of foodstuffs in ration. The components of ration should be of good quality. It should be fed individually. It should contain sufficient mineral matter. It should be Fairly Laxative. It should have sufficient quantity of green fodder. It should be fairly bulk, but not too bulky. It should be economical and consume less labour.

4.3 Thumb Rules of Feeding Cattle, Buffaloes, Sheep and Goat.

- The nutrient requirements of the animal are basically divided in to maintenance and production requirements. Maintenance requirement is the requirement of nutrients to just maintain the animals without losing body weight. It depends on the weight of the animal. Production requirement is the requirement of nutrients for the various production functions i.e milk, growth, meat and eggs.
- A young growing animal requires more nutrients in addition to its maintenance requirements.
- A pregnant animal requires more nutrients for the growth of foetus in the uterus in addition to its own maintenance requirement. A young growing pregnant heifer requires nutrients for maintenance, its own growth and the growth of its foetus.
- A milk producing animal requires more nutrients for milk production in addition to its maintenance requirement. A young growing heifer which is in 1st and 2nd lactation requires 20 and 10 per cent over and above the maintenance requirement.
- A work animal requires more nutrients for work in addition to its maintenance requirement.

- The dry matter (DM) requirement of cattle is at rate of 2.0-2.5% and buffalo is 2.5-3.0% of their body weight per day.
- The dry matter requirement of Sheep and Goat is 3% and 4% of their body weight respectively.

Out of total DM requirement, 67% should be met from roughages (of which 45% dry and 22% green) and remaining 33% from concentrates.

Calculation of Dry Matter (DM) requirement.

DM requirement of a cattle weighing 400 Kg can be calculated as 2.5% of body weight.

Total DM requirement is = $400\text{kg} \times 2.5\% = 10 \text{ Kg}$.

DM from concentrates = $10 \text{ Kg} \times 33\% = 3.30 \text{ Kg}$.

DM from dry roughages = $10\text{Kg} \times 45\% = 4.50 \text{ kg}$.

DM from green roughages = $10\text{Kg} \times 22\% = 2.20 \text{ Kg}$.

4.4 Principles of Ration Formulation for Different Classes of Animals.

- Calculation of the total nutrient requirements of the animals according to their body size and physiological functions i.e milk, growth, Pregnancy and work.
- Proper combination of available feedstuffs to supply these nutrients in the most economical manner.
- Local availability and cost of ingredients will be the determining factors.
- Green and dry roughages are normally the least expensive and are considered first.

The remaining requirements are met with concentrates.

Method of ration formulation: There are three methods i.e Pearson square method, Trial and error method and using computers.

Pearson square method : The Pearson square or box method of balancing rations is a simple procedure .

Procedure:

Example: Rice bran and soybean meal are available as feedstuffs to prepare a concentrate feed containing 27 percent crude protein for a calves.

- A square is constructed and the two feedstuffs are put on the two left corners along with the protein content of each.
- The desired protein level of the feed is placed in the middle of the square.

Next, the protein level of the feed is subtracted from that of the feedstuffs, placing the answer in the opposite corner from the feedstuff. Ignore positive or negative signs.

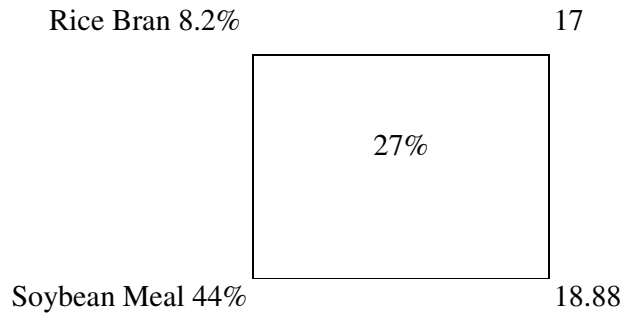


Fig./ 3.1 Pearson Square.

To make the 27 percent crude protein calf feed, we must mix 17/35.8 of rice bran with 18.8/35.8 soybean meal.

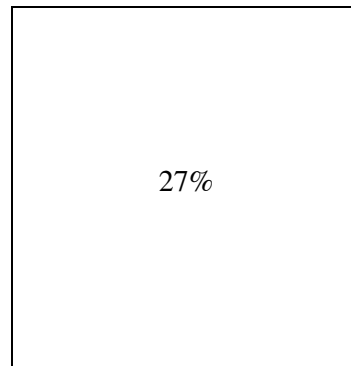
Rice Bran $17/35.8=47.5\%$

Soybean meal $18.8/35.8=52.5\%$

So to make 100 kg of this concentrate feed we must mix 47.5 Kg of rich bran with 52.5 Kg of soybean meal.

If more than two feedstuffs are used in a feed, they may be grouped into basal feeds (CP<20 percent) and protein supplements (CP>20 Percent), averaged within each group, and plugged into the square method.

*For example, suppose shrimp meal and corn were also available for the calf feed mentioned above. The crude protein levels of the fish meal (52.7 percent) and of corn (10.2 percent) are averaged with soybean meal and rice bran, respectively.



Basal Feed 9.2%

21.35

Rice Bran + Corn CP

Protein Supplement.

Soya bean meal + Fish meal 48.35% 17.8

Fig. 3.2 Pearson Square.

Basal feed = $21.35/39.15 = 54.53\%$

Protein supplement = $17.8/39.15 = 45.47\%$

Thus, to make 100 Kg of this feed one would mix the following:

Rice bran 27.265 Kg.

Corn 27.265 Kg.

Soybean meal. 22.735 Kg.

Fish meal. 22.735 Kg.

Trial and error method

To prepare calf feed containing 25% CP

Choose a combination of ingredients that will provide a feed containing 25% CP for Calves.

Calculate the required percent CP in the feed, E.G. rice bran = $40 \times 9.9/100 = 3.96$ or 4.

The mixed feed should contain 25% CP if 100 Kg of the ingredients combined.

Ingredient.	Amount.	% Crude Protein.
Rice bran.	40	9.90
Brewer Waste.	20	22.80
Soya bean meal.	28	46.20
Fish meal.	12	57.70
Total.	100	

Ration Formulation with Computers

Today almost all rations are formulated with the aid of computers. Use of computers has resulted in more complete evaluations of nutrient profiles in rations and allowed for economics to be included in ration formulation decisions.

4.5 Formulation of Milk Replacer and Calf starter

Milk replacer is a constituted feed for dairy calves. Milk can also be substituted with milk replacer for economical calf rearing. Milk replacer resembles milk in biochemical composition and decrease the cost of calf rearing.

Objectives of Milk Replacer : It is useful to raise orphan calves, supplement dam's milk, wean calves at an early age, make raising of calves cheaper and to maintain normal growth of calves.

Essential Points for Successful Results With Replacer : It should be nutritionally adequate, similar to composition of milk, less crude fibre, palatable and it should contain additives like antibiotic mixture, vitablend/Rovi mix etc. It should be easily mixable with warm water/ milk and economical. It contains minimum 20% crude protein. The milk replacer is diluted with water in the ratio of 1:8. There should be proper sanitation in calf pen. Sterilized utensils are to be used while feeding milk replacer to the young calves.

Composition of Milk Replacer

Wheat	: 10 Kg.
Fish Meal	: 12 Kg.
Linseed meal	: 40 Kg.
Milk	: 13 Kg.
Coconut Oil	: 10 Kg.
Butyric Acid	: 0.3 Kg
Citric acid	: 1.5 Kg.
Mineral Mixture:	3.0 Kg
Antibiotic Mixture:	0.2Kg
Vitamin mix(A,B2,D3):	0.015Kg

Calf Starter

An ideal calf starter contains 20-23 percent DCP and 70 percent TDN. Calf starter should be palatable and fibre should be less than 7 percent.

Composition.

Maize/Jowar	: 50 Kg.
Ground nut cake.	: 30 Kg.
Wheat bran/Rice bran	: 8 Kg.
Fish Meal/Dried skim	
Milk powder	:10 kg.
Mineral Mixture	: 2 kg.

To 100 kgs of above mixture, the following may be added

Molasses	: 5-10 per cent according to availability
Salt	: 0.5 per cent
Rovimix/vtablend	: 10 gms per quintal
Aurofac	: 20 g.

4.6 Formulation of concentrate feed for dairy animals, sheep and goat:

A balanced concentrate mixture can be prepared with local available feed ingredients. It should contain 14-16 % DCP and 65-70 % TDN.

Examples:

Conc.mixture – I

Maize/Jowar	: 30Kg
Wheat bran/ Rice bran	:30Kg
Ground nut cake	:20Kg
Gram chunni	:17Kg
Mineral mixture	: 02Kg
Salt	: 01Kg

Conc.mixture - II

Maize/Jowar	:20Kg
Wheat bran/ Rice bran	:37Kg
Gram chunni	:20Kg
G N cake /Til cake	:20Kg
Mineral mixture	: 02Kg
Salt	: 01Kg

Short Answer Type Questions.

1. What is Ration?
2. Explain maintenance ration
3. Define maintenance ration.
4. What is production Ration
5. What is milk replacer
6. Explain calf starters.

Long Answer Type Questions.

1. Mention various desirable characteristics of a good ration
2. Explain various thumb rules of feeding of dairy animals
3. How do you balance the ration using Pearson square method
4. Formulate calf starter and concentrate mixture for dairy animals

UNIT-5**Feeding of Dairy Animals****Structure**

5.1 Feeding of New Born Calf

5.2 Feeding of Calf up to 1 year age

5.3 Feeding of Heifer, milch and Dry animal

5.4 Feeding of pregnant and newly calved animal

5.5 Feeding of animals during drought and cyclone

5.1 Feeding of calf

Feeding of New Born calf : New born calf should be fed with colostrum from the mother within 30 minutes to one hour after birth. Colostrum is the first milk given by the mother after calving. The proteins of colostrum consists of a much higher proportion of globulin than in normal milk. These globulins are the source of antibodies which protect the young one/ calf from many infections during early stage of life, after birth. The protein content of colostrums is 3 to 5 times as that of normal milk. It is also rich in minerals and vitamin-A. Colostrum act as a laxative to remove the meconium (first faecal material) from the intestines of new born calf. It is given at 10% of body weight of the calf. Minimum of two litres of colostrums is given to a calf per day. It is given for a period of 3 to 5 days after birth.

System of calf Rearing.

Sucking method : The calf is allowed to suckle the mother before and after milking the cow. The calf gets whole milk throughout lactation.

Advantages : This is natural system of feeding and the calf gets milk free from contamination . No much care is required during calf feeding .

Disadvantages: When calf is dead, the cow refuses to give the milk. There may be about over feeding or under feeding of the calf. The actual quantity of milk yield of cow can not be recorded. The post partum heat will be late.

Weaning method : In this system, the calf is separated from its mother either just after the birth or after 2-3 days of birth.

Advantages :

- i) Cow continues to give milk whether calf is alive or not.
- ii) Calf can be fed scientifically as per requirements and no problem of under feeding and over feeding.
- iii) The actual amount of milk produced by cow can be recorded.
- iv) Milking without calf is more hygienic and sanitary.
- v) Cow becomes regular breeder and the calving interval is less than the un weaned animals.
- vi) The calf can be culled at an early stage.

Disadvantages: This method cannot be practiced in Indian cattle and buffalos. It can be easily practiced in exotic cattle and cross bred cows. The milk feeding pails should be clean.

Hand/Pail feeding: The weaned calf should be taught to take milk from a milk pail from first day onwards. When the calf develops appetite insert two fingers of right hand into the mouth while holding milk in left hand at convenient height for the calf. While calf suckles the fingers, the muzzle is gradually pressed down into milk pail. This way calf learns to drink milk from pail gradually.

Nipple system: A pail containing milk equipped with rubber nipple is used for milk feeding to the calf.

Milk feeding schedule to the calf

The calf after weaning from the dam, it should be fed with the whole milk, skim milk and re-constituted milk and also calf starters in gradual age. The temperature of the milk must be at body temp. i.e., 39 C, the utensils used must be clean and sterilized. The milk should be fed twice a daily.

Milk feeding schedule - I

Body weight(kg)	Calf age(days)	Colostrums(litre, per body weight	Whole milk (liters per body weight)	Skim milk(liters per body weight)
Upto 25	Upto 5	1/10th	-	-
20-30	09-20	-	1/10 th	-
25-50	21-30	-	1/15 th	1/20 th
30-60	31-60	-	1/20 th	1/25 th
40-75	61-100	-	1/25 th	1/25 th

Feeding schedule of calves- II

Age (Day)	Whole Milk (Kg)	Skim Milk(Kg)	Calf Starter in Kgs.
0-5	Colostrum	-	-
6-7	2.75	-	-
8-14	3.25	-	-
15-21	2.75	1.00	0.10
22-28	1.75	2.00	0.20
29-34	1.00	3.00	0.30
35-42	0.50	3.50	0.50
43-56	-	3.50	0.75
57-84	-	2.50	1.00
85-112	-	0.50	1.25
113-140	-	-	1.75
141-182 (up to 6 months)	-	-	2.00

Calf starter should contain 22% DCP and 70-75% TDN and it should be prepared from good quality feeds i.e., easily digestible low fibre feed and has to be free from any kind of toxins or anti metabolites.

Ingredient	Percent composition (Kg per 100 Kg)								
	1	2	3	4	5	6	7	8	9
Crushed maize	30	42	38	50	10	-	-	50	49
Crushed barley / oat	10	-	-	-	10	10	-	-	-
Crushed ragi / jowar	10	-	-	-	-	-	20	-	-
Crushed wheat /rice	-	-	-	-	30	40	30	-	-
GN cake / soybean meal	30	28	20	40	20	30	30	27	20
Til cake / linseed meal	-	-	-	-	-	-	8	10	10
Mustard cake	-	-	-	-	10	-	-	-	-
Fish meal	10	8	-	-	-	-	-	-	8
Wheat bran	7	19	26	-	1010	10	10	10	10
Molasses	-	-	-	7	7	7	-	-	-
Skimmed milk powder	-	-	13	-	-	-	-	-	-
Mineral mixture	2	2	2	2	2	2	2	2	2
Common salt	1	1	1	1	1	1	1	1	1

10 g vitamin supplement (A,B2,D3) should be added in 1 quintal of the mixture if green fodders are not fed.

Feeding schedule of Growing Animals from 6 months and onwards.

Age (months).	Approximate body weight (kg)	Concentrate mixture (kg)	Grass (Kg)
6-9	70-100	1.5-1.75	5-10
9-15	100-150	1.75-2.25	10-15
15-20	150-200	2.25-2.50	15-20
Above 20	200-300	2.50-2.75	15-20

5.3 Feeding of Heifers: Heifer is a growing animal .It requires nutrients for body maintenance and growth. When sufficient green fodder is available, they may be fed with adlibitum of green fodder and limited concentrate mixture. As a thumb rule, a heifer may be fed with about 30 kg. green fodder, 3 kg dry fodder and 1.5 to 2.0 kg concentrate mixture.

When sufficient green fodder is not available, it may be fed with 2.0 to 3.0 kg concentrate mixture and ad libitum dry fodder.

Feeding of Milch Animal.

Early lactation (0 to 70 days postpartum) : Milk production increases rapidly during this period and it will reach peak milk yield at 6 to 8 weeks after calving. Feed intake of the animal does not increase with nutrient needs for milk production, especially for energy. Energy will be mobilized from body tissue to meet energy requirements for milk production. It results loss in body weight. Good feeding is required during this period to increase the peak milk yield. As a thumb rule, the milch animal requires about 30kg. green fodder and 5-7kg dry fodder to meet the body maintenance requirements. One kg concentrate mixture is given for every 2.5kg milk in cows and One kg concentrate mixture is given for every 2 kg milk in buffaloes apart from maintenance requirements. Another one kg concentrate mixture is given to increase the milk yield over and above the maintenance and milk production requirements. About 30-50grams mineral mixture is given per day along with concentrate mixture in case of high milk producing animals.

Feeding of newly Calved Cows and Buffaloes : Challenge feeding of high milk yielding cows is started Just two weeks before calving. This challenge feeding will condition her digestive system for the increased amount of concentrates of early lactation and provide enough nutrients to initiate lactation on a higher plane. The challenge feeding should be done in following way.

- Start feeding 0.5 kg of the concentrate mixture 2 weeks before calving. Daily increase this quantity by 300-400grams until the cow is consuming 0.5 to 1.0kg concentrate mixture for every 100kg body weight.
- After calving, start increasing the concentrate mixture by 500grams a day in the first two weeks of lactation until the cow is consuming concentrate mixture on free choice level. It is continued until the cow achieves peak yield. Then the amount of concentrate mixture is fixed as per the milk yield i.e One kg concentrate mixture is given for every 2.5kg milk in cows and One kg concentrate mixture is given for every 2 kg milk in buffaloes apart from adequate green and dry fodder.

Feeding during mid lactation : Cow should be maintained at peak production as long as possible. Feed intake is maximum and no loss of body weight during this stage when the

animal is fed properly. As a thumb rule, the milch animal requires about 30kg. green fodder and 5-7kg dry fodder to meet the body maintenance requirements. One kg concentrate mixture is given for every 2.5kg milk in cows and One kg concentrate mixture is given for every 2 kg milk in buffaloes apart from maintenance requirements. About 30-50grams mineral mixture is given per day along with concentrate mixture in case of high milk producing animals.

Mid – to late lactation (150 to 305 days postpartum): Milk production is declining, the cow is mostly pregnant, and nutrient intake will easily meet or exceed requirement. Milk production should slowly decline at an 8 to 10 percent drop per month. Avoid over-conditioning cows. As a thumb rule, the milch animal requires about 30kg. green fodder and 5-7kg dry fodder to meet the body maintenance requirements. One kg concentrate mixture is given for every 2.5kg milk in cows and One kg concentrate mixture is given for every 2 kg milk in buffaloes apart from maintenance requirements.

5.4: Feeding of Dry and Pregnant Animal.

A dry pregnant cow should be fed with a well balanced ration during the last two months of pregnancy for the growth of foetus, to recoup the sufficient reserves of nutrients in the body of the cow for ensuring lactation. It results higher initial milk yield. It improves the body weight, condition and control the metabolic diseases like milk fever, ketosis and reproductive problems at the time of calving like dystocia and retained placenta. As a thumb rule, a pregnant and dry animal requires about 30kg green fodder, 5kg dry fodder and 2-2.5kg concentrate mixture along with 50grams mineral mixture per day.

Tips for Feeding Cows and Buffaloes:

- Good quality roughage saves concentrates. Approximately 20 kg of grasses (guinea, napier, etc.) or 6-8 kg legume fodder (Cowpea, lucerne) can replace 1 kg of concentrate mixture (0.14-0.16 kg of DCP) in terms of protein content.
- 1Kg straw can replace 4-5 Kg of Grass on dry matter basis. In this case the deficiency of protein and other nutrients should be compensated by a suitable concentrate mixture.
- Long and thick-stemmed fodders such as hybrid napier, jowar and maize should be chaffed and fed.

- Highly moist and tender grasses may be wilted or mixed with straw before feeding. Legume fodders may be mixed with straw or other grasses to prevent the occurrence of bloat and indigestion.
- Silage and other feeds, which may impart flavor to milk, may be fed after milking.
- Regularity in feeding should be followed. Concentrate mixture can be fed at or preferably before milking – half in the morning and the other half in the evening – before the two milkings.
- High yielding animals may be fed three times a day (both roughage and concentrate). Increasing the frequency of concentrate feeding will help maintain normal rumen motility and optimum milk fat levels.
- Sudden change in the feed should be avoided.
- Grains should be ground to medium degree of fineness during preparation of concentrate mixture.
- Concentrate mixture must be feed individually according to production requirements.
- All feeds must be stored properly in well-ventilated and dry places. Mouldy or otherwise damaged feed should not be fed to the animals .
- For high yielding animals, the optimum concentrate roughage ratio on dry matter basis should be 60:40.
- The manger should be kept clean otherwise the animals will not consume the given feed. It will decrease the milk yield.
- Sufficient fresh and good quality water should be available in the clean water trough. Nearly 4 litres water is required to produce every one litre milk synthesis in the udder.

5.5 Feeding of Animals During Drought and Cyclone: There is a severe shortage of conventional feeds during drought. Hence, unconventional feed ingredients can be used for livestock feeding. These are divided into.

Unconventional concentrates: Mango seed kernel, tamarind seed, sun hemp seed, rubber seed cake, neem seed cake and Babul pods etc.,

Unconventional roughages:- Tree leaves, groundnut straw, rice husk, coffee seed husk, sugar cane tops, forest grass, cotton straw and sunflower straw etc.,

Unconventional industrial by products:- Sugar cane bagasse, Fruit and Vegetable wastes, Distillation wastes slaughter house waste, poultry droppings, pulp and paper industry wastes, rumen contents, molasses from alcohol industries.

When there is a shortage of green grass or dry grass, the animals are fed with silage or hay. Sometimes cattle camps are conducted in severe drought conditions. Urea treated paddy straw can also be fed to the cattle during drought and famine conditions. Other sources of feeding materials are tubers, forest leave, urea, molasses are fed to the animals. The animals should have free access to water at all times during summer. Urea molasses feeding i.e Water 2.5%, Urea 2.5%, Molasses 92.0% Mineral mixture 2%, Common salt 1% can be practiced.

SHORT ANSWER TYPE QUESTIONS.

1. Write the importance of colostrums
2. Write advantages of weaning
3. What is the DCP and TDN in good calf starter
4. Write feeding of heifers
5. Write feeding during mid lactation
6. Write feeding of feeding of advanced pregnant animal

LONG ANSWER TYPE QUESTIONS.

1. Explain in detail about the feeding of calf up to one year.
2. How do you feed a heifer and pregnant animal
3. Write about the feeding practices for milch cows in different stages of lactation.
4. Feeding of dairy animals during drought and cyclone.

UNIT-6**FEEDING OF THE SHEEP AND GOAT****Structure:**

- 6.1 Feeding of Breeding stock
 - 6.2 Feeding of pregnant Ewe and Doe
 - 6.3 Feeding of new born and orphans.
 - 6.4 Creep feeding.
 - 6.5 Feeding of Ram lambs.
-

Small ruminants i.e sheep and goat are mainly raised under pasture land in the village common lands, agricultural lands after harvesting the crops and forest areas and grazing with supplementation of top feed resources during critical lean season under field conditions in India.

Sheep and goat differ in their feeding habits. The feeding behavior of sheep is called as grazing. The feeding behavior of goat is called as browsing. Goats prefer to consume a wide variety of feedstuffs. Goat are more selective and browse more, especially under extensive conditions than sheep. Goat generally have better body conditions compared to sheep under the same grazing conditions, mainly due to their ability to select a nutritious diet. Goats prefer to eat feed at a height of 20-120 cm. They have the ability to stand on their hind legs for long periods. They also have mobile upper lips and tongue that enable them to consume leaves between thorns. Crude fibre utilization is more in goats. Dry matter requirement of goat is about 4-5% of bodyweight. Dry matter requirement of sheep is about 3-4% of bodyweight. Goats generally produce more milk than a sheep from the same quantity of nutrients.

When sheep and goat are maintained under semi-intensive and intensive system, anjan grass, guinea grass, legume forages like lucern, berseem, cowpea, pilli pesara, stylo and hedge lucern can be cultivated. Multi cut fodder jowar and hybrid napier fodders can also be cultivated but the tender fodder should be chaffed and fed to the sheep and goat. Adult sheep

and goat requires about 5-7kg green fodder depending on the size of the animal. Concentrate mixture is provided during certain critical periods i.e 2weeks before and during breeding season, last two months of pregnancy, three months after lambing/kidding and young lambs and kids up to one year age to get higher growth rate.

6.1 Feeding of Breeding stock: Flushing increases the energy and nutrient intake two weeks before breeding season and during breeding season .This results more tupping per cent, increased rate of ovulation and increase in lambing rate in ewes and kidding rate in goats. Breeding ewe/doe is fed with 200 grams concentrate mixture daily apart from grazing on the good pasture land/forage for 2 weeks prior to breeding and during breeding season. Breeding ram or buck is fed with 500grams concentrate mixture daily apart from grazing on the good pasture land/forage for 2 weeks prior to breeding and during breeding season so that it can breed more number of females during breeding season. Breeding ram or buck is fed with 200grams concentrate mixture daily apart from grazing during non breeding season.

6.2 Feeding of pregnant and lactating ewe and doe: Good feeding is required for pregnant ewes and does during last two months of pregnancy for foetal growth and mammary tissue syntheses to produce more milk for lambs and kids, easy parturition and to prevent metabolic diseases such as ketosis. Pregnant ewe or doe is fed with 250 grams concentrate mixture daily apart from 5kg green forage and grazing during last 2 months of pregnancy.

Good feeding is also required for ewes and does after parturition to produce more milk for their young ones. It improves the growth rate of lambs and kids. Lactating ewes and does are fed with 250 grams concentrate mixture daily apart from 5-6kg green forage and grazing until the lambs / kids are separated from the mother (3months).

In case of high milk producing goats, concentrate mixture is to be given at the rate of one kg concentrate mixture for every 2.5 liters of milk apart from green fodder and browsing in the pasture land.

Concentrate mixture for adult sheep and goat can be prepared with the local available feed ingredients.

1. Ground maize/Jowar	: 27kg
2. Groundnut cake/ Sunflower cake	: 20kg
3. Wheat bran/Rice bran	: 50kg
4.Mineral mixture	: 02kg
5. Common salt.	: 01kg
Total	: 100kg

Adult ewes and goats after weaning of young one to 2 weeks before breeding season can be fed with only green fodder without concentrates. Whenever, green fodder / good pasture is not available, at least 200gms concentrate mixture should be fed to the adult sheep and goat.

6.3 Feeding of new born and orphans: New born lambs/kids and Orphan lambs and kids who are not having their mother , need to be taken care of in a special manner otherwise they will die because of insufficient feeding. Young lambs and kids are to be kept warm to protect them from cold conditions. Feed the orphan and new born with colostrum from the mother within 30minutes to one hour after birth. Colostrum is the good source of antibodies which protect the young one from many infections during early stage of life, after birth. The protein content of colostrums is 3 to 5 times as that of normal milk. It is also rich in minerals and vitamin-A. Colostrum act as a laxative to remove the meconium (first faecal material) from the intestines of new born lamb or kid. Colostrum feeding increases survival rate of the new born. The young lamb/ kids should be kept along with mother for one week in a separate shed.

In the absence of colostrum, they need to be fed with milk from other sheep or goat. New born should be fed for every 3 hours during the first 24 hours of their life. For the first day, only 50- 80 ml of milk should be fed for every four hours with a clean feeding bottle. This can be increased up to 200 ml per day up to 2 weeks. The milk should be clean and thoroughly boiled when fed to orphans to avoid infections.

6.4 Feeding of Lambs and kids

Feeding lambs / kids up to two weeks: There is no substitute to the ewe's milk for putting rapid gains on young lambs.

Creep Feeding: Lambs and kids should be started on creep feed between 1 - 2 weeks of age, though they will not eat significant amounts of feed until they are three to four weeks old. Providing early access to creep feed gets lambs in the habit of eating dry feed and helps stimulate development of their rumen. It increases the growth rate of lambs and kids and helps with early weaning. Lambs and kids may be with the following

Feed ingredient (%)	Pre-weaning period (up to 3 months). Creep feed	Growing period (3-6 months). Concentrate mixture	Finisher feed
1. Ground maize.	67	27	25
2. Groundnut cake.	10	35	20
3. Wheat bran.	10	35	52
4. Fish meal.	10	-	-
5. Common salt.	1	1	1
6. Min. mix.	2	2	2
Expected growth rate per day (gms).	110-125	100-120	100-120

Lambs and kids depend entirely on dam's milk up to 2 weeks.

Lambs and kids may be fed with small quantities of tender green forages or tree leaves from one month of age. These young animals may be maintained in a separate shed and they should not be sent for grazing along with their mothers up to 3 months age.

6.5 Feeding of Ram Lambs and Male kids

Ram lambs are intended for production of future breeding rams are to be provided with special feed and fodders from the early ages. Ram lambs should be allowed to suckle the dams milk up to 2 weeks .They should be fed with high energy and protein diets during this period. Generally they are weaned at 3 months age by the time they should be fed with 110 to

125 grams concentrate feed per day. During growing period i.e., 3 to 6 months, they should be given 100-120 grams per day and for finisher rations the energy and protein levels can be reduced. The ram lambs should be aimed to attain 25-35kg body weight by the end of 6-9 months, for which legume, non-legume forages should be fed adlibitum.

Feeding lambs beyond two weeks: The recommended rations are given above.

Body weight (Kgs).	When Leguminous fodder is available, Concentrate mixture in gms	When Leguminous fodder is not available, Concentrate mixture in gms	Roughages (Kgs).
1. 10-15	50	300	Ad lib.
2. 15-25	100	400	ad lib.
3. 25-35	150	600	Ad lib.

SHORT ANSWER TYPE QUESTIONS.

1. Write the feeding behavior of sheep and goat
2. What are the common forages suitable for sheep
3. Explain creep feeding.
4. Explain flushing in ewes
5. Explain colostrums feeding

LONG ANSWER TYPE QUESTIONS.

1. Write about the feeding of lambs and kids
2. Explain the feeding of breeding ewes, pregnant and lactating ewes and does
3. Explain the feeding of ram lambs and breeding rams

UNIT- 7**Feeding of Pigs and Rabbits****Structure**

7.1 Feeding of piglet

7.2 Feeding of gilt

7.3 Feeding of sow

7.4 Feeding of boar

7.5 Feeding of different age groups of Rabbit

Feeding Systems in pigs

Pigs are reared under scavenging, semi-scavenging and intensive systems of production. Major population comprises indigenous pigs which are reared under free- range scavenging system with little or no input. Indigenous and crossbred pigs are also reared under semi- intensive system wherein they are allowed to scavenge for the whole day and are supplemented with household kitchen or hotel waste, rice bran, wheat bran and broken wheat, pressmud, etc. Under intensive system, pigs of exotic breeds, elite crossbreds and small breeds are reared with concentrate feeds, hotel and kitchen wastes, cereal byproducts, vegetables wastes, root crops like boiled sweet potatoes, rhizomes, etc. Good remunerative price of pork in certain places of India and tariff facilities for live pigs have encouraged organized intensive farming.

7.1 Feeding of Piglets

In India, piglets are weaned at 8 weeks of age under intensive feeding system. However, weaning is advantageous on weight basis rather than on age basis as traditionally practiced. In India, phase or split weaning are being practiced in such a way that heavier piglets could be weaned at 6 weeks, followed by weaning of lighter piglets at 8 weeks. Such

spit weaning practice reduces the stress of negative energy balance of lactating sows and facilitates faster growth of light piglets. Creep feeding is essential for sucking piglets for faster growth and attainment of satisfactory weaning weight. Piglets should have easy access to creep feeds for intake. They contain 20% protein and fortified with adequate minerals and vitamins. Creep mixtures are introduced at 7-14 days of age and are fed till weaning. Piglets fed on creep attain 12-15 kg body weight at 8 weeks of age in Landrace and Yorkshire pigs and about 9-10 kg body weight at 6 weeks in Landrace X desi crossbreds. During suckling period, piglets are more prone to anaemia. A dose of iron injection may be given on 4th and 14th days as sow's milk does not contain enough iron to take care of piglets requirement in 1st and 2nd week of their age, moreover, the intake of creep feed is inadequate at early age. An alternate method of supplementing iron to the new born piglets is to paint the sow's udder with liquid oral iron supplements.

Composition of creep mixture

Ground Maize	: 40 kg
Wheat bran	: 10kg
Groundnut/Soya cake	: 10kg
Til cake	: 10kg
Skimmed milk powder	: 10kg
Fish meal	: 08kg
Molasses	: 10kg
Mineral mixture	: 02kg

Total : 100kg

Add vitamin mixture (A+B2+D3) :10gms per 100 kg feed.

Grower Ration : When the piglets weigh 10-12kg, they are to be fed with grower ration. At this stage pigs start eating more feed. The expected growth rate with grower ration is about 0.5kg per head per day with a feed efficiency of 4kg of feed to one kg live weight gain.

Composition of grower ration

Ground Maize	: 60 kg
Wheat bran	: 10kg
Groundnut/Soya cake	: 10kg
Til cake	: 10kg
Fish meal	: 08kg
Mineral mixture	: 02kg

Total : 100kg

Add Rovi mix (A+B2+D3) :10gms per 100 kg feed.

Finisher Rations: When the pigs have attained the body weight of about 50kg, they are to be fed with finisher ration till they attain market weight of 80-90kg.

Composition of finisher ration

Ground Maize	: 40 kg
Wheat bran	: 30kg
Groundnut/Soya cake	: 12kg
Til cake	: 10kg
Fish meal	: 06kg
Mineral mixture	: 02kg

Total : 100kg

Add Rovi mix (A+B2+D3) :10gms per 100 kg feed.

7.2 Feeding of gilts: The gilts meant for breeding should be removed from the growing group when they attained 45to 55kg body weight. These animals are fed with finisher ration. They should be subjected to limited feeding at a rate of about two-third of the requirement of growing group. Limited feeding increases the litter size by one to two piglets over that full-fed. It also reduces feeding costs.

7.3 Feeding of sows

Feeding unbred sows: unbred sows may be fed similar to the gilts to keep them in medium condition. When the sow is lean and run down in condition due to previous pregnancy and lactation, it needs good feeding to recoup.

Flushing: Sows and gilts are fed with flushing ration from two weeks before breeding and during breeding season for regularity of heat, more ovulation and fertilization. Gilts require 25-30 grams flushing ration for every kg body weight, while sows require 15-20gms for every kg body weight. Usually 2.0 kg of finisher ration is given for 15 days for flushing of breed able gilts or sows before mating followed by 1.5kg till farrowing.

Feeding pregnant sows: Feeding of pregnant sows and gilts should match their nutrient requirements. Good feeding during pregnancy period will result in good litter, heavier and healthy piglets at birth and sufficient milk production to the piglets after farrowing. Feed offered needs to be restricted to 2 to 2.5 kg per day because higher quantity of feeding may lead to embryonic mortality. Sows should gain 30to35 kg body weight during pregnancy period while 35to40kg gain in gilts.

Feeding sows at the time of parturition and during lactation: About 4-5 days before the farrowing, the sows ration should be reduced to nearly half. Laxative feeds like wheat bran, linseed meal should be included in the ration to prevent constipation. On the day of farrowing, it is better not to give any feed. Sufficient clean and fresh water should be available throughout the day. Thereafter, for the next 3 days increase the recommended ration gradually, by 4th day sow could get at least 2.0 kg of that feed. From 5th day onwards sows should be fed to appetite by offering the daily quota of feed twice daily. Lactating sow is fed with 3.5kg feed along with 0.2kg feed per piglet in the litter to produce sufficient milk to the pig lets. The interval between two feedings should be 8 hours. Such feeding is continued till weaning of the piglets. Thereafter, sows should again be fed 1.5 kg of feed daily till the breeding season. Good quality succulent fodder at the rate of 5-6 kg per pig may be offered along with concentrate mixture. Sufficient clean and fresh water should be available throughout the lactation period.

7.4 Feeding of Boars :

Breeding boars may be fed on finisher diets. About 1.5 to 2.0 kg finisher ration can be given per day for a breeding boar depending upon the condition of boar. However, the amount of feed offered may be of green berseem or Lucerne as in sows. Overfeeding of boars must be avoided.

7.5: FEEDING OF RABBITS : Rabbits are primarily mono gastric herbivores and consume common type of grains, pulses, legumes as greens or as hay and green vegetables or their leaves. They can be fed with the following local available feeds.

- Fresh grasses or legumes may be included in the ration to a level of 70%.
 - 50% legumes plus 50% grasses may afford minimum dietary requirement for resting does and bucks.
 - Carrots, green grass, spinach, turnip, Lucerne, Berseem etc. may be provided as good succulent feed for rabbits.
 - A small quantity of hay/straw may be fed in addition to the compound feed to prevent boredom and to provide bulk.
 - Molasses at the rate of 5% may be added to the diet to increase acceptability of the diet.
 - Abrupt changes in the quality or quantity of feed may be avoided.
 - Dustiness of mash may be avoided by adding water to moisten the feed slightly
- Feeding of rabbit in pellet form is more desirable than mash or ground form.
- Rabbit consumes dry matter @ 6 – 8% of their body weight
 - Avoid acidity (sour) of feed since sour feed is not liked by rabbit.
 - Clean and fresh water should be available at all seasons.
 - The doe imposes feeding pattern. A doe feeds her young only once in 24 hours. From the third week of life the young rabbit begin to move about and suckling mother's milk.
 - Normally rabbit feed and water throughout the day but feeding nocturnally is the common phenomenon
 - Young rabbits in growing stages and lactating does may be fed free of choice by keeping grain/pellets in the feeder at all times.
 - Dry does, bucks and replacement stock may be fed once a day at the rate of 100-120 g of pellet feeds.
 - Does may not be fed with heavy diet right after kindling. Feeding of does may be increased after 5-7 days of kindling.

Baby rabbits: A baby rabbit, or kit, feeds solely on its mother's milk for about the first three weeks. During the first few days, the milk contains high levels of antibodies that help protect the kit from disease. After three weeks, the kit will begin nibbling on alfalfa hay and pellets. By 7 weeks of age, baby rabbits can handle unlimited access to pellets and alfalfa hay in addition to mother's milk. Kits are usually weaned from their mother's milk by 8 weeks of age, depending on the breed.

Juveniles: Between weaning and 7 months of age, the young rabbit can have an unlimited amount of pellets and alfalfa hay. At 3 months of age, start introducing small amounts of vegetables into your rabbit's diet. Introduce one vegetable at a time. If any vegetable seems to cause digestive problems, avoid feeding it in the future.

Nutrient requirement of rabbit of different physiological status

Nutrient	Fattening or growing stock	Lactating doe	Does in kindle	Maintenance of adult animals
Digestible energy MJ/kg	10.4	10.9	10.4	9.2
Fat%	3.0	4.0	3.0	3.0
Crude protein%	14.0	18.0	14.0	15 -16
Crude fibre%	15.5	18.0	16.0	13.0

Concentrate mixture for Rabbits:

Feed ingredients	% composition
Ground Yellow Maize / Jowar	30 Parts
Ground nut cake / Til cake	33 Parts
Wheat bran / Rice polish	35 Parts
Mineral mixture	2 Parts
Vitamin A+B ₂ +D ₃	10 g /100 kg feed
Vit E	0.3 mg/rabbit

Daily feed requirement of rabbits:

Class of animals	Concentrates (g)	Roughages (g)
Does	150	500
Bucks	150	500
Lactating does	200	700
Weaner (6 weeks)	50	200

Short Type questions:

1. Explain creep mixture for piglets
2. Briefly explain about feeding of gilt.
3. Explain piglet anaemia
4. Write the names of various feeds given to the rabbits
5. Write about feeding of pregnant sow
6. Explain the importance of lactating sow

Long Type questions:

1. Explain in detail about feeding of different age groups of Pigs.
2. Explain briefly the feeding of rabbits

UNIT- 8

Feeding of Poultry

Structure

8.1 Feeding of chicks, growers and layers in poultry

8.2 Feeding of different age groups of broilers

8.3 Feeding of ducks, quails ,guinea fowls and turkeys

Feeding constitutes the major management concern in poultry production since the major expenditure is feed cost(60-70%). Carbohydrates and fats are the principal sources of energy. Fats are the concentrated form of energy and yield 2.25 times more energy than carbohydrates on weight basis. Fats are the source of essential fatty acids, i.e linoleic, linolenic and arachidonic acids. The essential amino acids for poultry are arginine, glycine, histadine, leucine, isoleucine, lysine, methionine, cystine, phynylalanine, threonine, tryptophane and valine. Out of these, argentine, lysine, methionine, cystine and tryptophan are critical amino acids in the practical poultry rations. The minerals and vitamins are critical in practical poultry rations. Important minerals in poultry rations are calcium, phosphorus, sodium, copper, iodine, iron, manganese and zinc. Important vitamins in poultry rations are VitaminA, VitaminD3, VitaminE, pyridoxine, riboflavin, pantothenic acid, niacin, folic acid, B12 and choline.

8.1 Feeding of chicks, growers and layers in poultry

The nutrient requirements of poultry depending upon the type and age of poultry being fed as well as the purpose for which they are fed. Layers are maintained on controlled feeding to avoid fat deposition, which can hamper further laying. Feeding is divided into three phases. The first phase is from 0 to 18 weeks, the second phase is from 18/20 to 42 weeks and third phase is from 43 weeks to till disposal.

The Bureau of Indian Standards (BIS) has specified standard requirements for starting, growing, laying, breeding and broiler chicken. The latest requirements by BIS are given in the table below.

Specification of Poultry feeds

Characteristics	Layer starter (0-8weeks)	Grower feed (8-20 weeks)	Layer feed 20 weeks onwards
Moisture % . Max	11	11	11
Crude protein % Min	20	16	18
Crude fibre % Max.	7	8	8
Acid insoluble ash % Max.	4	4	4
Salt % Max.	0.6	0.6	0.6
Calcium % Min	1.0	1.0	3.0
Phosphorous % Min	0.5	0.5	0.5
Lysine % Min	0.9	0.6	0.65
DL- Methaonine % Min.	0.30	0.25	0.30
Metabolisable energy (Kcal/kg)	2900	2900	2900

Classification of poultry feed stuffs

Poultry feed ingredients can be classified into the following groups

1. Energy feed stuffs: The cereal grains and their by products, fats and certain other carbohydrate feed stuffs serve as the chief source of energy in poultry rations. Commonly used energy feed stuffs include;

Maize

Bajra

Tapioca meal

Jowar (Sorghum)

Rice bran or polishing

Molasses

Wheat

Wheat bran

Barly

Oats

2. Protein feed stuffs:

The protein source may be classified into animal and plant origin. As a general rule, use of two or three protein feed stuffs provides a better assortment of amino acids and other nutrients than single one. Some of the animal and the vegetable protein feed stuffs are:

Animal Protein Feedstuffs

Fish meal
Blood meal
Meat meal
Silk worm pupae meal
Hatchery residue or waste
Poultry by-products meal
Liver residue
Milk and milk by-products

Vegetable protein feedstuffs

Ground nut oil cake
Coconut oil cake
Maize gluten meal
Sunflower oil meal
Soya bean meal
Sesame meal
Cotton seed meal
Leaf protein concentrates

3. **Fat sources:** Lard and animal tallow are some of the common fats. Vegetable oils can also be used in poultry feeds for preparing high energy rations.

4. **Minerals:** Animal proteins are better source of minerals than vegetable protein feed stuffs. The following mineral supplements are commonly used to supply one or more minerals required in the ration.

Lime stone	Oyster shell
Dicalcium phosphate	Bone meal
Manganese sulphate	Super phosphate
Sodium chloride	

5. **Vitamin supplements:** Yeast and fish oils are rich sources of critical vitamins. Number of preparations containing a combination of A+B2+D3 are used as premixes to fortify poultry feeds with vitamins.

Suggested rations for various age groups of chicken

Ingredients (kg/100kg)	Starter-1	Starter-1	Grower-1	Grower-2	Layer-1	Layer-2
Maize	32.0	44.10	27.10	--	35.0	20.80
Sorghum	11.0	--	--	41.0	-	20.0
Rice polish	16.80	18.0	40.0	40.0	30.0	30.0
Wheat bran	5.0	6.80	15.0	-	3.30	-
Ground nut cake	11.0	-	-	11.0	10.0	7.0
Maize gluten meal	-	6.0	-	-	10.0	12.0
Sunflower cake	11.0	12.0	10.0	-	-	-
Fish meal	12.0	12.0	6.0	6.0	4.0	2.0
Bone meal	0.70	0.50	0.60	1.0	1.60	1.0
Lime stone	-	-	0.80	0.5	5.50	5.60
Salt	0.40	0.50	0.40	0.40	0.50	0.50
Mineral and vitamin mixture	0.10	0.10	0.10	0.10	0.10	0.10
Total	100.00	100.00	100.00	100.00	100.00	100.00

Systems of poultry feeding:

1. Whole grain feeding system: This is old method of feeding the back yard poultry. The local available cereal grains, millets like rice broken, maize broken, ragi and bajra are provided to local poultry birds. It is not practiced in commercial poultry.
2. Grain and mash: Whole grain feeding is supplemented with protein mash mixtures to provide proteins. It is also not a common practice.
3. All mash system: It is the common poultry feeding system in poultry farms. Concentrate mixture is prepared with ground cereal grains, cereal bi-products, protein supplements, minerals and vitamins and other feed additives. The mash is provided in the poultry feeders. It is also more suitable for mechanical feeders.
4. Wet mash feeding: A wet mash is used to increase feed consumption. It is practiced in ducks. Wet mash is more palatable than dry mash. But it is more laborious and it may result mouldy feed.
5. Pellet feeding: It increases the feed conversion and body weight in broilers. Pelleting reduces dustiness and feed wastage. It improves palatability of feed. It is practiced in some of the commercial farms.

8.2 Feeding of different age groups of broilers

As the growth rate is very fast in broilers, they are fed ad-libitum with special attention. The feeds are high energy and high proteinous. Broilers are fed broiler starter up to 3 to 4 weeks and then shifted to broiler finisher ration from fifth week onwards. The Bureau of Indian Standards (BIS) has specified standard requirements for broiler chicken. The latest requirements by BIS are given in the table below.

Specification of broiler feeds

Characteristics	Broiler starter (0-6 weeks)	Broiler finisher (6-9 weeks)
Moisture % . Max	11	11
Crude protein % Min	23	20
Crude fibre % Max.	6	6
Acid insoluble ash % Max.	3	3

Salt % Max.	0.6	0.6
Calcium % Min	1.2	1.2
Phosphorous % Min	0.5	0.5
Lysine % Min	1.2	1.0
DL- Methaonine % Min.	0.50	0.35
Metabolisable energy (Kcal/kg)	3200	3200

Suggested rations for broilers

Ingredients (kg/100kg)	Starter-I	Starter-II	Finisher-I	Finisher-II
Maize	43.75	57.10	65.10	44.10
Rice polish	10.00	--	--	20.00
Groundnut cake	14.00	10.00	10.00	11.00
Sunflower cake	14.00	15.00	12.00	11.00
Fish meal	13.50	6.00	5.00	5.50
Meat meal	--	10.00	6.20	5.50
Animal fat	3.00	1.00	-	1.25
Bone meal	1.15	--	0.60	0.60
Lime stone	-	0.50	0.60	0.70
Salt	0.50	0.30	0.40	0.25
Mineral and vitamin mixture	0.10	0.10	0.10	0.10
Total	100.00	100.00	100.00	100.00

8.3 Feeding of ducks, quails, guinea fowls and turkeys

Feeding of ducks

Ducks are voracious eaters and foragers. Apart from compound feeds, snails, fingerlings, earthworms, insects and vegetation form a part of their diet when reared in ponds which reduce the feed cost.

Under intensive system of rearing dry mash, pellets or crumbs should be given free choice and wet mash provided necessarily at frequent intervals. Ducks have difficulty in swallowing dry mash ; they take a mouthful and swill it at the nearest water source , thus wasting a great deal of nourishment. Ducks have preference for wet mash. Pellet feeding has become popular in farms for its distinct advantages. A pellet of 3 to 5 mm size is used.

Annual feed consumption is about 50-60 kg per duck. It requires about 3 kg feed to produce a dozen of eggs and 3.22 kg of feed to produce 1 kg of broiler duck.

Ducks are very much susceptible to aflatoxin produced by fungus *Aspergillus flavus* in groundnut cake. Ducks can tolerate it up to 0.03 ppm as against 0.2 ppm in chicken. The moldy feed toxicosis is more harmful to the ducklings than adult ducks.

Feeding of quails

For feeding of quails can be classified as starter (0-3 weeks),grower (4-5 weeks) and layer or breeder (6 weeks onwards) depending up on their growth rate, efficiency of feed utilization, and production and reproduction performance. The starter period is the most crucial period and needs special management and feeding care. Therefore feeding of quails to the age of 3 weeks is of special importance in as much as the balanced and higher nutrient level are required in diet.

Feeding of guinea fowls

Improved guinea fowls require about 12kg of feed from day- old to 28 weeks of age and 31 kg thereafter that is from 29 to 64 weeks of age. The average consumption is about 100 g per bird per day during the laying period.

The energy requirement in breeder guinea fowl is 3,000 kcal at 0-6 weeks, 2850 Kcal at 7-28 weeks of age and 2,800 Kcal for adults. The protein requirement is 22 per cent at 0-6 weeks of age, 14 per cent at 7-28 weeks of age and 17-18 per cent for adults.

Feed is usually given in the form of crumps during the starting period and as pellets of 2.5 mm size thereafter. Guinea- fowls require more sulphur-containing amino acids than chicken for optimum growth, High amount of Vitamin E is also added to prevent perosis.

Feeding of Turkeys

Feed ingredients for compounding of rations of turkey remain the same as that of chicken , but their feed requirement differ from those of chicken. Turkeys require more protein, minerals and vitamins than poultry to meet the fast growth. Turkey rations are costlier than chicken rations. Turkeys must always fed on trough or hoppers and never on the ground. The feed hoppers should never be overfilled to avoid wastage.

Short Questions:

1. What are the essential amino acids for poultry
2. Name the ingredients of a chick ration
3. Name the ingredients of a layer ration
4. Write the specifications of broiler finisher feed
5. What are the feeds used in Duck feeding
6. Write the names of mineral and vitamin supplements used in poultry

Long Answer Questions:

1. Write the feeding of different age groups of Broilers
2. Write the feeding of chicks, growers and layers
3. Explain briefly about Duck feeding
4. Write various systems of poultry feeding
5. Write the classification of poultry feeds.

UNIT-9**FEEDING OF DOGS AND CATS****Structure**

9.1 Feeding of different classes of dogs

9.2 Feeding of different classes of cats

9.1 Feeding of dogs

Feeding of pups: Under normal conditions new born pups are nursed by their mother through natural teat feeding and they learn to eat mother's food after opening eyes at about 2 weeks of age. Ensure that the pups are getting enough milk from mother. If the milk is not enough, supplement the diet with calcium and general tonics. The demand for milk by the nursing ones will continue to increase for about 20-30 days. Lactation period may last for 8 weeks. The best age of weaning or separation of pup/ kitten from their mother is between 5-8 weeks.

Feeding of orphan pups: Orphanage is mainly due to large litter size, poor mothering ability, malnutrition of bitches and young ones and inexperienced mother will not allow the pups to suckle. So feeding of orphans with alternative foods is needed.

Alternative milk for orphans

- 1) Cow milk + Egg for yolk
- 2) Evaporated milk (Diluted to reduce lactose %)
- 3) Commercial milk replacer

Whole milk	800 ml
Cream (12% fat)	200 ml
Egg yolk	one
Sterilized bone meal	6 gm
Citric acid	4 gm
Cod Liver oil	3 gm

Tetracyclines 10 mg /kg milk replacer

(Proper stirring while mixing is needed)

4) 'Lactogen' – A commercial product

Food Formula for Pups

Milk based:

4 tsp Farex/ Cerelac + 1 tsp glucose + 10 ml ostocalcium liquid + milk as required.

Meat based:

2 cups cooked Rice + 200 g of beef mince / 2 hard boiled eggs (Remove one yolk) + finely chopped carrot/ beet root / beans / green peas + 1 tsp vegetable oil – divided and given as 2 meals.

2milk based + 2 meat based meals/ day after 5th week of age can be given.

Feeding Schedule for pups and kittens
1 st week – 2hr interval
2 nd week – 3hr interval in day time and 4 hr interval in night time
3 rd week – 4 hr interval in day once in night
5 th week – thrice daily at 4 hr interval, avoid night meal and milk supplement should be 14-16 % of body weight.

Feeding of growing dogs: The dog should be given 50-55gm dry matter/ kg body weight during the active growth up to 6 months of age. Afterwards the quantity of diet should be reduced to 38-40gm /kg body weight up to 1 year of age or maturity

Feeding of adult dogs: A standard balanced dog food should contain 20-22% crude protein, 4-5% fat, 5-10% crude fibre on dry matter basis.

A definite feeding schedule should be followed and it may be divided as breakfast, lunch and dinner. Dogs should be allowed 15-20 minutes time for eating and any leftover should be discarded. Long fresh bones with open extremities should be offered from the healthy carcass to chew for half to one hour. It keeps teeth and jaw muscles healthy.

Feeding schedule for mature dogs

Body weight (kg)	Cereals (g/day)	Meat (g/day)	Green vegetables or legume pods (g/day)
5	100	50	50-60
10	150	50	60-80
15	200	100	80-100
20	300	100	100-150
25	400	100	100-150
30	450	150	100-150
40	500	150	150-200
50	600	200	200-300
60	700	200	200-300

FEEDING OF CATS:

Cat feed should be rich in protein of animal or fish origin. Vegetables and green grass should also be provided to avoid digestive trouble. It should be given plenty of drinking water.

Cat should never be given a diet of dog food because dog food contains large amount of cereals and vegetables and the cat will not get enough animal protein. Cats are true carnivores and require almost twice as much protein in their diet as dogs.

30-40% of cat diet should be animal type proteins (meat, meat by products, fish, eggs and milk). About 10% of the diet should consist of fat which provides calories and the essential fatty acids.

When feeding meat all the bone should be removed or chopped to prevent pieces of bone from becoming lodged in the throat or digestive system. Cat should never be given chicken bones.

Feeding frequency

Age	Feeding frequency
2-3 months	4 meals per day
3-5 months	3 meals per day
6-8 months	2 meals per day
Adult	2 meals per day

Forms of pet foods

Canned foods: They contain about 75% water and their shelf life after opening the container is short. They contain more animal protein and higher fat content that makes them more palatable. They should not be fed straight from the refrigerator – should be allowed to warm to room temperature before being served.

Semi moist foods: They contain about 30% water. They contain some vegetable protein and supplemented with nutrients. They have chemicals added to keep them from drying out or spoiling.

Dry foods: They contain about 10% water and less fat and protein than semi moist foods. Milk or water can be mixed with the food to improve palatability. Cats on dry diet should have plenty of water available. Dry foods have the advantage of helping to clean the teeth and to prevent the build up of tartar.

Short Questions:

1. How do you feed a Puppy?
2. What is canned pet food
3. What are the ingredients in Cat feeding
4. What is dry pet food
5. Food formula for pups

Long Answer Questions:

1. Write about the feeding of different age groups of pups
2. Write briefly about the feeding of cats
3. Write about different forms of pet foods

UNIT-10**QUALITY CONTROL OF FEEDS****Structure**

- 10.1 Procurement and storage of feed ingredients
- 10.2 Methods of detection of feed adulterants
- 10.3 Quality control of finished feed
- 10.4 Packing and forwarding of feeds
- 10.5 Storage of concentrates- space requirement
- 10.6 Cleaning and Fumigation of stores
- 10.7 Use of Pesticides in Feed stores to control biological agents
- 10.8 Spoilage of Feed during storage

10.1 Procurement and Storage of Feed Ingredients:

The Purpose of quality control of feed stuffs is to ensure that the feed produced is unadulterated, true to their nature and produce desired results. The quality of the feed mainly depends on the selection of feed ingredients. The following factors are to be considered during procuring and storage of the feed ingredients for livestock.

- The feed ingredients either of animal or plant origin should be purchased from known sources of repute, with a supplier warranty.
- Monitoring of ingredients includes selection, inspection and sampling of ingredients for contaminants using risk based protocols.
- The laboratory methods used for testing the ingredients should be of standard method.
- The ingredients should meet acceptable standards for levels of pathogens, mycotoxins, herbicides, pesticides and other contaminants
- Raw materials found to be high incidence of salmonella should be treated with bactericidal organic acids.

Precautions and control measures to minimize the storage losses

1. Feed ingredients should be procured in good condition and kept dry and cool and used on a first-in, first-out basis.
2. Feed ingredients should be thoroughly dried to reduce the moisture content to 10%.
3. The feed ingredients are stored in containers like gunny bags, polythene bags and metallic bins etc. They should be kept under good hygienic and clean conditions during storage.
4. Stacking is done in such a way as to permit inspection of the bags for storage losses.
5. The produce should be periodically taken out, dried and re bagged to avoid the damage due to insects and fungi.
6. Grains can be mixed with dried neem leaves to prevent insect damage.
7. The feed and feed ingredient storage sheds and buildings should be entirely weather proof mainly to prevent the leakage of rain water. There should be controlled ventilation to prevent the built up of high temperature and high humidity.
8. The structures are built with provision to make them air tight to enable fumigation whenever necessary. Fumigation should be done under the strict supervision of experts or trained persons.
9. Malathion/Sumithion may be sprayed in the feed store to control insect pests.
10. Rodent control is the most important aspect during storage of feed and feed ingredients. Rodents can be controlled by using rat traps, use of poisoned baits. In the fields, aluminium phosphide tablets can be used to control rodents by placing them in rat holes and plugging them. During storage, bait prepared by using zinc phosphide (0.5%) is more effective. In case of chronic rodent problem, chemicals like warferin (0.5%) can be used.

Protecting the grains and other feed ingredients during storage is as good as producing them in the field.

10.2 Methods of Detection of Feed Adulterants.

Physical inspection : Visual inspection will give a good assessment of quality of feed ingredients. Items of physical inspection are colour, odour, taste, evidence of wetting, evidence of deleterious substances or foreign material, storage pests and evidence of damaged grain. Colour, odour and taste can be done with reference to normal and abnormal by experience of having normal things in mind. Eg. Maize, Jowar, Wheat and Rice etc.

- Evidence of wetting: Normally grain contains below 10% moisture, moisture level is less than 13% is considered as safe for storage. More than 13% moisture creates hot spots, which causes mould growth.
- Evidence of deleterious substances like dust, sand, straw, clay, nails etc., can be fined out by visual appearance.
- Storage pests: We can see the insects and faeces and eggs of insects by visual inspection and by smell especially in wheat bran; rice bran etc. If we suspect, we can test and observe the insect eggs under microscope.
- Evidence of damaged grain: Damaged or broken grain is unsafe for storage. Broken material will absorb more moisture and sometimes we can see insects. In unbroken grains, seed coat is intact and will be resistant for moisture absorption.

10.3 Quality control of Finished Feed.

It is important that representative samples of batches should be taken for check analyses to monitor the composition of the finished feeds. If results show deviations from the required composition, the reasons for this must be sought and rectified.

Quality control methods : The various methods include

Physical Tests

- Colour – Colour of desirable quality.
- Odour – Odour of a desirable quality ingredient.
- Texture – Fine, Coarse or medium.
- Test weight – Cubic foot weight.
- Miscellaneous – Adulterants, contaminants etc.

Chemical Tests

- Moisture
- Crude protein
- Total digestible nutrients (TDN)
- Crude fat
- Crude fibre
- Minerals

Toxicological Tests

- Aflatoxin
- HCN (Hydro cyanic acid)

Microscopic Test

(a) Done under low magnification

- Particle size.
- Softness.
- Hardness.

(b) High Magnification:

Requires more skill, but accurate results are obtained. The use of microscopy in feed quality control can give even the smallest feed manufacturer. Some measure of protection against adulteration and contamination of ingredients. Products may be examined for the presence or absence of basic ingredients and by means of spox test tracer ingredients which give much information on the presence of drugs or other micro ingredients.

10.4: Packing and forwarding of feeds.

- Compound feeds, whether in meal or pellet form, are usually packed in bags.
- Bags may be filled directly from mixers or from holding bins and may be weighed on a scale balance of 25 or 50 kg.
- Bags may be of jute or cotton and can be hand or machine-stitched or tied with a string or metal tie.
- Polythene bags are not normally recommended for storing animal feeds because of the risk of sweating and mould growth.
- If old bags are reused, care should be taken that they have not been used previously for the storage of fertilizers, or other chemicals.

10.5: Storage of Concentrates – Space Requirement.

Bagged ingredients should be stored in a well constructed building or room. These areas should be free of batteries, petroleum products, or other non feed items. Good manufacturing procedures require bags to store in bird-and rodent-proof areas. Bags should be stored near the weighing centre to minimize handling. An unloading dock may be required for mills handling bags.

Most standard pallets require a storage space of 4 foot by 4 foot. These wooden or plastic pallets can hold about 600 pounds of materials by stacking ten to twelve 50-pound bags. Bags can be stored along the exterior walls while maintaining an 8-foot walkway between the bags. Ingredients are unloaded into the building at the unloading dock at the end of the building. A 2-foot walkway is allowed between pallets and walls for access and rodent control.

There are four common problems with bag storage areas:

1. Rotation of stocks,
2. Excessive moisture.
3. Torn bags, and
4. Rodent control.

Precautions during storage:

- a. The moisture content of feed should <12%.
- b. Store feed in closed bags in a cool dry place.
- c. Prevent rodent and insect exposure.
- d. Add an antioxidant to the feed (or with the added fat) at time of preparation.
- e. If no antioxidant is added, store feed in a cool location for a limited period of time.

10.6 Cleaning and fumigation of stores.

- Cleaning includes removal of dust, remnants of feed ingredient, dirt and spider webs etc., in the feed store rooms.
- The floor, walls and roof should be properly cleaned using broom stocks or with vacuum cleaner.
- Repair the holes made by rodents by plugging with cement and chips.
- For cleaning of roofs it is better to clean by sucking operation with vacuum machines, which will squeeze dust, dirt, insect eggs or insects, spider webs easily.
- Clean the floors with washing with, detergent solution and let it dry without any moisture. Afterwards follow sanitization procedures.

Fumigation

- Fumigation is the introduction of a toxic gas into a space-whether a warehouse, godown, or a rat burrow, in high enough concentrations so that the gas fills all areas & kill target pests.
- Fumigation is quick acting, effective against various stages of the pest, highly penetrating into the packaging and commodities.
- Leaves no residue of toxicant and undesired odour. The gas being inert does not react directly with commodity.
- Normally fumigation carried out by production of formaldehyde gas by adding required quantity of formaldehyde solution (40% formalin) to potassium permanganate.
- Use 40 ml formaldehyde solution to 20 g of potassium permanganate for every 100 cft air space.
- The other method is to dip a piece of cloth in 100 ml of formaldehyde and hang near to fan in the relative humidity at above 75%.
- Formaldehyde gas is irritant to eyes and skin hence handle carefully and wear protective cover.
- Close air vent and exhaust, Min. 30 mts gas contact for disinfection. If necessary use ammonium hydroxide 25% to neutralize formaldehyde.

Qualities of ideal fumigant

- Low cost for effective dosage and application.
- High toxicity to insects; low to man.
- High volatility and penetration; low absorption.
- Non-corrosive.
- Non-Explosive, non-flammable.
- No damage to product quality.
- Aerate rapidly, no residue.
- No damage to germination.
- Residual spraying.

10.7: Use of Pesticide in Feed Stores to Control Biological Agents

The main biological agents are insects, fungi and rodents.

(a) Insects: At temperature 32 °C rate of multiplication is 50 times. The nutritive requirements of insects are same as those of vertebrates. Dead and live insects and their excreta cause the commodity unpalatable and unacceptable.

Control

- (1) Good hygiene.
- (2) Cleaning and checking of storage containers as well as the stored food as far as possible.
- (3) New dry grain should be kept separate from old grains.
- (4) Store should be remote from the field to reduce the risk of infestation.
- (5) Traditional pest control system such as use of local herbs. Mixing as with grain and smoking are effective and should be encouraged.

(b) Fungi: Fungi produce metabolites like aflatoxin which is toxic to animals. The fungus development occurs in the stored feed ingredients due to high humidity and wetting.

Control: Losses due to fungi can be reduced by applying drying and storage technology.

(c) Rodents: They not only consume feed but also foul with their excretions. Further they destroy containers by growing holes that results in leakage and wastage of feed.

Control

- (1) Rodent exclusion efforts in store construction.
- (2) Improved sanitation
- (3) Trapping and hunting.
- (4) Use of cats and dogs.
- (5) Rodent repellents and
- (6) Poisson baiting such as chlorofacalone, warfarin, coumatetralyl phosphate, barium carbonate etc.

10.8: Spoilage of Feeds during Storage.

- Spoilage is most often caused by improper storage of the material.
- There are many reasons for improper storage: the moisture content and temperature of the material at binning might have been initially too high for safe storage or moisture

was allowed to locally increase during storage either due to moisture migration or through leaky roofs and walls.

- Feed spoilage is caused by the growth of undesirable molds and bacteria. Their rapid growth can cause heating of feed, which reduces the energy as well as the vitamins A, D3, E, K and thiamine available to the animal.
- Mouldy feeds are dusty, which reduces their palatability.
- In addition to spoilage reducing the feed value and palatability, it can also increase the exposure of livestock to harmful moulds and bacteria.
- Animal sickness symptoms may be associated with the presence of mycotoxins.

Short Answer Type Questions.

- (1) Write the names of physical and chemical tests for quality control of feeds
- (2) What are the qualities of ideal fumigant
- (3) Write the control of rodents during feed storage
- (4) Write the control of insects and fungi during feed storage
- (5) Explain packing of feeds

Long Answer Type Questions.

1. Explain in detail about the methods of detection of feed adulterants.
2. Write about the precautions to be taken during storage of feed and feed ingredients to prevent the wastage of feed.
3. Explain the cleaning and fumigation of feed stores.

UNIT-11**FEED PLANT****Structure**

11.1 Methods of purchasing , procurement of feed ingredients and their physical evaluation.

11.2 Grinding of Feeding ingredients – Equipment

11.3 Mixing of Feeding ingredients – Equipment

11.4 Pelleting process- Advantages – Disadvantages

11.5 Compounding of Feeds- objectives –advantages.

11.1: METHODS OF PURCHASING, PROCUREMENT OF FEED INGREDIENTS AND THEIR PHYSICAL EVALUATION

- In order to ensure a continuous supply of raw materials at the mill, the feed ingredients purchased during the season to avoid price fluctuations.
- Proper storage of feed ingredients in bags will be preferable due to ease of handling.
- Raw materials should arrive in good condition and in sacks which have not been used for the storage of fertilizer, pesticides or chemicals.
- Contamination by string, large pieces of metal, wood or stones which could cause extensive damage to machinery can normally be removed on a coarse metal grid fitted over the sack tipping-in point of the feed mill and permanent magnets will normally remove any tramp ferrous metal which may enter the system, particularly before entering the grinder, mixer or pelleting.
- Storage areas must be waterproof and well-ventilated, and provide protection against infestation by insects and vermin which can quickly cause substantial losses in weight.
- If materials are to be stored in bags they should be kept in a building having a concrete floor.
- The roof and walls need only to be lightly constructed provided that they are pest and waterproof.

- The bags should be stacked a few inches above floor level, for example, on wooden pallets (see Figure 1), and away from walls.
- Raw materials may also be stored in bulk either in silos constructed from concrete or steel or in bins formed with partitions in conventional stores.
- Bulk storage normally entails a greater investment in capital equipment but lower operating costs.
- Proper storage of raw materials and of finished feeds is not only essential to prevent physical losses, but is also an important aspect of quality control.

Physical Evaluation of the Feed Ingredients.

Sensory property evaluation, including inspection of ingredient color, odor, texture, moisture, temperature, and a visual inspection for physical purity (absence of foreign materials and insect infestation) enables one to quickly assess whether the ingredient should be accepted or rejected.

Physical property evaluation usually involves testing incoming grain and feed ingredients for bulk density, purity, and texture. All of these properties will determine how the materials unload, convey into and out of bins, stores, and perform during processes. Purity refers to the absence of contaminants. The source of these contaminants may be physical (e.g., glass), chemical (e.g., seed treatment), and microbial (e.g., mycotoxin). The use of hand sieves to inspect for physical contaminants enables rapid evaluation of material. Texture of an ingredient is measured visually and with sieves.

11.2:- Grinding of Feed Ingredients – Equipment.

*The machine most commonly used in the feed manufacturing industry is the hammer mill and is illustrated in figure.

*Inside the grinding chamber, hammers, which may be fixed rigidly to the central shaft, or more often swinging on steel pins, rotate at high speed.

*The impact of the raw material on the hammers and the continual high-velocity impact of particle on particle results in materials breakdown until it is small enough in size to pass through a perforated screen.

*The smaller the screen size the more work will be required to reduce the particles to the desired size and the larger the grinder motor required.

*Raw materials also have different grinding properties somewhat related to their bulk density and flow characteristic. In general those of high bulk density grind more easily than fluffy, fibrous low-bulk density materials.

*Grinders are most efficient, when they are running at maximum capacity for a given raw material and screen size.

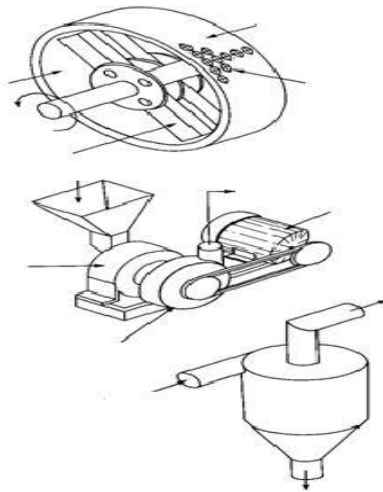
*Many small grinders have suction fans fitted to the grinder shaft which bring about cooling and conveying of ground material in one operation. Other grinders discharge directly into conveyors and the air drawn in during grinding is released through filter bags.

*Grinders may operate in a horizontal or vertical direction according to design.

*The moisture content of raw materials to be ground in a hammer mill should not normally exceed 13-14%.

*Large, lumpy, hard materials such as dried cassava roots and expeller oil cakes should be pre-crushed in a cake breaker to a particle size suitable for the dimensions of the hammer mill intake throat.

Fig No.11.1 Grinding Equipments



11.3 Mixing of Feed Ingredients – Equipment:

The purpose of mixer is to produce a homogenous blend of all the feed ingredients required in a feed formulation, so that at each feeding period each animal receives a balanced mixture of nutrients. Mixing often improves feed palatability if one or more of the raw materials is unpalatable to livestock. Mixing can be carried out with.

1. Shovels.

- Limited Quantities of animal feed can be mixed on a concrete pad with a shovel, in a manner similar to the dry mixing of cement and sand.
- Raw materials should be layered one above each other and then mixed and turned to form an adjacent heap.
- An efficient shoveling and mixing of the heap at least three times should produce an uniform product with the even distribution of small quantities of vitamins and minerals.
- The evenness of colour of the mixture will often give a fair indication as to the homogeneity of the mixed feed.

2. Conventional Feed Mixers : The most commonly used mixers in the feed industry are Vertical mixer, Horizontal mixer and Conveyor mixer.

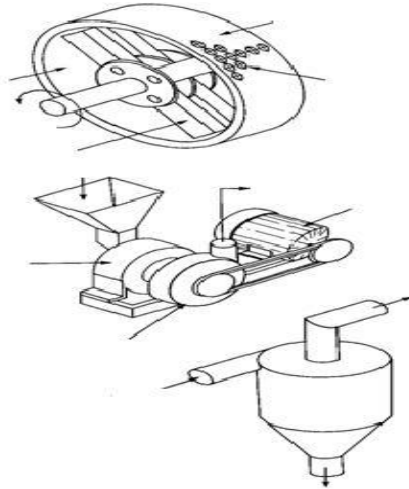
Vertical Mixer

It is a slow action, long-dwell time mixer which relies upon the continuous tumbling and intermingling of raw materials as they are discharged in a fountain-type action from a vertically running screw of approximately 8-10" diameter as illustrated in Figure 2.

- Raw materials may enter the mixer either at the top, from a cyclone or auger feed from the grinder, or at the base of the screw at a sack tipping point.
- After mixing for a pre- determined time, normally 10-15 minutes the mixture is discharged into a bag or conveyed by auger or bucket elevator to a storage bin or pelleter.
- Since many raw materials are dusty it is often desirable to include materials such as molasses, oils and fats in the formulations to reduce dustiness as well as to provide a source of nutrients.
- Vertical mixers, because of their slow-running action, are generally less effective in distributing liquids throughout the mixture and liquids tend to form balls, coated with fine particle material, rather than produce a surface coating on the solid material.

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Fig 11.2 Vertical and Horizontal Mixtures



For coarse cattle rations where large quantities of feeds are consumed per animal the need for a completely homogenous distribution of liquid is less critical than for poultry feeds of feeds to be pelleted, where it is desirable that liquids be well mixed with minimal lumping.

- Vertical mixers have a general tendency to encourage particle size segregation, especially if too long mixing times are used. They are tall units which may not readily fit into buildings with low roofs or ceilings. However, they can be easily loaded manually at floor level and are relatively low capital-cost machines widely used in feed manufacture where liquid addition is not required or for blending raw materials prior to grinding.

Horizontal Mixers

- As the name suggests, horizontal mixers operate with a horizontally turning mixing shaft.
- The shaft may carry paddles or agitators of various designs which come in very close proximity to the wall of a U- shaped trough.

- Raw materials are lifted, folded and abraded against each other resulting in a relatively short mixing time, typically of the order of 3-6 minutes, though it may vary depending on the nature of the mix.
- The mixer is suitable for blending upto 8% liquids into a dry mix and therefore offers greater versatility if a wide range of rations are to be offered from one feed mill unit.
- It is preferable that fats and molasses be warmed before addition to the raw materials in the mixer and they should be added as the last ingredients.
- Because the horizontal mixer is a faster mixing machine than a vertical mixer, two or three mixes can be achieved in the same time as one tone in a vertical mixer.
- A half-tonne capacity horizontal mixer could possibly replace a 1-tonne vertical mixer since two half tonne mixes could be made in a horizontal machine including loading and unloading in the same time as one tonne in a vertical mixer.
- A horizontal mixer is more sophisticated in terms of its engineering construction and thus more expensive to purchase than a vertical mixer of equivalent capacity.

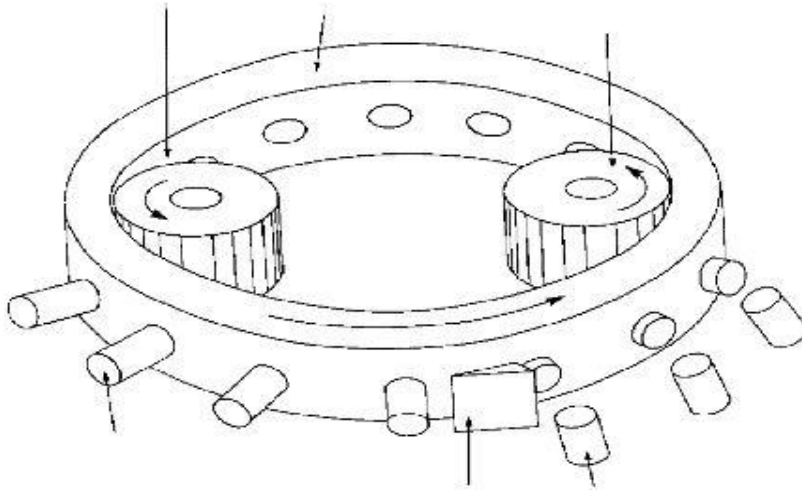
Conveyor Mixer

- Conveyor Mixers consist of a trapezoid metal box in which mixing is effected by slats extending almost the full width of the machine and which are carried on a pair of endless chains.
- Like the vertical mixer, this machine is limited in its ability to blend liquids thoroughly into the mixer.

11.4 Pelleting Process- Advantages- Disadvantages

Pelleting involves the compression of a mixed feed through holes in a hardened steel ring or plate(a die) by means of hardened steel rollers. The die forms the feed into pencil-like extrusions which are cut by knives into pellets of desired length on leaving the die. The principle of operation of a ring die is given in figure.

Fig.11.3 Pelleting Process



In a ring die pelleting, the rollers or the die may be driven but in a plate die pelleting the rollers only are driven.

- The die and rollers of a ring die pelleting may operate in a horizontal or vertical plane according to machine design.
- The pelleting process is very energy intensive, demanding upto 50% of the total power required for feed manufacture.
- The diameter of feed pellets is governed by the diameter of the holes in the die ring but the smaller the die holes the greater effort is required to force meal into these holes, hence the greater the power demand, that is, the smaller the pellet, the greater the cost of the manufacture.

Advantages of pelleted feed

- The use of pelleted feed is often popular with farmers because it is convenient to handle and reduces dustiness.
- It prevents segregation of raw materials during handling and selection by animals especially poultry, during feeding.
- This may be particularly useful where less palatable raw materials are included in the formulation.
- Pellets also reduce feed losses during feeding and may help to maintain, or increase, feed intake under certain conditions.
- The heat generated during pelleting can inactivate some pathogenic bacteria which may be present in raw materials.
- Finally pelleting can assist in preventing adulteration of feed by unscrupulous traders.

Disadvantages

- Pelleting increases the cost of feeds because the capital cost of pelleters is relatively high compared to grinders or mixers, the energy requirement is high.
- Additional care and skill is necessary for their maintenance and operation.

Types of Pelleters : Pelleters may also be divided into two further groups according to the pre- treatment of mixed feed prior to compression or extrusion in the die head. Pelleters may be considered as cold pelleters or conditioner pelleters.

Pellet Quality : Pellets should have a desired degree of hardness and should also show high resistance to abrasion during handling and transport. Pellet quality depends largely on the amount and nature of starch and protein in the raw materials. Their binding effect is modified by a number of other factors including the moisture content, fibre content, oil content and fineness of grinding of the raw materials.

Pellet Binders: Some mixtures of raw materials do not bind well together when pelleted and require the addition of special binding agents. Molasses is often added at 2-5% to aid binding, but other binders include bentonite clays and lignosulphonates and are added at the suppliers recommended dosage levels, usually about 1-2%.

11.5 Compounding of Feeds – objectives- advantages

- Individual ingredient feeding will results imbalance of ration and the animal may suffers from deficiency of nutrients which are lacking/low quantity in that particular feed.
- The digestibility and assimilation of nutrients will be less Without any processing the feed ingredients. When these ingredients are grinded into small particles, the surface area available for enzymatic action will be increased and the digestibility will also be increased quickly.
- The requirement of nutrients for different classes of animals are different. i.e., growing, pregnant, milch animal, working, dry animals, etc. No single ingredient will satisfy all the requirement of nutrients. So different ingredients are selected and proportions of each ingredient selected and are calculated to make a definite quantity which will satisfy the nutrient requirement for that class of animals.
- When all the ingredients are mixed and fed without processing individual ingredient, there is chance of picking only certain ingredients by the animals selectively leaving

others. To counter act this disadvantage, all the ingredients are ground into smaller particles powder(grinding) and mixed very well(mixing) so that the animal takes all the ingredients mixed in that feed.

Objectives

- To improve the nutritive value of feed.
- To balance the protein and energy requirement.
- To balance minerals and vitamins
- To mask the non tasty food ingredients
- To utilize the agro industrial and livestock industry by products
- To have uniform protein and energy and other nutrient per unit weight of feed.
- To improve the palatability.
- To avoid wastage by binding and pelletization process.
- To improve the digestibility of nutrients.

Advantages

- Compound feeds are complete feeds containing all the necessary nutrients at optimum level.
- Compound feeds can be prepared for different class of animals and quantity of feed given can be calculated depending on the production.
- Feed wastage can be minimized.
- Compound feeds will have high digesting and assimilation properties due to processing methods.
- Agro industrial by products and livestock industry by products can be mixed without affecting palatability. Otherwise these ingredients will not be consumed by the animal.
- The cost of nutrient per unit weight is cheap by utilizing wastes/by products.
- The animal will be healthy, as they receive all the vitamins and minerals at optimum quantities.
- Production of milk will be increased due to balance of protein and energy.
- By using molasses no feed wastage will be occurred.
- No wasting of feed by dusting by using pellets.

Short Answer type questions

1. What is grinding and mixing
2. Mention different types of grinders
3. Define Pelleting process.
5. What is compounding of feeds
6. Mention the equipment used for compounding of feeds
7. What is the binding ingredient used in pelletization

Long answer type questions

1. Explain grinding of feed ingredients.
2. Explain mixing process of feed ingredients.
3. Discuss about various types of mixers.
4. Explain pelleting of feeds.
5. What are the advantages and disadvantages of pelleting process
6. Briefly write about compounding of feeds.

UNIT-12**DIGESTIVE SYSTEM****Structure:**

12.1 Digestive System of Ruminants

12.2 Digestive System of Pigs

12.3_ Digestive System of Poultry

12.4 Digestive System of Rabbit

12.5 Digestive System of Dog

12.6 Digestive System of Cat

12.1 Digestive System of Ruminants

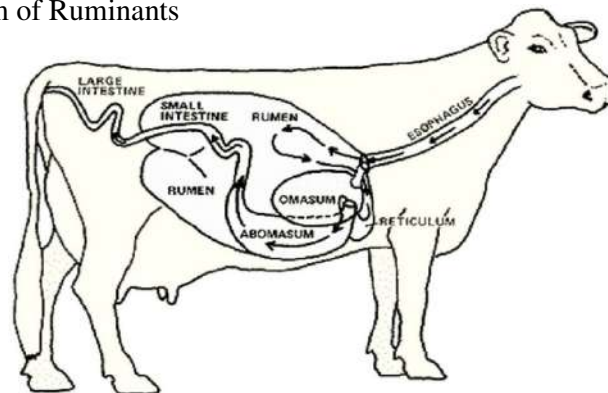


Fig. 12.1 Sketch diagram of Digestive system

The digestive system of ruminants consists of mouth, pharynx, oesophagus, rumen, reticulam, omesum , abomasum, small intestine, large intestine, liver and pancreas.

Mouth: The mouth is the first part of the alimentary canal. It consists of lips, teeth, tongue and salivary glands. Salivary Glands are situated around and in the mouth of the animals.

They are parotid, mandibular and sublingual glands which secrete saliva in the mouth. Tayaline enzyme is not present in the saliva of ruminants.

Pharynx: It is a funnel shaped passage situated at the back of the mouth, which is common passage for digestive and respiratory system.

Oesophagus: It is a muscular tube, which conveys the food and water to the rumen from the mouth.

Stomach: In ruminants, the stomach is very large and compound. It consists of four parts, Rumen, Reticulum, Omasum and Abomasum. The ruminating animals take the feed plenty without chewing. This feed and fodder is stored in rumen. Stored feed is brought back to the mouth for mastication and mixing of feed with saliva to make a pasty material which is fit for digestion, this process is known as Rumination.

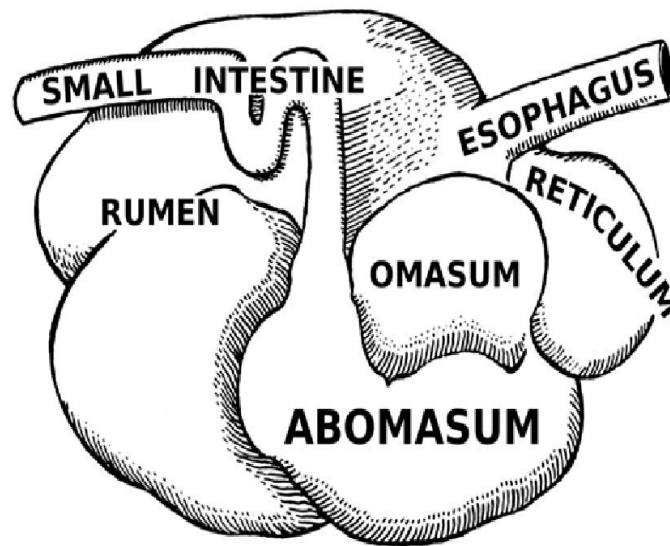


Fig. 12.2.Organs that Comprise the stomach of ruminant

(a) Rumen

- This is the first part of the stomach in ruminants and it is a big sac occupying the left side of the abdomen.
- The rumen is a large fermentation chamber .It contains rumen liquor containing high population of micro-organisms mainly bacteria and protozoa.
- The rumen microbes secrete the necessary enzymes for cellulose and hemi cellulose degradation. Roughages contain more crude fiber (cellulose, hemi cellulose and lignin). Volatile fatty acids (Acetic acid, propionic acid and buteric acid) produced during degradation of crude fiber in the rumen are absorbed in the rumen,reticulam and omasum. Acetic acid forms 60 to 70 % followed by propionic acid (15-20%) and buteric acid (10-15%) of the total volatile fatty acids(VFA) produced in the rumen.
- The rumen microbes synthesise microbial proteins providing the essential amino acids required for ruminants.
- The rumen microbes synthesise the B complex vitamins required for ruminants.
- About 70-75 per cent of the digestible organic matter of the normal diets is digested by the rumen microbes with the production of volatile fatty acids(VFA), carbon dioxide and methane.
- Fats are hydrolysed to fatty acids and glycerol. The glycerol is fermented to propionic acid. The unsaturated fatty acids are hydrogenated by the rumen microbes.

(b) Reticulum

- This is the second part of stomach of ruminants. The mucus membrane of this part is triangular or a square marking looking honey comb structure.
- The heavy or solid objects, which are swallowed by animal are collected this portion.
- When these objects are sharp and pointed they may penetrate, the diaphragm and heart and causes a severe disease known as “Traumatic Pericarditis”, which often leads to sudden death of the animal.

(c) Omasum: This is the third stomach of ruminants. It is in round shape, it has leafy rough portions through which the food passes crushed in between the leaves of this portion.

(d) Abomasum

- This is the fourth part of stomach of ruminants. This is a “True stomach” and its secretion has same properties as in non-ruminants. It has digestive glands known as cardiac, fundus and pyloric. These glands secrete the gastric juices which help in the digestion of starch and proteins.
- The pH of the abomasum is normally in the range of 2.0 to 2.5. This low pH facilitates initial protein breakdown and kills the bacteria which have spilled over from the rumen.

Small Intestine: This is divided into three portions known as “Duodenum”, jejunum and Ileum. It secretes several enzymes responsible for digestion of starch, fat and proteins. The end products of starch (Glucose), proteins (Amino acids) and fat (Fatty acids) after digestion are absorbed by the villi of small intestinal wall.

Large Intestine: The large intestine is divided into three portions called caecum, colon and Rectum. The rectum ends with Anus.

Liver : Its colour is dark red-brown. It is a large gland. The main function of liver is to produce bile, which helps in digestion of fats. The bile juice is stored in gall bladder. The bile is poured into duodenum of small intestines through bile duct.

Functions of liver: It secretes bile juice, stores glucose in the form of glycogen, stores fat and vitamin-A. It takes up the detoxification of different toxins.

Pancreas : The colour is reddish cream and it secretes pancreatic juice which is poured into duodenum of small intestines through pancreatic duct. It helps in digestion of starch and proteins. Pancreatic juice contains trypsinogen, chymo-trypsinogen, carboxy trypsinogen, amylase and lipase. It also secretes insulin and glucagon hormones.

Spleen: It is the biggest lymph gland and located on the left side of the abdomen. It is responsible for synthesis of blood cells and provides disease resistance to the animal.

DIGESTIVE SYSTEM OF MONOGASTRIC (NON-RUMINANTS) ANIMALS

The digestive system of mono-gastric (Non-Ruminants) such as pigs, horses, rabbits, dog and cat etc. consists of mouth, pharynx, oesophagus, stomach, small intestine (Duodenum, jejunum and Ileum), large intestine (caecum, colon and Rectum), liver and pancreas.

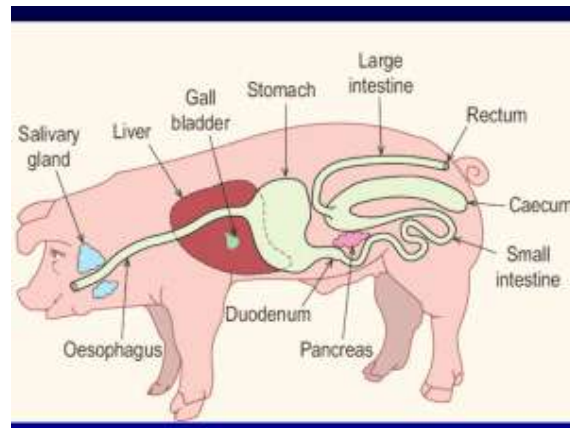
Digestive System of Pigs:

Fig. No. 12.3 Digestive System of Pig

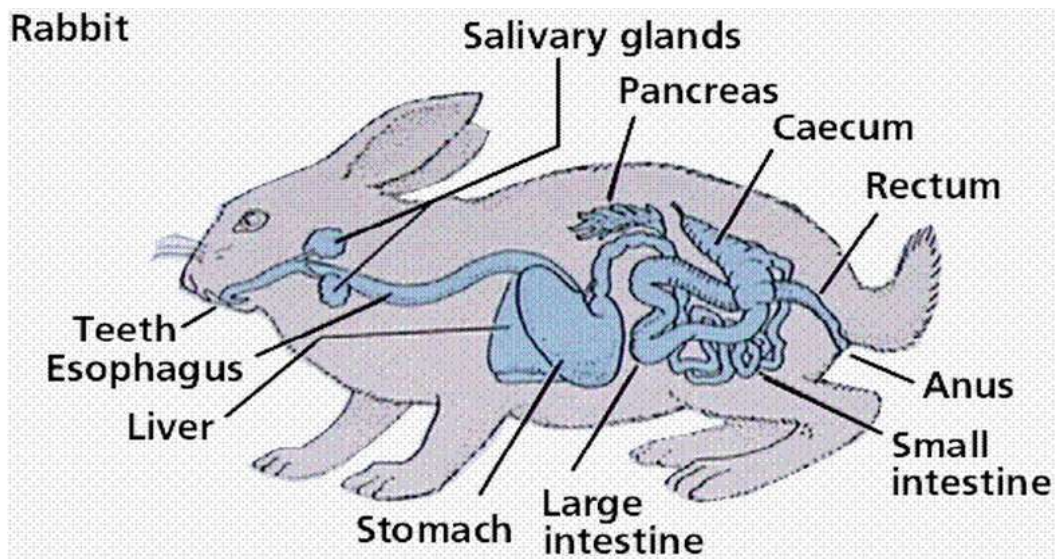
Digestive System of Rabbit:

Fig . No. 12.4 Digestive System of Rabbit

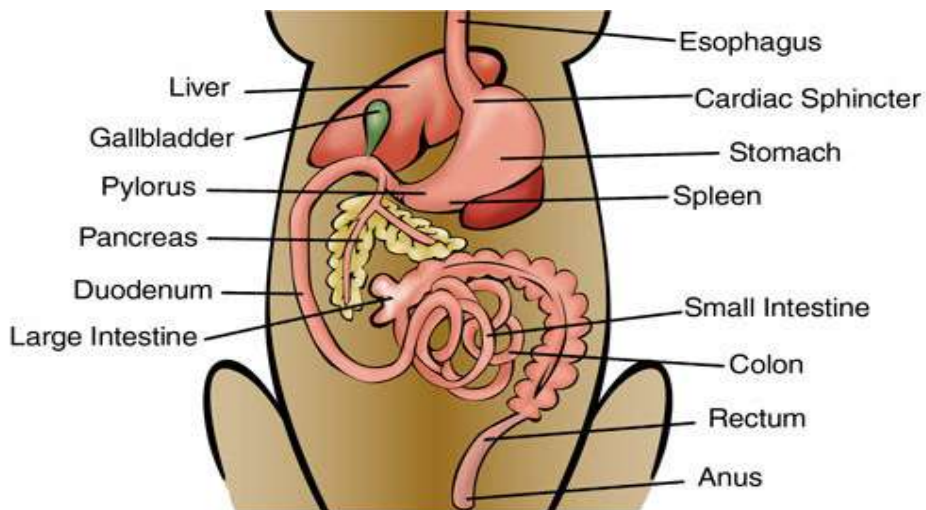
DIGESTIVE SYSTEM OF DOG

Fig.No. 12.5 Digestive System of Dog

DIGESTIVE SYSTEM OF CAT

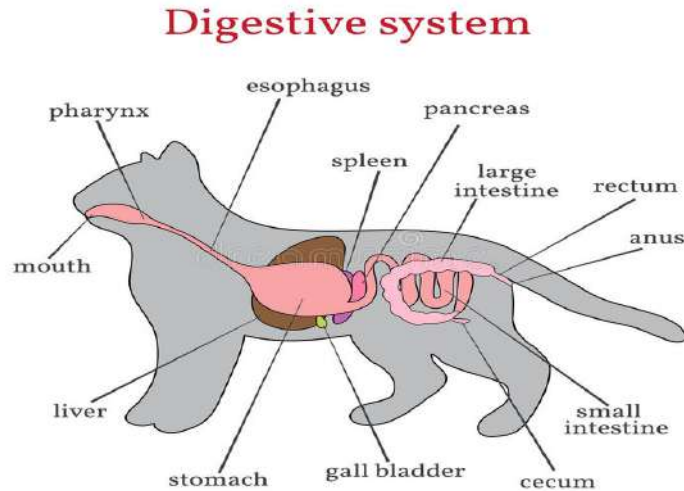


Fig.No.12.6 DIGESTIVE SYSTEM OF CAT

The basic functions of various organs of the digestive system of mono-gastric (Non-Ruminants) animals such as pigs, horses, rabbits, dog and cat etc. is almost same.

Mouth

The mouth serves a valuable role not only for the consumption of food but it also provides for the initial partial size reduction through grinding. While teeth serve the main role in grinding to reduce food size and increase surface area, the first action to begin the chemical breakdown of food occurs when feed is mixed with saliva.

There are three main salivary glands, which include the parotid, mandibular and sub-lingual glands. The amount of mucus present in saliva is regulated by the dryness or moistness of the food consumed. Thereby in a dry diet, more saliva mucus is secreted while in a moist diet, only an amount to assist with swallowing is secreted. Saliva generally contains very low levels of amylase, the enzyme that hydrolyses starch to maltose. The contribution of digestive enzymes from saliva is minor but still noteworthy.

Once food is chewed and mixed with saliva, it passes through the mouth, pharynx and then the oesophagus to the stomach.

Stomach

The stomach has four distinct areas which include the oesophageal, cardiac, fundic and pyloric regions. Once food passes through this region, it enters the cardiac region. In the cardiac portion of the stomach, mucus is secreted and mixed with the digested food. Food then passes into the fundic region which is the first major portion of the stomach that begins the digestive process. In this region, gastric glands secrete hydrochloric acid, resulting in a low pH of 1.5 to 2.5. This reduced pH kills bacteria ingested with the feed. Other secretions in this region are present in the form of digestive enzymes, specifically pepsinogen. Pepsinogen is then broken down by the hydrochloric acid to form pepsin, which is involved with the breakdown of proteins.

Finally the digesta moves to the bottom of the stomach i.e. pyloric region. This region is responsible for secreting mucus to line the digestive membranes to prevent damage from the low pH digesta as it passes to the small intestine. The pyloric sphincter regulates the amount of chyme (digesta) that passes into the small intestine. This is an important function not to overload the small intestine with chyme so proper and efficient digestion and absorption of nutrients occurs. In addition, once the chyme leaves the stomach, the material is quite fluid in consistency.

Small Intestine, Pancreas and Liver

The small intestine is the major site of nutrient absorption, and is divided into three sections. The first section is the duodenum. The ducts from the pancreas and the liver (gall bladder) open into the duodenum. The pancreas is involved with both exocrine and endocrine excretions. This means the pancreas is responsible for secretion of insulin and glucagon in response to high or low glucose levels in the body. In addition, it has exocrine functions of secreting digestive enzymes and sodium bicarbonate. The digestive enzymes secreted break down (hydrolyse) proteins, fats, and carbohydrates in the chyme. In addition, the sodium bicarbonate serves a vital role to provide alkalinity so chyme can be transported through the small intestine without causing cell damage because of the low pH after leaving the stomach. The pancreas serves as the most vital organ in the digestive process for producing and secreting enzymes needed for the digestion of

chyme and the prevention of cell damage due to pH. In addition to the pancreas secreting into the duodenum, bile, which is stored in the gall bladder and produced by the liver, is secreted as well. Bile salts primarily assist in the digestion and absorption of fat but also help with absorption of fat-soluble vitamins and aids pancreatic lipase in the small intestine. Finally, bile salts are necessary for the absorption of cholesterol, which takes place in the lower small intestine and are circulated to the liver via the portal vein.

Once the chyme passes through the duodenum, the digestion process is in full swing. Upon leaving the duodenum, enters the middle portion of the small intestine, the jejunum. This portion of the small intestine involves both the further breakdown of nutrients as well as the beginning of absorption of nutrients. Nutrient absorption continues into the final section of the small intestine, the ileum. Absorption of nutrients in the jejunum and the ileum occurs in the area termed 'brush border', or the intestinal mucosa. The mucosa is comprised of finger-like projection called villi, which in turn contain more micro-size projections called microvilli. The tips of the microvilli form web-type structures called glycocalyx. Amino acids and simple sugars released into the brush border membrane are absorbed into the microvilli first, then into the villi, and then pass into the circulatory system. Absorbed amino acids and simple sugars are taken directly to the liver via the portal vein. For dietary fat that is broken down and absorbed into the brush border, they enter the lymphatic system and are released into general circulation via the thoracic duct.

Large Intestine

First, digesta from the small intestine passes into the caecum. The main function of the large intestine is the absorption of water. The chyme that passes through the small intestine and into the large intestine initially is very fluid. The large intestine epithelium has a large capacity for water absorption. Once digesta passes through the ileum into the large intestine, no enzymatic digestion occurs. However, limited microbial enzymes activity does occur in the large intestine, which forms VFAs (volatile fatty acids). These can be readily absorbed in the large intestine. Generally these provide only enough energy to assist in the nutrient requirements of the epithelium of the large intestine. Also, B-vitamins are synthesised in the large intestine and are absorbed in a very limited amount, but not significant to alter nutritional supplementation of them. With the

majority of water removed, the digesta is condensed into a semi-solid material and is passed out of the rectum and anus.

The digestive enzymes and their action

Organ	Enzyme	Nutrients digested	Product of digestion
Mouth(saliva)	Ptyalin	Starch	Maltose
Stomach (Gastric juice)	Renin	Milk proteins	Coagulates milk proteins
	Pepsin	Proteins	Poly peptides
	Lipase	Fats, oils and other lipids	Monoglycerides, glycerol, fatty acids
Duodenum (Pancreatic juice,Bile juice)	Amylase	Starch, glycogen and dextrin	Maltose, glucose
	Trypsin	Protein break down products	Proteoses, peptides
	Chymo trypsin	Protein break down products	Peptides
	Carboxy peptidase	Protein break down products	Peptides, amino acids
	Lipase	Fats,oils and other lipids	Monoglycerides, glycerol, fatty acids
Small intestines	Maltase	Maltose	Glucose
	Lactase	Lactose	Glucose + Galactose
	Sucrase	Sucrose	Glucose + Fructose
	Aminopeptidase	Protein breakdown products	Peptides, amino acids
	Dipeptidase	Protein breakdown products	Amino acids
	Nucleotidase	Nucleoprotein	Nucleic acids, nucleosides
	Nucleosidase	Nucleoprotein	Purines, phosphoric acid

12.3 Digestive System of poultry:

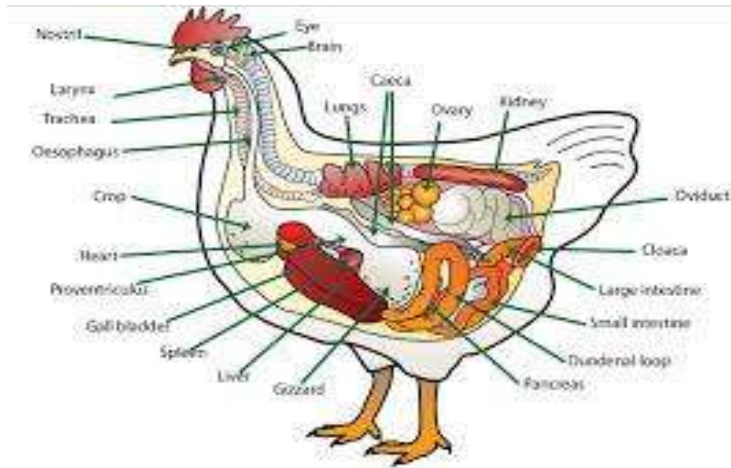


Fig. No.12.7 Digestive System of Poultry

The alimentary canal

The alimentary canal is a long tube-like organ that starts at the beak and ends with the vent or cloaca in the abdominal region. The nutrients from the food, after digestion, are absorbed through the wall of the alimentary canal into the circulatory system for transport to the liver or other parts of the body. The waste remaining is eliminated from the body via the cloaca or vent.

Mouth structure

Fowls don't have lips and cheeks, they have a beak. There are no teeth. The hard palate that forms the roof of the mouth, presents a long, narrow median (median – along the middle) slit that communicates with the nasal cavity. Numerous ducts of the salivary glands pierce the hard palate to release their secretions into the mouth cavity. The tongue is long and pointed and conforms to the shape of the beak in which it operates. The mouth has two major functions:

1. To pick up the food particles.
2. To direct the food into the oesophagus – as part of the bird's eating behaviour.

Pharynx

The pharynx is continuous with, and follows, the mouth. It is a common passage to digestive system and respiratory system. Epiglottis over the larynx of respiratory system prevents the passage of food into the respiratory system.

Oesophagus, crop and proventriculus

The oesophagus connects the mouth region to the crop. The crop is a large dilation of the oesophagus located just prior to where the oesophagus enters the thoracic cavity. The crop provides the capacity to hold food for some time before further digestion commences. This capacity enables the bird to take its food as “meals” at time intervals but permits continuous digestion. Inside the thoracic cavity, the oesophagus enters or becomes the proventriculus. It is a very glandular part of the digestive tract (often called the glandular stomach).

Proventriculus

The glandular stomach, or proventriculus, is relatively small and tubular. These glands produce a number of juices or enzymes used in the digestion. These glands also produce hydrochloric acid as well as lymphoid tissue.

Gizzard

The muscular stomach or gizzard is located immediately after the proventriculus. It has a flattened, rounded shape somewhat like a convex lens, with one side slightly larger than the other. It is thicker at the centre and becoming thinner towards the edges. The gizzard almost always contains quantities of hard objects such as gravel or other grit that aids in the disintegration of food, which is the primary function of the gizzard.

The small intestine

The small intestine begins at the exit from the gizzard and ends at the junction of the small intestine, caeca and colon. Only the duodenum can be easily distinguished in the fowl. There is no clear demarcation between the jejunum and ileum and the small intestine appears as one long tube. Much of the digestion of the food and all of the absorption of the nutrients takes place in the small intestine and hence its structure is quite important.

The small intestine has a number of very important functions:

1. Produces a number of enzymes involved in the digestion process
2. Site of much of the digestion and absorption of the food

The villi in the small intestines are very actively involved in the absorption process.

Duodenum

The **pancreas** lies between the arms of the loop and is attached to, and actually holds together, each arm of the duodenum. **Bile ducts** from the gall bladder that are attached to the liver and two to three pancreatic ducts enter the small intestine by a common papilla at the caudal end (closest to the rear) of the duodenum. The **pancreas** is a very important organ in the process of digesting food .

Jejunum and the ileum

The jejunum and the ileum commence at the caudal end of the duodenum where the bile and the pancreatic duct papilla are located and terminates at the ileo-caecal-colic junction. This junction is where the small intestine, the two caeca and the colon all meet.

Large intestine

The large intestine is very short and does not differ to any extent from the calibre of the small intestine. The **bursa of fabricius** is located immediately above the cloaca of young birds but disappears when the birds have reached approximately one year old.

Caeca

The two caeca or blind pouches are about 16-18 centimetres long in the adult.

Cloaca

The large intestine terminates in the front part of the cloaca. The cloaca is a tubular cavity opening to the exterior of the body and is common to the digestive and uro-genital tract.

Liver

The liver is a bi-lobed organ .The right side lobe is larger. The liver is dark brown or chocolate in colour except for the first 10-14 days when it may be quite pale due to the absorption of lipids (fats) from the yolk as an embryo. It weighs approximately 50 grams in adult birds. The capsule is the membrane that covers the liver and is thinner than that of mammals. The **gall bladder** lies on the right lobe beneath the **spleen**. Two bile ducts emerge from the right lobe and one of these originates from the gall bladder and the second provides a direct connection from the liver to the small intestine.

Functions of liver:

1. Bile formation – consisting of bile, various pigments and bile salts. Bile is involved in the digestion of fats to fatty acids and glycerol
2. Production and destruction of blood cells

3. Synthesis of plasma proteins and fibrinogen (associated with blood clotting)
4. Storage of glycogen, fat and fat-soluble vitamins e.g. vitamin A
5. Detoxification of certain substances

Pancreas

This organ has three lobes that occupy the space between the two arms of the duodenal loop. Two or three ducts pass the secretions of this organ into the distal end of the duodenum via papillae common with the ducts from the gall bladder and the liver. The structure is similar to that of the pancreas of mammals and consists of special secreting tissue for pancreatic juice as well as other groups of cells called the “islets of Langerhans”. These are mainly associated with the production of hormones. In poultry the cells of the islets of Langerhans are less defined than those in mammals. The functions of the pancreas are:

- Produce pancreatic juice which is a mixture of digestive enzymes.
- Produce the hormones insulin and glucagon that are involved in the metabolism of carbohydrate.

Enzyme action

After ingestion, the food is mixed with saliva and mucous from the mouth and oesophagus and these secretions thoroughly moisten the food. The enzyme amylase, which is produced by the salivary and oesophageal glands and found in the saliva and mucous, can now commence to breakdown the complex carbohydrates. However, the amount of enzyme action at this stage is minimal and the first major enzyme activity takes place in the proventriculus and in the gizzard.

Hydrochloric acid, pepsin and gastrin

The secretions of the proventriculus, or glandular stomach as it is often called, include hydrochloric acid to lower the pH of the system and the food mixture, the enzyme pepsin that acts on protein, and the hormone gastrin that stimulates the production and release of gastric juice in the proventriculus and pancreatic juice from the pancreas.

One effect is an increase in the pH of the intestinal contents of the latter half of the duodenum from strongly to weakly acid.

- In addition to enzymes, the pancreas produces **insulin** and **sodium bicarbonate**. The insulin is involved in the maintenance of blood sugar levels while the sodium bicarbonate, which is strongly alkaline, will increase the pH of the intestinal contents.

Waste (faeces)

The remainder of the material consists of waste and undigested food and are mixed with the urine in the cloaca and eliminated from the body as **faeces**. The appearance of the faeces varies considerably, but typically is a rounded, brown to grey mass topped with a cap of white **uric acid** from the kidneys. The contents of the caeca are also discharged periodically as discrete masses of brown, glutinous material. The average daily production of faeces from laying hens is between 100 and 150 grams. These fresh droppings are approximately 75% water and will air dry under favourable conditions to approximately 30% water.

Short Questions:

1. List out the different parts of the Digestive system of a Ruminant
2. Write the functions of rumen
3. Write the functions of liver
4. Write the functions of pancreas
5. List out the different parts of the Digestive system of poultry
6. List out the different parts of the Digestive system of pigs

Long Answer Questions:

1. Briefly explain the digestion takes place in a Ruminant
2. Write about the action of various digestive enzymes in mono gastric animals
3. Briefly explain about digestive system of Poultry
4. Write about the functions of rumen, liver, pancreas and small intestines

*******End of chapter*******

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LIVESTOCK MANAGEMENT AND DAIRYING**I YEAR****BLUE PRINT****PART B – VOCATIONAL SUBJECTS****PAPER – I: RUMINANT LIVESTOCK PRODUCTION MANAGEMENT (THEORY)****PERIODS/WEEK: 04****PERIODS/YEAR:135**

S.No	NAME OF THE UNIT	No. Of Periods	Weightage in marks	Short answer questions	Essay/ Problem questions
1.	Introduction - Confirmation points of different Ruminants.	5	2	1	1
2.	Breeds of dairy cattle, buffaloes , sheep and Goats	20	8	1	1
3.	Selection and Breeding of Ruminant Livestock	15	8	1	1
4	Housing , Hygiene and sanitation of Livestock farms.	15	8	1	1
5.	Care and Management of Ruminant Livestock	25	10	2	1
6.	Activities in a Livestock farm	15	8	1	1
7.	Reproductive System and A.I.	25	10	2	1
8.	Lactation and milking methods in Dairy animals	15	8	1	1
	Total	135			

LIVESTOCK MANAGEMENT AND DAIRYING

I YEAR

PART B – VOCATIONAL SUBJECTS

BLUE PRINT

**PAPER –II: NON- RUMINANT LIVESTOCK PRODUCTION MANAGEMENT
(THEORY)**

PERIODS/WEEK: 04

PERIODS/YEAR:135

S.No	NAME OF THE UNIT	No. Of Periods	Weightage in marks	Short answer questions	Essay/ Problem questions
1	Poultry production	75	30	3	3
2	Swine production	40	20	3	2
3.	Rabbit production.	10	10	2	2
4.	Pet animal management	10	10	2	1
	Total	135	70		

LIVE STOCK MANAGEMENT AND DAIRYING**I YEAR****PART B – VOCATIONAL SUBJECTS****BLUE PRINT****PAPER – III: FEEDS & FEEDING OF LIVESTOCK [THEORY]****PERIODS/WEEK: 04****PERIODS/YEAR:135**

S.No.	Name of the Unit	No. Of Periods	Weightage in marks	Short answer questions	Essay/ Problem Questions
1	Fodder Production	20	10	1	1
2	Fodder conservation	10	05	1	1
3	Common feeds and fodders	10	07	1	0
4	Formulation of rations	10	06	0	1
5	Feeding of Dairy animals	25	10	1	1
6	Feeding of Sheep and goat	10	04	1	1
7	Feeding of Pigs and Rabbits	10	04	1	0
8	Feeding of Poultry	10	07	1	1
9	Feeding of Dogs and cats	05	04	1	0
10	Quality control of Feeds	05	04	1	0
11	Feed plant	10	04	1	1
12	Digestive System	10	05	0	1
	Total	135	70		

MODEL QUESTION PAPER
LIVESTOCK MANAGEMENT AND DAIRYING
I YEAR THEORY
PAPER-I

RUMINANT LIVESTOCK PRODUCTION MANAGEMENT

Time: 3 Hours

Max.marks:50

SECTION - A

Note: i) Answer all Questions.

ii) Each question carries 2 marks

2x10=20

1. List out few domestic ruminants
2. What is the meaning of weaning and culling ?
3. Define ewe
4. Name any four breeds of Indian sheep.
5. What is grading up?
6. What are the advantages of loose housing system ?
7. Explain about colostrum
8. Write down the dental formula of cattle
9. Define parturition
10. List out milking methods

SECTION – B

Note: i) Answer any 5 Questions

ii) Each Question Carries 6 marks

5x6=30

11. Write about the conformation points of cattle
12. Write about the classification of Indian cattle according to utility and explain breed characteristics of any two breeds
13. Write about the various systems of breeding in cattle and buffaloes
14. Explain various buildings required in a dairy farm.
15. Write about the care and management of calf
16. Explain the various methods of identification in cattle and sheep
17. Write about the advantages of A.I and methods of A.I.
18. Explain the various methods of clean milk production

MODEL QUESTION PAPER
LIVESTOCK MANAGEMENT AND DAIRYING
I YEAR THEORY
PAPER-II

NON RUMINANT LIVESTOCK PRODUCTION MANAGEMENT

Time: 3 Hours

Max.marks:50

SECTION - A

Note: i) Answer all Questions.

ii) Each question carries 2 marks

2x10=20

1. What is broiler?
2. What is deep litter ?
3. What is incubation period in Chicken?
4. Define sow
5. Gestation period in pigs
6. Piglet anemia
7. Name two breeds of rabbit
8. Gestation period in rabbit
9. Name two breeds of dogs
10. Grooming of dogs

SECTION – B

Note: i) Answer any 5 Questions

ii) Each Question Carries 6 marks

5x6=30

11. Write about the reproduction system of hen with diagram.
12. Explain about brooding and management of chicks
13. Write about the summer management of layers
14. Explain about any two breeds of exotic pigs
15. Write about the care and management of piglets.
16. Write about the external body parts of rabbit
17. Explain about housing of rabbits
18. Write about the de worming and vaccination schedule of dogs

MODEL QUESTION PAPER
LIVESTOCK MANAGEMENT AND DAIRYING
I YEAR THEORY
PAPER-III
FEEDS AND FEEDING OF LIVESTOCK

Time: 3 Hours Max.marks:50

SECTION - A

Note: i) Answer all Questions.

ii) Each question carries 2 marks

2x10=20

1. Write two examples of legume fodders
2. What is silage
3. Name any two feed ingredients
4. Define ration
5. What is calf starter
6. What is flushing?
7. Feed efficiency in pigs
8. What is brooding in poultry
9. What are the common feeds used in dogs
10. What is fumigation

SECTION – B

Note: i) Answer any 5 Questions

ii) Each Question Carries 6 marks

5x6=30

11. Write about the cultivation practices of Hybrid Napier .
12. Explain about silage making
13. Write about the feeding of calves up to 6 months of age
14. Explain feeding of lambs , ewes and rams
15. Write about the feeding of chicks
16. Write briefly about digestive system of poultry
17. Write about feeding of layers
18. Explain about the cultivation practices of Jowar