

Practical Manual B. Sc. (Hons.) Agriculture

Livestock and Poultry Management



Department of Agronomy

School of Agricultural Sciences

SHRI GURU RAM RAI UNIVERSITY

[Estd. by Govt. of Uttarakhand, vide Shri Guru Ram Rai University Act no. 03 of 2017 & recognized by UGC u/s (2f) of UGC Act 1956]

FOREWORD

It has always been the motto of the teachers and scientists to use newer methods as older ones are modified and new ones are developed. I am very happy to learn that **Dr. Gaurav Jain, Assistant Professor**, School of Agricultural Sciences, who are actively engaged in teaching of various courses offered by the Department of Agriculture, have developed “**A practical manual for Livestock and Poultry Management**”. The manual indeed will help the students. I congratulate the author for the effort in writing this manual.



Prof. (Dr.) U.S. Rawat

Vice Chancellor

Shri Guru Ram Rai University

Dehradun, 248001

FOREWORD

Principles of Agronomy is a core course for the under graduate students. This course has been modified and updated as per direction of ICAR. In this manual **Dr. Gaurav Jain** have integrated the latest knowledge of agronomic principles to be used by students. This manual touches the practical aspects like external anatomy/body parts of cattle, buffalo, sheep and Goat; handling and restraining of livestock; identification methods of farm animals; judging of dairy cattle/buffalo by outward appearance and score card method; planning and layout of housing; computation of ration and milking methods.

I am sure that this valuable manual would be of immense use to the students and faculty members. I would like to congratulate author for bringing an experience in the form of manual.



Prof (Dr.) Priyanka Bankoti

Dean, School of Agriculture Sciences

Shri Guru Ram Rai University

Dehradun, 248001

PREFACE

The prospect of Indian agriculture has changed dramatically in the recent past and reached a point of threshold new researches on various aspect of eco friendly crop management are in progress to cater the needs of farming community in different agro- climatic regions of the country. With the introduction of new and common course curricula in all SAU's to under graduate students, it has become imperative to enrich them with the latest technology of crop production. The present manual is an effort in this direction in which authors have tried to describe the latest practical approaches for the agronomic principles. The manual has been written in simple language and easy to understand.

The authors gratefully acknowledge and express their deep sense of gratitude to Prof. (Dr.) U.S. Rawat, Vice Chancellor and Prof (Dr.) Priyanka Bankoti, Dean, College of Agriculture for their guiding inspirations in the preparation of this practical manual.

Special thanks are also due to Ms. Kamlesh Jeena and Mr. Sobit for computer typing for computer graphics of this manual.

Dr. Gaurav Jain

Assistant Professor, SAS

Shri Guru Ram Rai University

Dehradun, 248001

EXERCISE-1

STUDY OF EXTERNAL ANATOMY/BODY PARTS OF CATTLE, BUFFALO, SHEEP AND GOAT

Objectives:

A person working with animals should have proper knowledge of the different parts of the animal body for the following reasons:

1. To judge the utility of animal. Degree of development of certain parts of the animal body has relationship with the usefulness of the animal e.g. size of the udder and milk production in lactating animals, development of legs and ability to work in working bullocks etc.
2. The knowledge of external anatomy or body parts is essential for classification/recognition/registration of breed of animal.
3. For giving exact information and communication at the time of sickness, injury, theft, sale and purchase of animal etc.
4. To know about the sex as well as the general health/sickness of the animal.
5. The student must be acquainted with different terminologies of animal body parts.
For the convenience and ease of understanding the body parts, the cattle/animal's body is arbitrarily divided into five regions, viz.

(A) Head

(B) Neck

(C) Body or Barrel

(D) Fore limbs or Fore quarters and

(E) Hind limbs or Hind quarters.

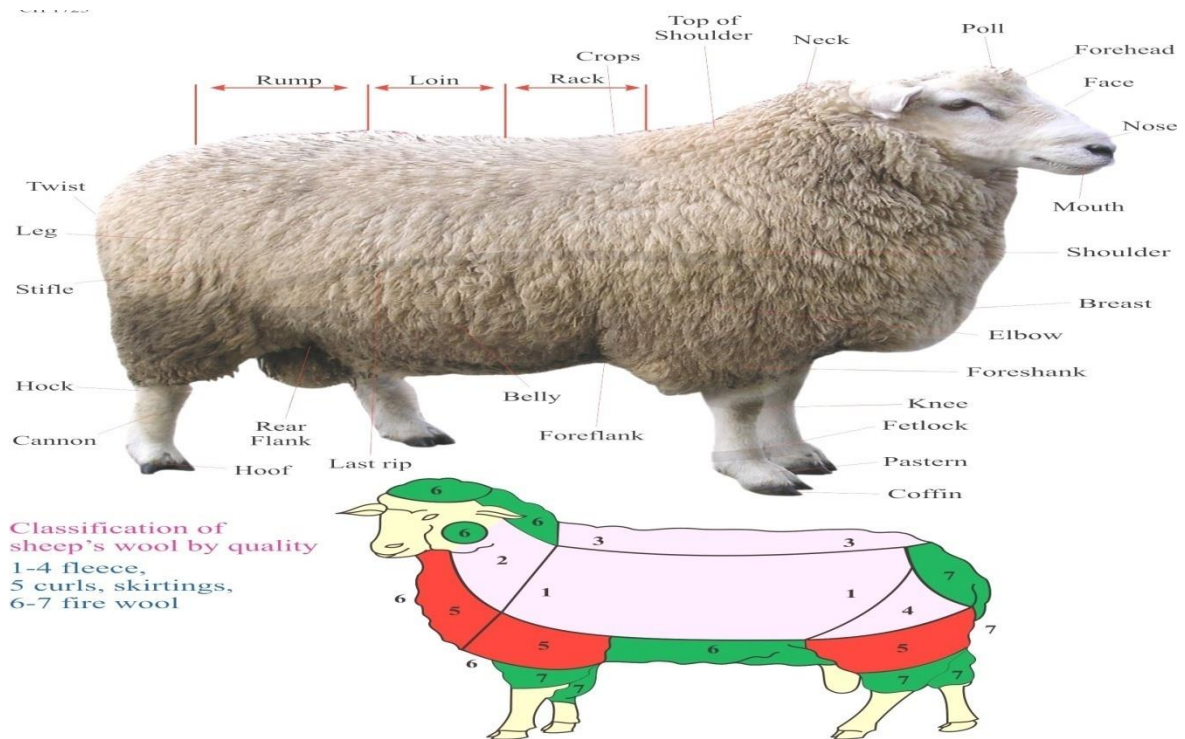
The External Body Parts of a Cow:

(A) Head :

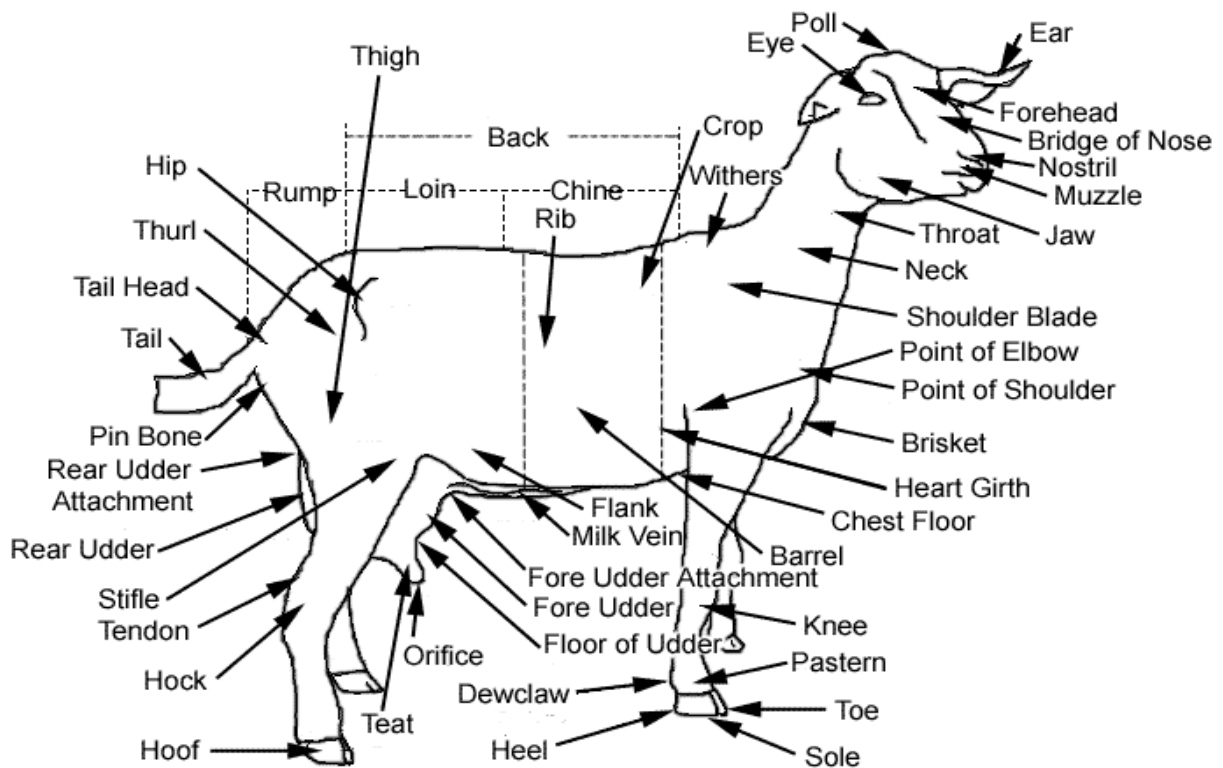
1. Mouth : Lips, tongue, teeth, jaw and dental pad, organ of prehension.
2. Horn : Generally black in young age and yellowish black in old age. In some breeds they are pinkish yellow. The rings are present on horn.
(A) Tip of the horn
(B) Base of the horn.
3. Head crest : The portion between the bases of horns.
4. Fore head : The portion situated below the head crest and above the level of two eyes. It is flat, dishy or bulging in shape.
5. Face : It is the portion below the level of two eyes up to the muzzle.
6. Poll : It is the bulging portion situated at the middle top centre of the forehead.
7. Cheeks : Lateral portion of the face below the eyes on both the side.
8. Chin : Portion below the lower lip. It is fleshy and pink in colour.
9. Muzzle : The projecting part of the head including the mouth, nose and jaws.

-

2



External Body Parts of Sheep



External Body Parts of Goat

(B) Neck :

1. Neck crest : It is the upper portion of the neck between head crest and hump/points of withers. It is the portion where yoke is placed in bullocks.
2. Dewlap : A hanging loose, wavy fold of skin between chin and brisket. It is more developed in tropical breeds of cattle and helps in heat dissipation. European cattle possess less developed dewlap.
3. Brisket : A fleshy bulging mass between and in front of the fore limbs.
4. Jugular groove : A groove running down the neck above the wind pipe.

(C) Body or Barrel :

1. Hump : The bulging fleshy mass between neck crest and back.
2. Point of withers : Point just behind the hump located between the two shoulder blades.
3. Back : Portion between point of withers and the last ribs.
4. Loins : The triangle formed by joining the head of last ribs to the two hook bone.
5. Sacrum : Portion from middle point of two hook bone and ending near the croup or root of tail.
6. Rump : Sloppy/encircling portion on either side of the croup between the hook bone and pin bone.
7. Hook-bone : It is the prominent bone on either side of the root of tail (tuber ischii).
8. Pin bone : It is also the prominent bone on either side of the root of tail (tuber ischii).
9. Tail : A distinct flexible appendage extending from the rear end of the animal's body.
10. Switch : Bunch/tuft of hair at the end of the tail.
11. Chest : Portion between two fore limbs just behind the point of elbow.
12. Heart girth : The circular measurement around chest.
13. Ribs : Thirteen pairs.
14. Hollow of the flank : The depression of the abdominal cavity between last rib and hook-bone which is triangular in shape.
15. Flap of the flank : Thick skin hanging between hind limb and abdomen.
16. Navel : Point on the lower side of the belly, left by dropping off the navel cord through which embryo receives nutrition and oxygen from the mother and gives off the waste products.

17. Udder : Structure containing mammary glands of cows. It has four quarters each having one separate teat. Degree of development of udder generally shows the capacity for production of milk. The teats are well placed at equal distance, shows even development of udder.
18. Milk vein : Situated on either side of abdomen between udder and milk well. It is zigzag and carries impure blood from the udder to the heart.
19. Milk well : It is point on either side of the chest where the milk vein enters into the body cavity.
20. Milk mirror : The bare yellowish portion extending from below the vulva up to the udder.
21. Anus : Posterior opening of the alimentary canal.
22. Vulva : External female uro-genital organ reflects that female is in heat or not.
23. Supernumerary teats : Extra teats which are non-functional. They may be removed.

(D) Fore Quarters :

1. Shoulders : Portion between the points of withers and point of shoulder.
2. Point of shoulder : It is a prominent joint of shoulder situated between point of withers and the elbow joint.
3. Arm : Portion between point of shoulder and point of elbow.
4. Fore arm : Portion between elbow joint and knee joint.
5. Knee joint : Joint between fore arm and shank.
6. Cannon : The portion between knee joint and fetlock joint.
7. Fetlock : Joint between the shank and pastern.
8. Pastern : Round portion between the fetlock joint and coronet.
9. Coronet : Hairy streak just above the hoof.
10. Hoof : It has two digits, black in colour in case of cow and buffaloes. The space between the two digits is known as interdigital space.
11. Dewclaw : Rudimentary hoof, two in number on each leg.

(E) Hind Quarters/Limbs :

1. Point of hip or hook bone : The external angle of ilium occurs as a bony prominence on either side of loin.
2. Hip joint : The prominence formed over the hip joint by the greater trochanter of the femur.
3. Stifle : The joint between femur, patella and tibia. Situated between hip joint and hock joint at the flap of flank.
4. Thigh : The region between the hook bone and pin bone on upper side and hock joint on lower side.

- Upper thigh – Portion up to stifle.
Lower thigh – Portion from stifle to hock joint.
5. Hock joint : The complex joint formed between lower thigh and cannon. It is made due to union of tibia and fibula, bones of hock and metatarsal.
 6. Hock point : The upper most extremity of the hock joint.
 7. Tendo- Achilles : The large tendon attached to point of hock. The milk man's or achilles tendon rope is tied on the tendon of the cows to prevent kicking or hamstring while milking. Parts below the hock joint are similar to those found in fore quarters.

Points of Bull/Bullock :

1. Scrotum : It is pouch in which testicles are situated.
2. Testicles : Two in number, found inside the scrotum and produce sperms.
3. Penis : Male uro-genital organ of copulation.
4. Sheath : Outer covering of the penis.

Questions:

Q.1. Draw the figure of cow and goat and point out the different body parts.

Q.2. Write the importance of muffle, neck crest, hollow of the flank and udder in dairy livestock.

Q.3. Enlist the joints of fore and rear quarter of animal.

Q.4. Differentiate the male and female animal from their body parts.

EXERCISE-2

HANDLING AND RESTRAINING OF LIVESTOCK

Farm animals are kept by their owners for economic motive. Therefore it becomes necessary to work with them and handle them for various purpose viz.:

1. To take work from the animals like bullocks, horses and camels etc.
2. To milk animals like cows, buffaloes etc.
3. To control and restrain the animals for treatment, castration, breeding, giving identification marks etc.
4. Transport the animals after purchase, for sale or for shows and exhibitions.

The method/s of handling the animals will be different for the different animals. The factors governing the method and mode of handling the animals are as follows:

- | | |
|--------------------|---------------------------------|
| (1) Species, | (5) Physiological status, |
| (2) Breed, | (6) Age, |
| (3) Sex, | (7) Familiarity-previous habit, |
| (4) Individuality, | (8) Use of proper method. |

1. Species: Animals of different species have different temperament, different body size and strength etc. A horse is more active, large and powerful animal as compared to sheep. The methods of their handling will be different.

2. Breed: Animals of different breeds react differently as they have temperamental differences. A Gir or Sindhi animals will be very mild and docile as compared to a Kankrej or Khillar animal which would be very nervous and vicious. The latter are to be handled with more caution.

3. Sex: Sex difference is found to govern the temperament of animals. A breeding male i.e., bull, ram, buck, etc., may be more temperamental and vicious than the respective females viz., cow, ewe, or doe or castrated males viz., bullock, wether, etc., they are, therefore, to be handled with more caution and should be restrained better.

4. Individuality: Certain individuals may be more or less temperamental than others. While handling the animals, the temperament of the individual animal may be assessed from the behaviour of the animals and also from the past experiences of the workers and owners etc.

5. Physiological status: Female animals in heat and soon after calving are more nervous and excitable. The same animals after about mid pregnancy develop mild, docile temperament.

6. Age: Animals which are adult and old viz., cows, bulls etc., can be handled easily. Young animals viz., heifers, bull calves etc., are more likely to be nervous and mischievous.

7. Familiarity: With familiar persons and in familiar surroundings animals may be handled relatively easily. This very much depends upon the degree of previous handling i.e. the habit of the animals. Animals made used to tying, untying, grooming, and tying of the legs etc., give much less trouble in handling than those kept under ranching or semi-ranching conditions.

8. Use of proper method: If undue fear, pain, discomfort or excitements are caused to the animals while handling, they get unruly and wild. Teasing of a horse or a bull; rough, noisy treatment to a freshly calved heifer etc., are the examples of improper handling.

While taking work from farm animals or while milking, treatment, castration, applying identification mark, it becomes necessary that some of their activities or undue movement can be prevented. This process is called restraining and the contrivances/devices used for these purposes are called restraints. Some of the common restraints are as follows.

Muzzle



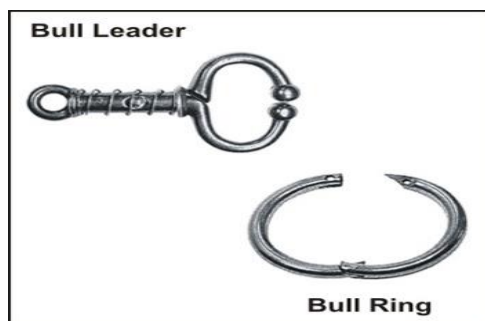
- : Muzzles are used to prevent cattle; horses etc. eating their beddings, calves suckling their mother or bullocks eating grasses while inter culturing. There are two kinds of muzzle
 1. Wire muzzle or Coir muzzle
 2. Leather box muzzle.

Bull-Nose Ring



- : They are used for restraining powerful bulls. They are generally made in the semi-circular pieces joined together. They are made from non-rusting metals like steel, aluminium or brass. A hole is first punched with the help of bull nose punch in the nasal septum and then bull nose ring is fixed.

Bull Leader



- : It is a long stick with sliding hook at one end and used to control the bull from close distance when applied on the bull nose ring.

Side Stick



- : A specially prepared stick of desired length with ropes on either end or a simple strong-stick may be used for this purpose. It is tied at one end with the halter and the other end is held in a position by means of ropes. Side sticks are used to prevent animals licking medicines applied on the limbs and suckling their milk by her.

Mouth Gags



- : Gags are devices for keeping the jaws of animals apart for examination of mouth. Drinking pattern mouth gag is most suitable for cattle, other mouth gag (i.e. Vernell's mouth gag, Butler's mouth gag, wooden mouth gag etc.) are also used for introducing the cattle probing.

Milk Man's Rope



- : It is applied by passing a thin rope around the joint of hind legs together and finally making a quick release knot of the free ends towards milker for milking.

Nose-Peg



- : It is made from wood having one end button shaped and other long end pointed with a round groove at central bar and used for restraining camels.

Travis or Crush



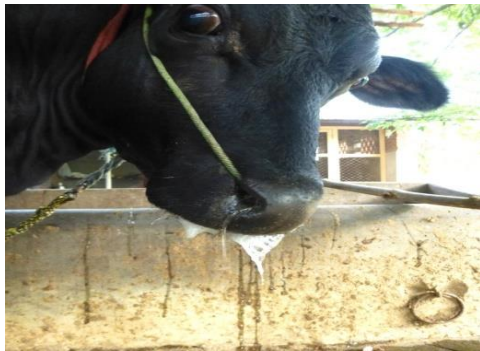
- : These are made of hard seasoned wood or metal tubing to restrain the animals in standing position. Now a day's Travis for large animals are available in various designs for specific use.

Halter



- : Halters are made up of leather, but for farm animal's simple rope can be used.

Nose String



- : A thin cotton rope is passed through the hole made in nasal septum and behind the base of horn. Then both end of the rope is tied.

Twitch



- : A twitch consists of a piece of stout wood about one meter long carrying a hole at one end. A loop of piece of rope is inserted through this hole. For applying a twitch, the horse should be haltered and held by an assistant. The rope is applied on the muzzle with left hand while holding the stick with right hand. After adequate grip on upper lip, twists up the loop by means of stick.

Cradle



- : Ten or twelve pieces of wood are arranged on two pieces of cord. Two short pieces of wood board longitudinally are kept on either side of long pieces. It is useful to prevent a horse getting his head to a fore or hind limb in cases of blistering or wounds. It allows very little vertical or lateral flexion of head.

HANDLING OF SHEEP

Objective: To study various methods of handling of sheep for identification, castration, docking, crutching, shearing, weighing, drenching etc.

Catching:

For catching a sheep, take it long a fence or in a corner of yard in the group, follow it for a while and grasp it hurriedly either under the chin or neck and push it back. Generally ewes, hoggets and lambs can be held in the position simply by grasping under the chin and the rear flanks with two hands simultaneously. Some time a sheep can be held between two knees of the operator while the chin is kept grasped. As young and female sheep are mild and timid, they are not required to be secured rigidly. Under no circumstances the sheep should be caught by wool.

Controlling:

For castration place the ram lambs on its rump in sitting position. Draw each hind legs forward and upward inside the fore-legs. Hold the hock joints with four fingers and catch the fore-legs at the knee with your thumb. For docking same procedure is applied, but the back of the lamb is facing to the operator. For securing sheep in standing position "Y" shaped portable sheep stalk or small Travis can be used. For mass drenching or vaccination, sheep are driven through a catching pen leading to a race.

Casting of sheep:

First stand on one side of the sheep body and catch the fore and the rear legs while passing your hands underneath the sheep. Gently pull the legs upwards. Allow the sheep to fall when it is rolling on your limbs. The legs are tied with ropes as in cattle.

Questions:

Q.1. Enlist the common restraints used for restraining of bulls.

Q.2. Name the animals in which nose string and nose ring are used along with the method of application for restraining.

Q.3. Enlist common restraints used for restraining of horses along with the method of application.

Q.4. Define restraints and restraining.

Q.5. Justify: Restraining of bull is more difficult than cow.

EXERCISE-3

IDENTIFICATION METHODS OF FARM ANIMALS

If a herdsman has only few animals, recognizing each animal separately is possible for differentiating them according to their external appearance. But when the number is large, some systematic method of identification is necessary.

Objectives/Importance:

1. Identification of farm animals is essential for efficient routine management viz., breeding a cow in estrus, treatment of sick animal, recording milk production of animals etc.
2. It is necessary for registration as well as for insurance of livestock.
3. In case of loss or theft of animals, identification marks are useful.

Systems of Identification:

1. Name:

Name can be given to the animals after the place of purchase, owner, from physical appearance or on the names of rivers, gods etc. Generally this system of naming is used along with other systems of identification. This system is useful for small number of animals only while not applicable in large herd or flock.

2. Marking or Numbering:

Name alone is inadequate for large herd or flock for identification purposes. For this reason, system of giving identification marks or numbers should be followed.

(a) Tattooing:

This consists of piercing small letters and/or figures by steel points into the subcutaneous tissue by means of tattooing fork. The steel points carry small amount of tattooing ink into the subcutaneous tissues.

The part to be tattooed should be thoroughly scrubbed with methylated spirit to remove grease and debris. Tattooing ink is applied over the parts. The desired number or figure fixed to the tattooing fork is then firmly pierced. The ink is rubbed on the pierced mark of the part with the thumb.



(Tattooed Dog)



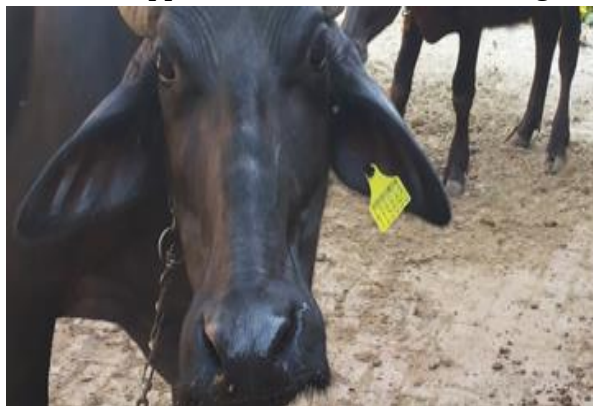
(Tattooing ink with tattooing fork)

The inner surface of ear is most suitable site for tattooing. A portion of the ear free from hair and devoid of major blood vessels is chosen. Tattooing can be done underneath the root of tail,

escutcheon or on inner surface of lips or on the gums; if necessary. Tattooing number is used for new born calves, foals, lambs, kids etc.

(b) Ear Tagging:

Tags are small metal or plastic plates like labels which can be readily inserted on the ears of young animals. Tags bear number of the animal and name of the farm. Tags are fixed to the ear with the help of tagging forceps. Tagging is mostly used for marking sheep and goats. Though pigs and young calves can be tagged, the marking site of the tag should be on the top of ear. Some antiseptic should be applied to the wound for healing.



(Ear Tagging in Buffaloes)



(Ear Tags with Ear Tag Applicator)

(c) Ear Notching:

This method is mostly used to mark pigs at a commercial farm. It comprises of cutting 'V' or 'U' shaped notched at specified places along the borders of ears. Notches may be made by means of special ear notching or sharp scissors. Coded series for ear notches are used for identification, for this reason, one must decide suitable coding system for his farm.



(Ear Notching in Pigs)

(d) Branding:

It consists of searing a number on skin, hooves or horns. Branding is most suited for marking cattle, buffaloes, camels etc. Calves should be branded at the age of one year. Branding is done by means of metal numbers specially made for this purpose. It is usual practice to brand the animal on shoulder and thigh or horns or hooves. Branding preferably is done during the winter season.

Hot Branding:

The iron numbers fixed to wooden handle are heated in fire and are branded on the thigh or shoulder so that roots of hair will die. These numbers can be read throughout the life of an animal.

Cold Branding:

In this method the metal (brass) bumpers are dipped in a liquid popularly known as branding oil or branding ink. The liquid has some corrosive substance in its composition which acts as a burning agent. These numbers gone away after a year or two.



(Hot Branding Iron Rod)



(Cold Branding Iron Rod)

Freeze Branding:

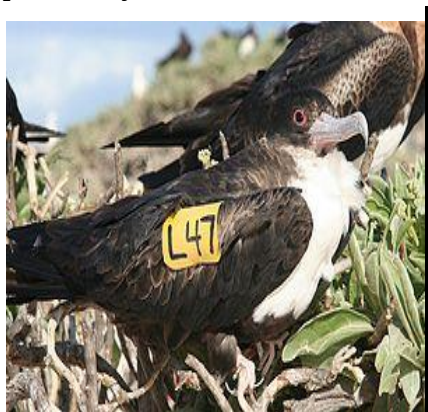
In this method the branding iron is frozen at -196°C or at -700°C by liquid nitrogen or carbon dioxide. Here the hair turns white.

(e) Number Plates:

Plates of various shapes and sizes bearing the name and address of the owner and number of the animals are placed around the neck of animal by means of neck strap or neck chain. Sometimes such plates are also fixed around the base of the horn. Such plates are largely used for dairy cattle and buffaloes.

(f) Wing and Leg Bands:

These are very light, adjustable aluminium colored numbering strips. These are mainly used for identification of birds. Wing bands are inserted through a slit made in the skin near the edge of wing. Leg bands are applied on the legs with a slight free movement, if properly adjusted. There are practically little chances of their loss.



(Birds with Wing and Leg band)

(g) Toe Punching:

Small holes are pierced in the webs of the feet of chicks after hatching. These marks are used for group identification in ducks.



(Toe Punch)

(h) Colour Marking:

The colours are painted/spread on different body parts of animal. This is commonly used in sheep, goats, camels and donkey for group identification. This method is very simple and cheap.



(Colour Marking in Goat and Sheep)

(i) Electronic Chip:

It is the electronic silicon chip that can be fitted at the shank region or at neck region by putting incision on skin and muscles at the part and remain for throughout the life. The electronic identity gives detail and record the information about the animal regarding different farm activities (milking, breeding).

Questions:

Q.1. Enlist the methods of identification commonly used for each of the following: Cattle, Buffalo, Poultry, Duck, Sheep, Goat, Camel and Donkey.

Q.2. State the procedure of ear tagging in calf/foal.

Q.3. What precautions will you take while branding an animal?

Q.4. What precautions will you take after branding an animal?

Q.5. Write the complete procedure of ear notching in pigs.

Q.6. What are the advantages of colour marking method of identification over other methods?

EXERCISE- 4

VISIT TO INSTITUTIONAL DAIRY FARM (IDF)

We visit various dairy farms where cattle, buffalo or both the species are maintained with different objectives. Information to be collected and critical observations to be made while moving in/taking round in the farm and having clear concept of target/goals for performance traits for different species or breed will help to analyse managerial practices and performance of the herd.

Information to be collected and certain observations to be made while visit to dairy farm are:

1.	Species/breeds: of bovine kept	Cattle : Buffalo:
2.	Size of the farm:	Small/Medium/large
3.	Institutional/organized or Private	a) Organized- Government/University /Trust b) Private
4.	Establishment	a) When: b) By whom:
5.	a. Objective/Motive	Academic/Research /both Business -Profit
	b. Objectives, if a research farm	a) b)
6	Land available	Livestock farm Fodder Farm
7.	Systems of Farming	Specialized /Diversified /Mixed Farming
8.	Building/Structure	a) Primary structures c) Layout of sheds b) Ancillary structures d)Type of arrangement
9.	Feed and fodder	Fodder crops Cultivated/Dry/ Purchased Feeds being utilized
10.	Observations while visit to sheds	Condition of animals, Condition of sheds, Cleanliness of sheds, floor, water trough, manger Drainage facility, Manure pit, distance from sheds, condition Fly/Mosquito/Insects problem
11	Level of mechanization/use of machines	Chaff cutter Milking machine Harvester (mechanical harvesting)
12.	Information on method of rearing calves	Weaned /suckled
13.	Information on Herd performance traits	Production performance: Wet average and Herd Average Reproductive performance: Milch : Dry Ratio (% milch animals)

14.	Herd performance characteristics	i) Age at First Calving (AFC) ii) Calving Interval/ Inter calving period (CI) iii) Lactation period /days iv) Total Lactation Milk Yield (TLMY) v) Standard Lactation Milk Yield i.e. first 300 days (SLMY) vi) Dry period/days
15.	Mortality in Calves / the Herd	Calf mortality < 6 month of age or Overall herd mortality
16.	Efficiency of Land use	Cropping intensity

i) BREEDS OF LIVESTOCK:

Identification of Various Breeds of Cattle, Buffalo, Sheep and Goat:

Breed is a group of animals of a species having similar physical and economical characters. Each ecological region has a breeds of animals adapted to the climate of that region. According to necessity and adoption, a breed of animal developed by the people in a region.

Objectives:

- To be familiar with breeds.
- To know the physical characteristics of breeds.
- To know the breeds of animals of the region, state and country.

Breeds of Cattle:

There are 42 well defined cattle breeds classified as milch, draught and dual purpose and are usually named after area, location and habitat they occupy.

Utility Classification of Cattle Breeds:

(A) Bos. indicus: Indian cattle, humped cattle.

1. Milch Breeds: (Dairy Breeds)

Features:

- (i) The cows are high yielder produce 1500 liters or more milk per lactation.
- (ii) The cows are docile and mild in temperament while the bullocks are slow workers.

Breeds: Red Sindhi, Sahiwal, Gir, Deoni and Gaolao.

2. Dual Purpose Breeds: Useful for both milk and draught purpose.

Features:

- (i) The cows are fairly good milkers, produce 900-1400 liters milk per lactation.
- (ii) Bullocks are medium fast and good for draught.

Breeds: Kankrej, Haryana, Ongole, Tharparkar, Rath, Mewati and Nimari.

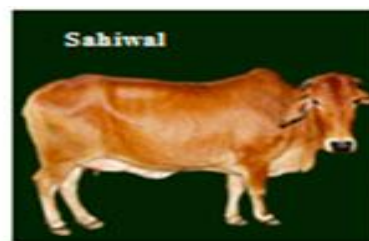
3. Draught Purpose Breeds: Useful for agriculture works

Features:

- (i) Majority of Indian breeds raised for draft purpose.
- (ii) Cows are poor milk producers; produce less than 900 liters milk per lactation.
- (iii) Bullocks are active, powerful and good draft animals.

Breeds: Khillari, Hallikar, Malvi and Amritmahal .

Photographs of Breeds of Cattle



Cattle Breeds

	<u>Milch purpose</u>	<u>Dual purpose</u>	<u>Draught purpose</u>
North Gujarat	--	Kankrej	--
Gujarat	Gir	--	Dangi
India	Red Sahiwal, Gaolao	Sindhi, Deoni, Tharparkar, Haryana, Ongole, Rathi, Mewati, Nimari	Amritmahal, Khillari, Kangayam Nagori, Malvi, Ponwar, Siri

Buffalo Breeds

North Gujarat	Mehsana, Banni
Gujarat	Jaffarabadi, Surti
India	Murrah, Nagpuri, Bhadwari, Toda, Sambalpuri, Jerangi, Kalahandi

Indian buffaloes: (*Bubalus bubalis* Linn.)

Local name: Arna, Bhains, Geva, Erumai.

Features:

- Semi aquatic animal abundant in humid localities.
- Large massive and clumsy creature.
- Short thick legs and conspicuous hoofs.
- Horns thick, flat, curved or straight.
- Jet black colour or light coloured brown breeds.

Photographs of Breeds of Buffaloes

Nili Ravi



Toda



Jaffarabadi



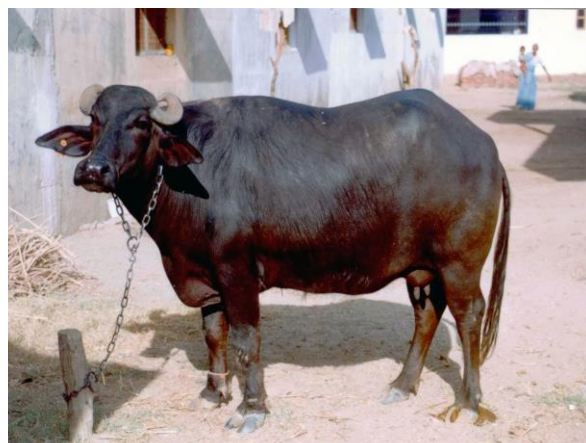
Mehsana



Murrah



Banni



CLASSIFICATION OF BREEDS OF SHEEP AND GOAT

Classification of Breeds of Sheep:

Sheep produce fleeces of different types. The fleece differs in their hair content, fiber diameter, fiber length and fineness of wool and accordingly sheep breeds are classified as:

1. Fine Wool Breeds:

Features:

- (i) Produce only wool fibres in their fleece, hair absent.
- (ii) Fibre diameter ranges from 17 to 23 μ (microns), very fine wool.

Example: Merino, Rambouillet, Pollworth.

2. Medium Wool Breeds:

Features:

- (i) Fleece of these sheep does not contain hair.
- (ii) Diameter of wool fibre varies from 23 to 32 μ (microns).

Example: South Down, Suffolk, Hampshire.

3. Long Wool Breeds:

Features:

- (i) Wool is coarse having fiber diameter more than 33 μ .
- (ii) Fibre length varies from 15 to 30 cm.

Example: Lincoln and Leicester.

4. Crossbred Type Wool Breeds:

Features:

- (i) Developed by crossbreeding between fine wool breeds and long wool breeds.
- (ii) Wool quality similar to medium wool sheep.

Example: Corriedale, Panama, Columbia, Hissardale.

5. Carpet Wool Breeds:

Features:

- (i) Fleece contain hair i.e. modulated fibers
- (ii) Wool is coarse wiry and tough used for carpet making.
- (iii) Wool fibre diameter is more than 33 μ .

Example: Marwari, Patanwadi, Bikaneri, Chokla, Magra.

6. Fur Wool Breeds:

Features:

- (i) Skin of sheep with wool known as fur used for making fancy articles, fur coat, purse, ladies wear, gloves etc.
- (ii) Skin is obtained by killing of lamb called pelt.

Example: Persian, Lamb pelt, Karakul, Broadtail.

Classification of Breeds of Goat: Our traditional goat farmers have extensively practiced the art of selection and inbreeding for evolving definite breeds with specific or multiple functions. The country as a whole represents an important genetic reservoir of goat breeds for meat, milk, fibre and skin production.

- (A) **Milch Breeds:** These breeds of goats are mainly reared for milk purpose on commercial lines. E.g. Alpine, Saanen, Toggenburg and Nubian. Saanen is also known as Jersey of the goat world due to its high milk production potential.
- (B) **Dual Purpose Breeds:** These breeds of goats are reared for milk as well as for meat purpose. They produce 100-200 liters of milk per lactation and 1-2 kids per kidding. E.g. Jamunapari, Barbari, Beetal. Whereas, triple purpose breeds i.e. for milk, meat and hair are Marwari, Mehsana, Kutchi and Zalawadi.
- (C) **Meat Breeds:** These breeds of goats are mainly reared for meat purpose on commercial lines. E.g. Black Bengal goat breeds (known for excellent mutton and skin quality), Deccani, Malabari etc.

ii) STUDY OF DAILY ROUTINE FARM OPERATIONS

All the routine operations on a dairy farm are scheduled to meet with the main object of producing milk from the animal and selling the same profitably. The work of production and sale of milk is to be done daily twice all throughout the year without any holidays. Daily, twice, the milk has to reach the customer's doors at the appointed time. In order to achieve this, the timings of all the different works, to be done daily on the farm, are fixed. It is very necessary to observe the fixed timings.

Dairy animals are creatures of habit. They become nervous if the regularity of different time schedules is not observed. This leads to loss in production. Dairy farm is a very busy concern. Unless the timings and sequence of all the routing operations are decided and scrupulously observed, there will be mismanagement.

Daily Farm Operations Schedule

The various operations should be carried out in an orderly manner as per well prepared schedule.

Approximate time (hours)	Sl. No.	Farm operations
03.00 - 03.30	1.	Cleaning/brushing of milch animals
03.30 - 05.00	1.	Feeding half of the daily concentrate ration just before milking.
	2.	Milking cows.
05.00 - 05.30	1.	Delivery of raw milk (in cans) to the milk pick-up van of dairy plants and receiving previous day's empty cans.
	2.	Washing and disinfection of milking barns.
05.30 - 08.00	1.	Cleaning of milk cow sheds.
	2.	Feeding of dry/green fodder to milch stock.
	3.	Cleaning farm premises.
	4.	Isolation of sick animals.
	5.	Isolation of "in-heat" cows for artificial insemination

Note: Use milkers at the rate of one for every 12-14 cows, for all the above operations. Milkers go off duty by 8.00 a.m. and farm labour come on duty.

Approximate time (hours)	Sl. No.	Farm operations
08.00 - 12.00	1.	Cleaning calf, maternity, dry-stock, bullock and bull sheds.
	2.	Feeding half of the daily concentrate ration to calves, pregnant cows and bulls.
	3.	Exercising and grooming of bulls.
	4.	Treating sick animals.
	5.	Breeding cows that are "in-heat".
	6.	Harvesting, chaffing and feeding of green fodder to all the stock. Mangers in all sheds should be filled with green fodder.

Note: Animals should be taken for grazing (if practiced) between 09.00 a.m. and 02.00 p.m. in winter, and between 06.00 a.m. and 10.00 a.m. and again between 05 .00 p.m. and 07.00 p.m. in summer.

Approximate time (hours)	Sl. No.	Farm operations
12.00 - 01.00	1.	Lunch-cum-rest period for labourers.
01.00 - 03.00	2.	Miscellaneous jobs for dairy farm stock identification; periodical vaccination; preparation of concentrate mixture; repair of farm fences, fittings and repair of equipments; rope and halter making; weekly scrubbing and white-washing of drinking water tanks; manure disposal/ conservation; hay and silage making; periodical spraying of animal houses with suitable pesticides; periodical deworming of stock; clipping hair from sides and hind-quarters of cows; grooming; toe trimming; dehorning of calves; attending to sale and purchase of livestock and their transportation; fitting and training of cows for show.

Note:

1. The dairy manager should plan the jobs well in advance in such a way that they are evenly distributed over the week. Some jobs may require longer time and the labour have to work extra time on such occasions.
2. Milkers come on duty by 2.30 hours and remain up to 5.30pm hours whereas general farm labours go off duty by 5.00 hours.

02.30 - 03.00	1.	Washing, brushing of milch cows by milkers.
Approximate time (hours)	SL.No.	Farm operations
03.00 - 04.30	1.	Feeding the other half of daily concentrate ration to milk cows just before milking.
	2.	Milking.
	3.	Cleaning calf, maternity, dry-stock and bull sheds and feeding the

		other half of concentrate ration to calves, pregnant cows and bulls.
04.30 - 05.00	1.	Delivery of milk (in cans) to milk pick-up vans of milk plants and collection of mornings empty cans.
	2.	Washing and disinfection of milking barns.
	3.	Feeding dry and green fodder to calves, dry-stock and bulls.
05.00-06.30	1.	Cleaning of milch cow shed.
	2.	Feeding green / dry fodder to milch stock.
	3.	Cleaning farm premises.

OTHER FARM OPERATIONS:

(A) CASTRATION:

Castration means to render the gonads non-functional. Though the definition includes the operation performed on animal of either sex. Conventionally castration means rendering the testis (male gonads) functionless.

Aims of castration:

Castrated animals produce better quality of meat. If male animals are not castrated, their meat will have a peculiar odour and will be coarser. Consequently entire male animal will fetch lower price. Castrated animals grow faster. Castrated animals are more docile and so easier to handle. A small number of male animals will be required for breeding. Excellent male animals are selected for breeding. The others if not castrated will produce inferior progeny. Castrated male animal can be grazed, housed or managed together with female animals.

Age of castration:

Ram lambs should be castrated while they are young, the best age being 7 to 15 days.

Methods of Castration:

There several methods of castration. Each method has some advantages and disadvantages.

1. Open method of castration:

In this method an incision is made, on both the testicles through the scrotum. The testicular material is removed completely. If the animal is not young, profuse bleeding takes place in this method. A mild disinfectant may be used to wash the wound. The operation should be done on a clear day with all the aseptic precautions. Lambs to be castrated should be placed in a clean, dry place and pain should be minimum.

2. Close method of castration:

In this method the spermatic cords leading to the testicles are crushed. This method does not leave an open wound and is bloodless. As the nerves and blood vessels are cut off the testicles become functionless, the tissues die and shrink in size. It is quick and almost painless operation. "Burdizzo"castrator is used for crushing the spermatic cords. The operator must be skilled in its use otherwise result in partly castrated lambs.



Burdizzo Castrator



Castration with Burdizzo Castrator

3. Elastration or Rubber band method:

It is also a bloodless method of castration. A very tight and strong rubber ring is put around the spermatic cord at an early age of animal. Because of the constant heavy pressure the nerves and blood connections are cut off and scrotum with testicles gradually dies and drops down.



Elastrator with Rubber Ring for Castration

Vasectomization:

Sometime adult male animals are vasectomized so that they can be used as teasers. Teaser should have sex libido and can detect female animals in heat, but they can't impregnate females as their ejaculates do not contain live sperms. This is so because at the time of vasectomization, the vas-deferentia are cut and ligated, but the blood and nerve supply to the testicles are kept intact.

(B) DOCKING:

Docking means cutting of the tail from the base.

Aims of docking:

Docking is done in case of sheep that are kept for wool production. As wool acts as an insulating layer and does not allow quick evaporation of the moisture. The skin becomes wet and dirty due to urination and defecation. The dirty area with warmth provides a good breeding place for flies. They lay eggs which hatch into larvae in this area. Larvae pass down the skin and causes inflammation and complication like maggot wound. If tail of sheep is removed, area around the tail

dries up quickly and as a result avoids fly nuisance and its complications. The Indian sheep are not docked because they have shorter tails and they grow shorter and sparse woolly coat. But for exotic and crossbred sheep, it is necessary to dock them.

Age of docking: Lambs may be docked at the time when they are castrated.

Methods of Docking:

1. Docking with a knife:

The lamb is held in the same way as for castration. The tail is severed about 2.5 cm from the body as measured on the underside of the tail. Press the skin towards the body before cutting, leaving loose skin above the cut. A band or tourniquet may be tied at the base of the tail before cutting, which should be removed after 3 to 4 hours.

2. Docking with hot iron pincers or chisels:

This method results in loss of blood and less danger of infection. But the wound heals slowly. The cutting iron is heated up to just turning to red. The cutting edge of this iron is sharp, so in this method the cutting is obtained by burning through rather than cutting through the tail. Electrically heated irons with thermostatic control are also available.

3. Elastrator:

This bloodless method of docking is similar to that used in castration. The light rubber band is fitted around the tail. This method is not liked by many persons as the tail is removed slowly and sometimes putrefaction takes place creating a condition favourable for flies to breed.

In general docking and castration of animals should be done under all the sanitary precautions and when there is minimum fly nuisance.

(C) HOOF TRIMMING:

Thorough pairing or trimming of the hooves of sheep is the most important part of the prevention and treatment of foot-rot. For this purpose specially designed knives or secateurs are used. Moistening the hooves before pairing, will soften them and will make the job easier. A mild antiseptic solution may be used to wash the hooves. Hoof trimming is also done with stud rams and ewes before mating season.

iii) STUDY OF FARM RECORDS

Dairy business cannot be carried out without maintaining the necessary set of accurate records.

Importance of Records:

1. Records are the mirrors of a farm. They are necessary for genetic improvement of dairy cattle. Records are necessary to know the milk production efficiency of the dairy animals and based on this information we can retain or cull the cows or their offsprings. Hence without a set of records properly, accurately and reliably maintained, improvement of livestock by breeding is not possible.
2. Records give us the information about the financial status of the dairy farm. Whether it is making profit or incurring loss or is just maintained. They also give the information about the extent of profit or losses.
3. Profit can be increased by reducing the wasteful and undue expenditure. To know such items, it is necessary to have detail record on each item of expenditure viz. feeds, labours, interest, depreciation of farm building and farm equipments, animals and miscellaneous items like medicine, vaccination

breeding charge etc. The sales of milk, sale of culled animals, sale of manures, sale of empty gunny bags etc are also recorded.

Classification of Records:

Records required to be maintained on the dairy farm can be classified into four major group or categories.

1. Records/Register Pertaining to Financial and Account Matter.
2. Records/Register Pertaining to Accounting of Animals.
3. Records/Register Pertaining to Milk Production.
4. Records/Register Pertaining to Reproduction

1. Registers Pertaining of Financial and Account Matter

It includes registers such as cash book, ledger book, milk coupons, bill book, receipt book, demand and collection register, dead stock register, concentrate and forage register etc. These register are more pertaining to administration and account side rather than the technical side and hence not discussed in detail over here.

2. Register Pertaining to Accounting of Animals

These include registers such as cattle yard report/daily dairy roll call register, herd register, birth and death register. This group of register is concerned with increase or decrease in the herd strength. The increase in herd strength may be by birth, purchase of animal and farm transfer. The decrease in herd strength could be due to death, sale and farm transfer of animal.

a. Cattle Yard Report

This is a primary record, maintained daily and is also called daily diary. It is a key register on the livestock farm. Entries in all other register are made from this register. This register gives herd strength and detail of all changes in the strength. It also records details of sickness and treatment, vaccination, deworming, estrus, breeding/service to the heifers and cows, pregnancy diagnosis, feeding etc. Any other item thought to be important is also noted in this register such as extreme change in climate, rainfall, cloudy or windy weather, cyclone etc.

b. Roll Call Register

This is an annual register maintained month wise. It is changed every year on 1st April. It gives the number of animals in each class or the herd. Change in the number of animals in any class is noted and detail of change is given. The number of animals in each class on the last day of the month is recorded and carried over to the first date of next month, after actual counting the herd strength.

Roll Call Register									
Month.....									
Date	Cows	Heifers	Bulls	Bullocks	Male Calves		Female Calves		Others
					≤1yr	≥1yr	≤1yr	≥1yr	

c. Herd Register

This is also an annual register. It is changed every year on 1st April. In this register all the individual animals in different classes of the herd are listed according to their date of birth. The animal as on 31st March is listed class wise on 1st April of the next year according to their birth date. The details of each animals, viz. name and number, date of birth, parents etc. are given. Any new addition of animals in each class after 1st April is demarcated by a line. The details of removal of animals from the herd during the year should be given in the respective columns.

d. Birth Register

This is an annual register, which give information about the number of births on the farm, sex of calves born (male and female). Birth weight of the calves, name of sires and dams, date of last service of dam, gestation period, number of heifers becoming cows, their age at the first calving etc. Average of the above characters for the year is made at the end of the year.

e. Death Register

Like birth register, it is also an annual register. It gives information about total death during the year and their cause. The frequency of a particular disease can be seen from this register. The responsible person must sign the register, as it is concerned with final write off of the animal.

Sr. No.	Name and No. of animal	Breed Group	Sex	Class	Date of Birth/ Death	Post mortem done or not	Post mortem report and reasons of death

3. Register Pertaining to Milk Production

These include 4 register viz. Daily milk production register, Monthly Milk Production register, Lifetime milk production register (monthly progress register) and History sheet.

a. Daily Milk Production Register

This is written daily both morning and evening or sometime thrice a day. Cows are listed in this register according to their breed group and date of calving. The daily total milk production is divided by the number of milking units (both morning and evening milking unit) gives "**wet average**". If the milk production is divided by total number of cows, then it gives "**herd average**". By watching carefully the fluctuation in the wet average as well as correcting the reason efficiency of the milk animals is maintained by taking care to breed the animals within 2-4 months postpartum. This is included in the column of date of last service. The total milk production of each cow for a month is transferred into the monthly milk yield register.

b. Monthly Milk Production Register

It is an annual register. Cows in the milk on 1st April are entered in this register according to their date of calving up to 31st March is entered at the top of the register. From April the entries are made till the cow dries-off or till the total milk production of lactation completed, if not, the total milk production of lactation is carried over a new register next year. Lactation day are also shown at the bottom. This register gives information like name and number of cows, which have completed their lactation, their lactation milk yield, length of LP, length of previous dry period etc. If the cow

has calved again, this information is then entered into the history sheet of concerned cow completing the lactation.

c. Life Time Production Register (Monthly Progress Register)

This register gives the information about the milk yield of the individual cow from first calving till death or sale. That is the performance of entire productive life of each cow is available from this register. Annual milk production each year and also the progressive annual average (PAA) are calculated from this information. The PAA figure indicates the upward and downward trend in the productive efficiency of the cow. This figure can be used in taking decision for culling or retaining the animal.

d. History Sheet

This register gives overall milk productive capacity of the cow. One page is allotted to each heifer on calving. At that time all details of their parentage/pedigree, breeding, description of phenotype, birth date, date of calving, age of first calving etc. are entered on the upper part of the page. Relevant information about service, date of calving, calf born, sex of calf etc. are entered in the lower part in respective columns. On completion of lactation, lactation milk yield, milk yield of first 300 days, lactation period, dry period, gestation period etc are entered and the average are calculated. The average daily milk production from first to latest calving is a good indicator of the increase or decrease in overall efficiency of the animal to produce milk and to reproduce, from the lactation to lactation.

4. Register Pertaining to Reproduction

It includes Cattle yard report, Service book, Service ledger and History sheet.

a. Cattle yard Report

Some details are already given under group 1 register. This gives information like cows and heifer coming in heat, date of heat, date of service, (natural or artificial) name and number of sire/bull used etc. These entries should be made promptly. Otherwise calves with unknown sire will be born. These entries of the service are transferred into service book later on. Finding of rectal palpation of repeat breeders, pregnancy diagnosis etc from this register are transferred to service ledger.

b. Service Book

This is maintained monthly. Service to heifers and cows are written in this register from cattle yard report. This is useful in making the list of cows/heifers due for pregnancy diagnosis. Similarly, list of advanced pregnant animals and the list of animals expected to calve in current month are made from this register.

Service book				
Month.....Year.....				
Date	Name and No of Cows/ Buffalo	Name and No of bull /Buffalo bull	Natural services of AI	Remarks

c. Service Ledger

This register gives the information of near past history and current state of reproduction of each breedable female in the herd. The list of examination of repeat breeder and anoestrus animals can be prepared from this register.

Sr. No.	Service ledger (Classified/individual service register)							
	Name and No. of Heifer/Cow	Date of Calving	Service Records (Dates of AI/PD)					
			1st	2nd	3rd	4th	5th	Remark

d. History Sheet

It gives information about overall reproductive efficiency of each cow e.g. age at first calving, length of dry period, calving interval for all lactation etc. of individual cow.

Questions:

Q.1. What is the importance of maintaining dairy farm records?

Q.2. Write the importance of castration and docking along with the methods to perform them.

Q.3. Define: Wet Average and Herd Average.

Q.4. Define: Service Book and Service Ledger.

Q.5. How breed classification is important in management of livestock?

EXERCISE- 5

JUDGING OF DAIRY CATTLE/BUFFALO BY OUTWARD APPEARANCE AND SCORE CARD METHOD

Good seed stock is necessary/essential of profitable farming. It is well established that fertilizer application given to high yielding variety gives more production and profit than the low yielding variety. The same principle applies to dairy farming too.

Importance:

Dairy animals are kept/maintained by the people for the production of milk and young ones. The cows vary in their milk production capacity because of several factors: the most important ones are heredity or genetic makeup of animals and their feeding practice followed on the farm. It is not difficult to discover the individual cow production at least one and a half to two times the amount of milk and butter fat as compared to other cows in the same herd with same feed. It therefore requires a good judgment in selecting better cows and culling out the unproductive, aged, defective or infertile animals from the herd (called culling) to improve the overall performance of the herd. Culling and selection both requires careful judging of the animal.

Pedigree and production records are the best for selection of the animal. But such records are available only on a few organized dairy farms in our country. Therefore selection of dairy cows/buffaloes is largely done based on their general physical/outward appearance.

Physical or Phenotypic Selection

It has been found that in dairy animals certain physical characters are associated with high production e.g. wedge shape body, large capacious udder, thin skin, slender neck etc. By understanding these characters, it may be possible to judge the production capacity of individual cow, when pedigree and performance records are not available.

In USA, there are six breed associations for major breed of cattle, viz. HF, Jersey, Guernsey, Brown Swiss, Ayrshire and Milking short horn. They have developed a system of classifying individual cows on the basis of their physical appearance (type) within the breed. The animals are rated according to the standard score card by giving marks to different phenotypic characters and are placed in one of the following categories according to the total scores obtained.

Sr. No.	Class	Rated Score Points
1	Excellent	90 and above
2	Very Good	85 to 90
3	Good Plus(Desirable	80 to 85
4	Good (acceptable)	75 to 80
5	Fair	65 to 75
6	Poor	Under 65

Selection/Judging of Dairy Cows

There are 4 basic or fundamental lessons/principles or pre-requisites, which must be mastered by a person to become reasonably proficient cattle, judge viz.

1. He must have knowledge of the ideal cow and a clear mental picture about its conformation that can be compared with other dairy cows under selection.
2. He must learn/know the relative importance of different body parts of a cow and their relationship with milk production.
3. He must learn to evaluate good and bad points of each animal and to make allowance or deductions depending upon its closeness to the ideal cow.
4. He must learn to balance the goodness and lacunae of a cow under selection against the rest of the cows in the herd or group for appropriate ranking.

Criteria for Judging

While selecting a dairy cow, we have to carefully observe and analyze the animal giving major consideration to the following four factors. We should give only the deserving marks/points against the maximum assigned to each factor.

General Appearance	30 points
Dairy Characters	20 points
Body Capacity	20 points
Mammary system	30 points
Total	100 Points

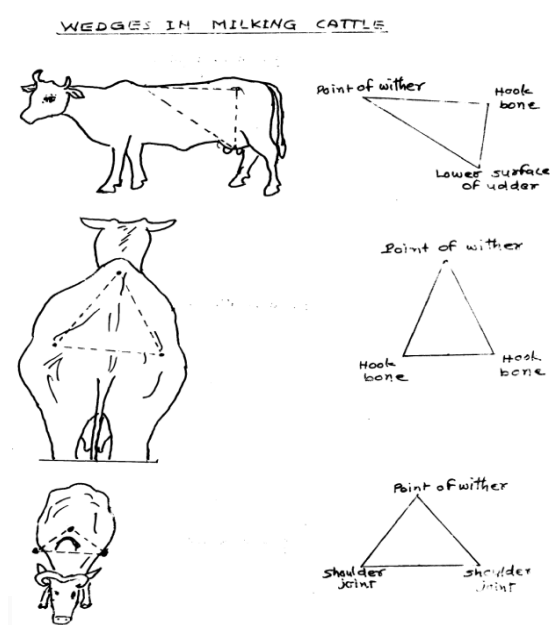
1. General Appearance: The cow should be true to the breed characters with angular body. It should have good size, style, graceful walk and attractive look. It should have clear cut head. Large muzzle and bright eyes that is prominent and spaced wide apart. The shoulder blades should be smoothly set into sharp withers. The top line (from the Point of wither to the root of tail) should be well levelled. Good feet and legs are important in selection dairy cows. The legs/feet should be squarely set and wide apart. The hind shanks should be flat a moderate in size. The pasterns should be springy and not weak or too straight. The hind legs should be perpendicular from hock to pastern. Cows with weak

back, sloppy rump and high tail head are undesirable and should be rejected. Similarly the cows with sickle hock or crooked legs are also not good as such lumpy legs become worst with age.

The body of the dairy cow should be of an angular shape as viewed from front, side and top. The angularity of body is referred to as wedges. In dairy type cows, the wedges are as follows.

(A) Front wedge (B) Side wedge (C) Top wedge

(A) Front wedge: It is a triangle, formed by joining the point of wither with the floor of the chest along with the shoulders. Broader the base, better it is. Broad base of the triangle shows that the vital organs like heart and lungs are well developed. If these organs are



well developed the cow has sound health to produce more milk.

(B) Side wedge: This wedge is formed by joining the point of wither, hook-bone and lower surface of the udder. If we consider the line joining hook-bone and lower surface of udder as base and if it is broad, it indicates that mammary system is well developed, indicating higher production of milk.

(C) Top wedge: It is formed by joining two hook-bones with the point of wither. The line joining two hook-bones will be the base. Broad base indicates more space for the development of digestive system. More capacious the digestive system, the milk production will be more.

2. Dairy Characters: Dairy characters are usually related with high milk production. Cows with good dairy characters have angular wedge shaped body (prominent bones and joints because of lesser fleshy and fattiness) and long lean neck, which bends smoothly at withers. These are also reflected by sharpness of withers and spacing of ribs. The ribs should be wide apart, flat, long and well sprang in animals with excellent dairy characters. A dairy cow should have deep, arched and refined flanks indicative of plenty of room for digestive organs. Such animals can consume and digest large quantity of feed. A thin mellow, medium, loose pliable skin and smooth glossy hair coat is also a very good indicator of dairy character. The thighs of high producing cows are usually incurving to flat from the side and wide apart from the rear. Fleshy brisket, short thick neck and coarseness of body are associated with beef characters. Beef cow are blocky rather than angular in shape. Similarly, coarse flat top shoulders are related with the beefiness. Cows with shallow flank have poor/lower capacity to consume large amount of feed.

3. Body Capacity: A dairy cow must consume large quantity of feed (grains, roughness and pasture grass) in order to be heavy milk producer. She must have sufficient room in the body to handle these bulky feeds. Body capacity is usually determined from the size of the barrel (belly, girth) and by heart girth. Larger heart girth i.e. width and depth of the chest are necessary to provide greater room for the heart and lungs. Long well sprung ribs and wide chest between the forelegs are desired in dairy animals. Similarly, longer deep belly gives more room (space) for digestive organs.

4. Mammary System: The udder is a business end of the dairy cow. A good cow must have large capacious good udder. The length, width and depth of udder determine its capacity. The udder should be attached high and wide on the rear (backside) and should be carried well forward in front. It should blend smoothly with the body. There should be no tendency for the udder to break away from the body, either in front or rear, because of loose ligament (attachment). An udder lacking firm attachment with the body is known as broken udder. Broken udder is getting worst with the advancement of the age. Deep swinging/pendulous udders are hard to milk and are easily injured. The udder should have soft and pliable texture. There should not be any excess hair on, and any flesh fat or nodular growth inside. Ideally the udder of dairy cows should be bowl or cup shaped. The round and tight, goaty or broken up udder are not desirable. The floor/bottom of the udder should be levelled. The four quarter of udder should be of equal size and blend smoothly to each other. The udder with deep crevices between the quarters is known as badly quartered udder.

All four teats should be uniform in size wide apart and squarely/evenly placed. Closeness of any two teats indicates poor development of quarters. Teats should be moderate in size and cylindrical in shape. Blend teats or supernumerary teats are not desired. Too large or too small teats are difficult to milk. Teats should not be pear shaped, bottle shaped or funnel shaped. The mammary

veins/milk veins should be large prominent and tortuous, which indicate better functioning of udder tissues towards greater synthesis of milk.

UNIFIED SCORE CARD FOR JUDGING HEIFER/COW

Breed characteristic should be considered in application of the score card

Particulars/Points to be considered for scoring	Perfect score	Name/No. of Heifer/Cow				
1.General Appearance/Breed Characteristic	30					
Attractive individually with femininity, vigor, stretch, harmonious blending of all parts, and compressive style and carriage. All parts of a cow should be considered in evaluating cow's general appearance. Head Clean-cut proportionate to body, broad muzzle with large open nostrils, strong jaws, large bright eyes, forehead broad and moderately dished, bridge of nose straight, ears medium size and alertly carried. Body Shoulder blades: Sharp set smoothly and tightly against the body. Back: Straight and strong, broad and nearly level Rump: Long wide and nearly level from hook bones to pin bones, clean cuts and free from patchiness. Thurls: High and wide apart. Tail and Head: Set level with backline and free from coarseness. Tail: Slender. Legs and feet Bone flat and strong, pasterns short and strong hocks, cleanly molded. Feet: Short compact and well rounded with deep heel and levelled sole. Fore Legs: Medium in length, straight wide apart and squarely placed. Hind Legs: Nearly perpendicular from hock to pastern from the side view and straight from the rear view.						
2. Dairy Characters: Evidence of milking ability, angularity and general openness without weakness freedom and general coarseness giving due regard to period of lactation. Neck: Long lean and blending smoothly into shoulder, clean cut throat dewlap and brisket.	20					

Wister: Sharp. Ribs: Wide apart rib bone wide flat and long Flanks: Deep and refined. Thighs: Incurving to flat and wide apart from the rear view, providing ample for the udder and its rear attachment. Skin: Loose and pliable.						
3. Body Capacity: Relatively large in proportion to size of animal, providing ample capacity, strength and vigor. Barrel: Strongly supported, long and deep, ribs highly strong and wide, depth and width of barrel tendency to increase towards rear. Heart Girth: Large and deep, with well sprung fore ribs, blending into the shoulders, full at elbows, wide chest floor.	20					
4. Mammary System: A strongly attached, well balanced, capacious udder of fine texture indicating heavy production and a long period of usefulness. Udder: Teats and mammary veins symmetrical, moderately long, wide and deep, strongly attached, showing moderate average between halves, no quartering on sides, soft pliable and well collapsed after milking, quarters evenly balanced. Teats: Uniform size of medium length and diameter, cylindrical squarely placed under each quarter. Plumb and well spaced from side and rear views. Milk Vein: Very prominent large, tortuous extending from udder to well ahead up to chest.	30					
Total Score	100					
Order of Rank of the animals assessed						

BODY CONFORMATION OF SHEEP:

- Head: It is comprises of horns, ears, face, eyes, nostrils, mouth and lips. Head carried well above the shoulders and kept raised, gives majestic appearance to the animal. It must be feminine in a ewe and masculine in a ram. Head with open face is desirable. Both the jaw should be even and the teeth of lower jaw should meet the dental pad near its extremity. No teeth should be missing.
- Neck: It should be of moderate length, without too many neck folds and wrinkles.
- Body: Fine wool sheep has angular body, whereas, mutton type sheep looks more blocky, compact and low-set appearance. However, it should have broad and deep chest. The brisket must be prominent. The ribs should be well sprung and the back reasonably level. The tail should be well set. Drooping rumps are objectionable. The quarters (limbs) should have

proper length and should be full down to the hocks. The legs should set well on the body and spaced well apart. Crooked or sickle shaped hocks are undesirable. The hoof should not be over grown. The genital organs in rams and the mammary glands in ewes give some indication of their reproductive and/or nursing ability. The body should be well covered with fleece. The wool should be bright in colour without too much dirt and grease. Sheep must have wool of good quality, length and optimum density. The general appearance of an animal must be impressive and should look impressive.

The distinctive characters of wool type and mutton type sheep are:-

Wool type sheep	Mutton type sheep
1. They have angular body conformation.	1. They are blocky, compact and barrel in shape.
2. They have heavy, dense fleece. Fibre length - 5 to 7 cm and fibre diameter 17 to 22 micron.	2. They have light fleece. Wool fibre length - 4 to 5cms and fibre diameter 23 to 33 micron.
3. They have relatively lesser growth rate.	3. They reach maturity earlier as they have faster growth rate.
4. They have strong flocking instinct. E.g. Merino, Rambouillet.	4. They produce more lambs in a year. E.g. Dorset, Southdown, Suffolk.

BODY CONFORMATION OF DAIRY TYPE GOAT:

- Head should be long and of moderate width.
- Neck and shoulder—the neck should be long and sloppy and good depth.
- Chest- should be moderately deep and good width giving the appearance of strength.
- Fore-legs should be straight, strong and possess good bone.
- Foot- the animal should stand well its legs without the tendency to turn walks on heels.
- Body- good depth is an important feature the back should be level from the shoulder to the hips and then drop slightly at the tail region.
- Ribs- should be well sprung to give a barrel effect. Large barrel indicates capacity to take more feed.
- Bones should give the appearance of strength with the hocks slightly bent.
- Udder and teats should be carried well under the body and should be large and proportional to sized of the body. It should undergo considerable shrinkage after milking. The teats should be considerably apart of moderate length and of suitable sized to be conveniently held in hand during milking.
- Milk veins should be well developed.

Questions:

Q.1. What is the importance of judging of dairy cattle?

Q.2. What are the pre-requisites/basic principles of judging of dairy cows?

Q.3. What are the different objectives of judging of dairy cattle?

Q.4. Point out the important dairy character of a milch cow.

Q.5. What are the different indicators of body capacity of a cow?

Q.6. Define angularity of body, mention the different wedges of a dairy cattle.

Q.7. Mention the important points about body conformation of sheep and goat.

EXERCISE- 6

CULLING OF LIVESTOCK

Culling is elimination or weeding out of undesirable animals from the herd, for reasons of uneconomic, poor production, or very poor reproductive ability, with sterility problems and breeding, irregularities, very poor conditions, stunted growth, suffering from incurable illness, or disease animals found to be positive for serious infectious diseases like Tuberculosis, Johne's disease, Brucellosis, lost one or more quarters and teats of the udder due to chronic mastitis resulting in marked reduction in milk production.

Undesirable breed characters present in young animal. When the herd is a pure bred herd leading to disqualifications of family lines, exhibiting heritable characters like supernumerary teats, loose horns in cows of certain breeds. Disable animals due to injury or loss of organ, extreme lameness leading to unmentionable conditions, unhealed fractured animals etc. come under the animal proposed for culling. The culled animals carry lower values and a separate list is made for such culled animals and it is known as culling list. When the culling cows for poor production, the entire lactation at yield is considered and preferably first two lactations are observed and if the lactation yield is less than what is expected from the breed or herd, the animal is included in the culling list. Very old animals are culled, as their maintenance will be uneconomical.

Male animals or other animals surplus in the farm or not useful in the farm and they are culled. Calves born with congenital defects like congenital fibrosis of the eye, total blindness or some other defects are included in the culling. Calves born much below the normal birth weight are included in the culling. Yearlings animals male or females, stunted much below their normal body weight, potbellied conditions, and bad conformation are culled. Dairy animal management valuation and culling is done on the farms every year at least once in year. In some farms culling is done twice a year however doing it once a year is must.

Cull in This Order Until You Reach Your Desired Herd Size

Disposition: Some producers can tolerate more disposition problems than others. Disposition should be evaluated both in the pasture and in the pen because some cattle will react differently once corralled. Make a note of those animals that make it difficult to gather the herd or rotate pastures. Any animal that is aggressive should make the list.

Open Females: All open females should be culled. It will be very difficult for an open cow to make up for a year of lost production. In addition, if a heifer does not settle in the same period as her contemporaries, she is telling you that she does not fit your management environment.

Structural Soundness: Evaluate the structural soundness of each cow based on her ability to raise a calf. Anything that limits her ability should be noted. Look for bad feet or toes, a history of prolapse, eye problems and poor udder conformation, including bad quarters and big teats.

Age: Typically, a cow is most productive between the ages of 4 and 9. The condition of a cow's teeth is indicative of her age. A cow with broken or missing teeth should probably be culled. Those with badly worn or separated teeth would be next on the list. At this point, it becomes increasingly difficult to make culling decisions because you will have to cull productive animals.

Bred Cows Older than 9 Years of Age: These cows will likely be culled in the near future and are close to the end of their most productive years. Within this group, cull the thin cows first.

Replacement Heifers: First, cull yearling heifers that have not been exposed to a bull. These animals have very good value as feeder heifers. Bred heifers would be next in the culling order.

Phenotype: Use this as an opportunity to make your herd more uniform. Any cow that does not fit due to breed, size or low productivity should be culled next.

Bred Cows 3 to 9 Years of Age: These are your most productive cows. If you must cull out of this group, 3-year-olds and those cows that are 8 to 9 years old would go first. The decision about which animals to cull can be difficult. Each operation will have different goals and, therefore, may need to adjust accordingly. Use this list as a guideline for developing a culling order for your herd.

Culling in Dairy Animals 10 points:

1. Do not move non-ambulatory animals to market under any circumstances.
2. Make the decision to treat, to cull, or to euthanize animals promptly. Sick and injured animals should be segregated from the herd.
3. Delay transport of an animal that appears to be exhausted or dehydrated until the animal is rested, fed, and rehydrated.
4. Milk all cows that are still lactating just prior to transporting to a packing or processing facility.
5. Use a transportation company that is knowledgeable about your animal care expectations and provides for the safety and comfort of the animals during transport.
6. Do not transport animals to a packing or processing facility until all proper treatment withdrawal times have been followed.
7. Do not transport animals with a poor body condition, generally a Body Condition Score of less than 2 (1-5 scale).
8. Do not transport animals that require mechanical assistance to rise and are reluctant or unable to walk, except for veterinary treatment. When using any handling device, abuse must not be tolerated.
9. Do not transport animals with bone fractures of the limbs or injuries to the spine. Animals with a recent fracture unrelated to mobility should be culled and transported directly to a packing or processing facility.
10. Do not transport animals with conditions that will not pass pre-slaughter inspection at a packing or processing facility. If unsure, consult with your veterinarian before transporting an animal to a packing or processing facility.

Questions:

Q.1. What are the objectives of culling?

Q.2. Mention the factors which affect the culling.

EXERCISE- 7

PLANNING AND LAYOUT OF HOUSING FOR DIFFERENT TYPES OF LIVESTOCK

HOUSING FOR DAIRY CATTLE

An efficient management of cattle will be incomplete without a well planned and adequate housing of cattle. Improper planning in the arrangement of animal housing may result in additional labour charges and that curtail the profit of the owner. During erection of a house for dairy cattle, care should be taken to provide comfortable accommodation for individual cattle.

Livestock is provided housing for following purposes/objectives:

- To protect the animals from adverse climatic conditions, predators and theft
- To provide clean and comfortable shelter
- To improve productive and reproductive efficiency
- To ensure proper feeding and management

Location of Dairy Farm Buildings:

The points which should be considered before the erection of dairy buildings are as follows.

1. Topography and Drainage

A dairy building should be at a higher elevation than the surrounding ground to offer a good slope for rainfall and drainage for the wastes of the dairy to avoid stagnation within. A levelled area requires less site preparation and thus lesser cost of building. Low lands and depressions and proximity to places of bad odour should be avoided.

2. Soil Type

Fertile soil should be spared for cultivation. Foundation soils as far as possible should not be too dehydrated or desiccated. Such a soil is susceptible to considerable swelling during rainy season and exhibit numerous cracks and fissures.

3. Exposure to the Sun and Protection from Wind

A dairy building 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. Buildings should be placed so that direct sunlight can reach the platforms, gutters and mangers in the cattle shed. As far as possible, the long axis of the dairy barns should be set in the north-south direction to have the maximum benefit of the sun.

4. Accessibility

Easy accessibility to the buildings is always desirable. Situation of a cattle shed by the side of the main road preferably at a distance of about 100 meters should be aimed at.

5. Durability and Attractiveness

It is always attractive when the buildings open up to a scenic view and add to the grandeur of the scenery. Along with this, durability of the structure is obviously an important criterion in building a dairy.

6. Water Supply

Abundant supply of fresh, clean and soft water should be available at a cheap rate.

7. Surroundings

Areas infested with wild animals and dacoits should be avoided. Narrow gates, high manger curbs, loose hinges, protruding nails, smooth finished floor in the areas where the cows move and other such hazards should be eliminated.

8. Labour

Honest, economic and regular supply of labour is available.

9. Marketing

Dairy buildings should only be in those areas from where the owner can sell his products profitably and regularly. He should be in a position to satisfy the needs of the farm within no time and at reasonable price.

10. Electricity

Electricity is the most important sanitary method of lighting a dairy. Since a modern dairy always handles electric equipments which are also economical, it is desirable to have an adequate supply of electricity.

11. Facilities, Labour and Food

Cattle yards should be so constructed and situated in relation to feed storages, hay stacks, silo and manure pits as to effect the most efficient utilization of labour. Sufficient space per cow and well arranged feeding mangers and resting are contribute not only to greater milk yield of cows and make the work of the operator easier also minimizes feed expenses. The relative position of the feed stores should be quite adjacent to the cattle barn.

Noteworthy features of feed stores are given:

- Feed storages should be located at hand near the center of the cow barn.
- Milk-house should be located almost at the center of the barn.
- Centre cross-alley should be well designed with reference to feed storage, the stall area and the milk house.

DAIRY CATTLE HOUSING:

Loose Housing System:-Loose housing may be defined as a system where animals are kept loose except milking and at the time of treatment. The animals are provided with a shed for feeding, watering and shelter during extreme climate. This system is more economical. The system consists of various units for successfully layout as follows: The entire shed is surrounded by boundary wall of 5 feet height. On one side of house, there is provision of feeding area under covered shed having 2-2 ½ feet of feeding space per cow. A common water tank is providing on one side of house. Concentrates are fed at the time of milking in hopper bins, where cow stands in stanchion in milking area. The paved area is a place of house where she gets fresh air and sunshine (100-150 square feet/cow). A box stall or calving box of 10'x10' or 12'x18' should be provided for calving and sick animals (1 per 15 animals). A calf pen of 10'x10' will be sufficient for 4 calves.

There should be a provision of weight bridge, platform balance for weighing animals and bull pen 12'x18' for housing and feeding a bull. There should be a manure pit located away from barn. In nut shell, the loose house should have facility for feeding, watering, milking, rest, calving box, calf pen and sick animal box.

Advantage of Loose Housing:

- It is economical as the cost of construction is significantly lower than conventional type.
- Animals get enough exercise and feel more comfort.
- Facilitates easy detection of animals in heat.
- Possibility to make further expansion without much change.

Disadvantage of Loose Housing:

- More space (10-20% extra) is required than conventional type of housing.
- Individual feeding attention is not possible.
- Herd cannot be displayed easily.
- The animal in heat is disturbed by fellow animals.

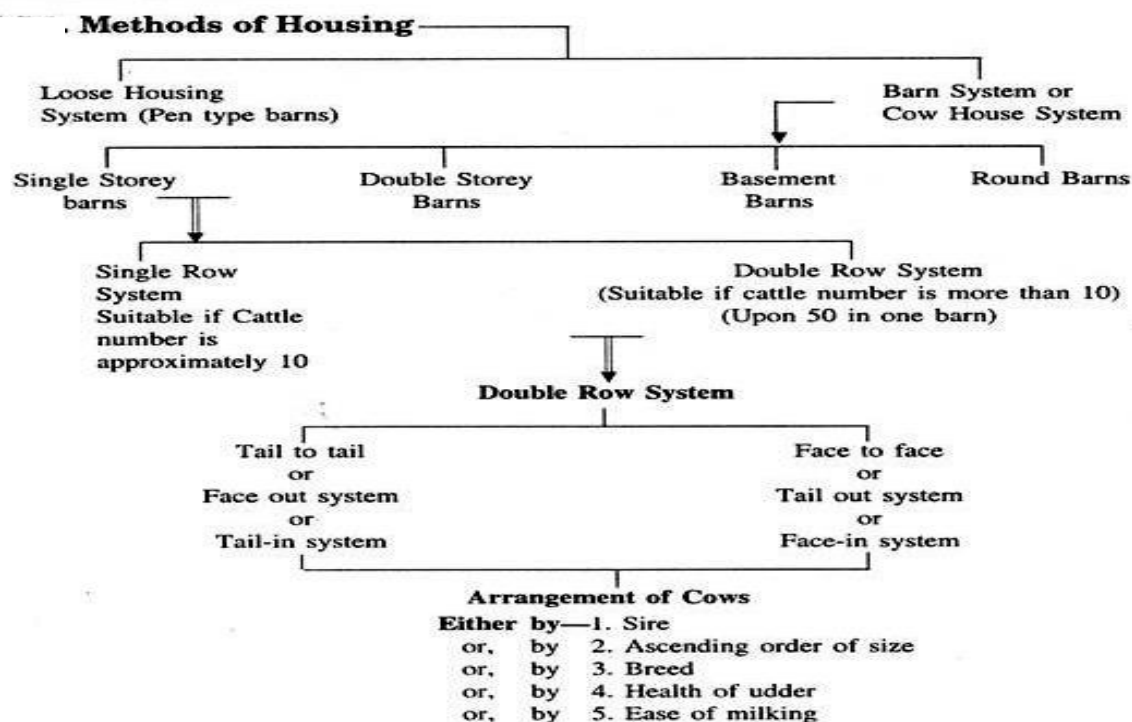


(Cattle Shed)

Conventional Housing System: - They are standard stalls with facilities for feeding, watering and housing of individual animals. The conventional dairy barns are comparatively costly but animals are more protected from adverse climatic conditions. In this system, cow sheds can be arranged in a 'single row' (if cattle number is more than 10 or up to 50). In double row system, the cows can either be faced in (face to face system) or faced out (tail to tail system). The system consists of various units for successful layout for proper housing of different classes of dairy cattle and buffaloes on the farm.

Cow Sheds:

Cow sheds can be arranged in a single row if the numbers of cows are small. Say less than 10 or in a double row if the herd is a large one. Ordinarily, not more than 80 to 100 cows should be placed in one building. In double row housing, the stable should be so arranged that the cows face out (tail to tail system) or face in (head to head system) as preferred.



Advantages of Tail to Tail System:

- Under the average conditions, 125 to 150 man hours of labour are required per cow per year. Study of time: Time motion studies in dairies showed that 40% of the expended time is spent in front of the cow, and 25% in other parts of the barn and the milk house, and 60% of the time is spent behind the cows. Time spent at the back of the cows is 4 times more than the time spent in front of them.
- In cleaning and milking the cows, the wide middle alley is of great advantage.
- Lesser danger of spread of diseases from animal to animal.
- Cows can always get more fresh air from outside.
- The head gowala can inspect a greater number of milkmen while milking. This is possible because milkmen will be milking on both sides of the gowala.
- Any sort of minor disease or any change in the hind quarters of the animals can be detected quickly and even automatically.



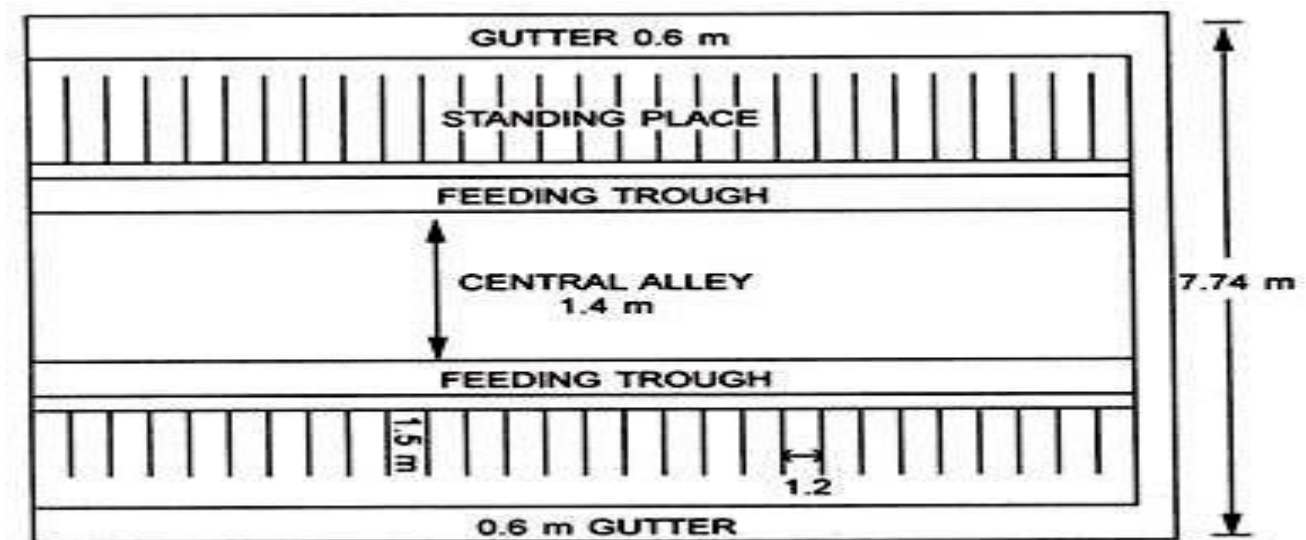
Tail to Tail System

Advantages of Face to Face System:

- Cows make a better showing for visitors when heads are together.
- The cows feel easier to get into their stalls.
- Sun rays shine in the gutter where they are needed most.
- Feeding of cows is easier; both rows can be fed without back tracking.
- It is better for narrow barns.



Face to Face System



Top View of Face to Face System/Barn

Floor:

The inside floor of the barn should be of some impervious material which can be easily kept clean and dry and is not slippery. Paving with bricks can also serve ones purpose. Grooved cement concrete floor is still better. The surface of the cow shed should be laid with a gradient of 1" to 14" from manger to excreta channel. An overall floor space of 65 to 70 sq.ft. per adult cow should be satisfactory.

Walls:

The inside of the walls should have a smooth hard finish of cement, which will not allow any lodgement of dust and moisture. Corners should be round. For plains, dwarf walls about 4 to 5 feet in height and roofs supported by masonry work or iron pillars will be best or more suitable. The open space in between supporting pillars will serve for light and air circulation.

Roof:

Roof of the barn may be of asbestos sheet or tiles. Corrugated iron sheets have the disadvantage of making extreme fluctuations in the inside temperature of the barn in different seasons. However, iron sheets with aluminium painted tops to reflect sunrays and bottoms provided with wooden insulated ceilings can also achieve the objective. A height of 8 feet at the sides and 15 feet at the ridge will be

sufficient to give the necessary air space to the cows. An adult cow requires at least about 800 cubic feet of air space under tropical conditions. To make ventilation more effective continuous ridge ventilation is considered most desirable.

Manger:

Cement concrete continuous manger with removable partitions is the best from the point of view of durability and cleanliness. A height of 1'-4" for a high front manger and 6" to 9" for a low front manger is considered sufficient. Low front mangers are more comfortable for cattle but high front mangers prevent feed wastage. The height at the back of the manger should be kept at 2'-6" to 3". An overall width of 2' to 2 1/2' is sufficient for a good manger.

Alleys:

The central walk should have a width of 5'-6' exclusive of gutters when cows face out, and 4'-5' when they face in. The feed alley, in case of a face out system should be 4' wide, and the central walk should show a slope of 1" from the center towards the two gutters running parallel to each other, thus forming a crown at the center.

Manure Gutter:

The manure gutter should be wide enough to hold all dung without getting blocked, and be easy to clean. Suitable dimensions are 2" width with a cross-fall of 1" away from standing. The gutter should have a gradient of 1" for every 10' length. This will permit a free flow of liquid excreta.

Doors:

The doors of a single range cow shed should be 5 feet wide with a height of 7 feet and for double row shed the width should not be less than 8 to 9 feet. All doors of the barn should lie flat against the external wall when fully open.

Calving Boxes:

Allowing cows to calve in the milking cow shed is highly undesirable and objectionable. It leads to insanitary in milk production and spread of disease like contagious abortion in the herd. Special accommodation in the form of loose-boxes enclosed from all sides with a door should be furnished to all parturient cows. It should have an area of about 100 to 150 sq.ft. with ample soft bedding, it should be provided with sufficient ventilation through windows and ridge vent.

Isolation Boxes:

Animals suffering from infectious disease must be segregated soon from the rest of the herd. Loose boxes of about 150 sq.ft are very suitable for this purpose. They should be situated at some distance from the other barns. Every isolation box should be self contained and should have separate connection to the drainage disposal system.

Sheds for Young Stocks:

Calves should never be accommodated with adults in the cow shed. The calf house must have provision for daylight ventilation and proper drainage. Damp and ill-drained floors cause respiratory trouble in calves to which they are susceptible. As far as possible the shed for the young calves should be quite close to the cow shed. Each calf shed should have an open paddock or exercise yard. An area of 100 square feet per head for a stock of 10 calves and an increase of 50 square feet for every additional calf will make a good paddock. It is useful to classify the calves below one year into

three age groups, viz., calves below the age of 3 months, 3-6 months old calves and those over 6 months for a better allocation of the resting area. An overall covered space of:

1. 20-25 square feet per calf below the age of 3 months,
2. 25 -30 square feet per calf from the age of 3-6 months,
3. 30-40 square feet per calf from the age of 6-12 months and over, and
4. 40-45 square feet for every calf above one year, should be made available for the sheltering.

A suitable interior lay-out of a calf shed will be to arrange the standing space along each side of a 4 feet wide central passage having a shallow gutter along its length on both sides.

Provision of water troughs inside each calf shed and exercise yard should never be neglected.

Bull or Bullock Shed:

Safety and ease in handling a comfortable shed protection from weather and a provision for exercise are the key points while planning accommodation for bulls or bullocks. A bull should never be kept in confinement particularly on hard floors. Such a confinement without adequate exercise leads to overgrowth of the hoofs creating difficulty in mounting and loss in the breeding power of the bull. A loose box with rough cement concrete floor about 15' by 10' in dimensions having an adequate arrangement of light and ventilation and an entrance 4' in width and 7' in height will make a comfortable housing for a bull. The shed should have a manger and a water trough.

If possible, the arrangement should be such that water and feed can be served without actually entering the bull house. The bull should have a free access to an exercise yard provided with a strong fence or a boundary wall of about 2' in height, i.e., too high for the bull to jump over. From the bull yard, the bull should be able to view the other animals of the herd so that it does not feel isolated. The exercise yard should also communicate with a service crate via a swing gate which saves the use of an attendant to bring the bull to the service crate.

Floor Space Requirement for Cattle and Buffalo:

Type of animals	Floor space required (sq. met/animal)		Max. no. of animal/pen	Height of shed (cm)
	Covered area	Open paddock		
Bulls	12.0	120.0	1	175 in medium and heavy rainfall area and 220 in semi arid and arid areas
Cows	3.5	7.0	50	
Buffaloes	4.0	8.0	50	
Down calvers	12.0	12.0	1	
Young calves	1.0	2.0	30	
Older calves	2.0	4.0	30	

HOUSING FOR SHEEP AND GOAT

Normally, sheep and goat do not require elaborate housing facilities but minimum provision will definitely increase productivity by protecting the animals against bad weather conditions. Shed should be provided with gunny bags or thatching material and bamboos. The roof of shed should be made up of asbestos sheet and supported by angle iron.

Generally, loose housing is practiced which is having following sheds:

- General flock shed
- Shed for rams/bucks
- Lambing/kidding shed
- Lamb shed/kid shed
- Sick animal shed

HOUSING FOR SHEEP:

The sheep should be protected from adverse climatic conditions particularly during winter and rainy weather. The sheep barn should be located on dry, well drained site with yard space and paved area adjacent to it. A floor space of 12 square feet/ewe is sufficient in barn having the facility for feeding and watering. The feeding pasture should be fenced to protect the sheep from dogs and predators. Feed racks may be placed in zigzag fashion along the fence. The hay racks 16' long and 2 ½' to 3' height with 8" opening at about 1' from the bottom are sufficient for a flock of 40 ewes. The grains are fed from separate trough which may be of 10"x12"x4" in size and may be kept at about 8-10" from the ground. A watering trough of similar size may also be constructed.

For lambs, a 12' long water tank equipped with float valve may be constructed. Dipping vat made up of cement concrete with a size of 16' x 4' x 10'-12' inside width at bottom and 20-24' inside width at top is sufficient. The top of vat should be 8-12' above the ground level. The inclined ladder and a ramp for exit of sheep should be 6'-7' long for a 3' deep vat. At the exit end, a drain platform is built.

Shearing room should be made for shearing the sheep which should be well lighted and ventilated. On either side of shearing room, there should be 2 simple fenced lofts for collection of sheep before and after shearing with a passage of 1.5' width leading to shearing room should also be there. There should be provision for sheds for breeding rams and lambs and an isolation box for sick animal. A lambing pen for pregnant ewe should be provided for safe lambing. Other accessory units like store for wool, feed and fodder, farm equipments, clinic, etc. should also be provided.

Sheep house should have the following sheds and facilities:

1	Sheep barn/general flock shed	6	Stores	11	Grain trough
2	Ram shed	7	Shearing room	12	Watering tank
3	Lambing shed	8	Feed racks	13	Dipping vat
4	Lamb shed	9	Loft/yard		
5	Isolation box	10	Grazing pasture area		

HOUSING FOR GOAT:

Goat housing is somewhat similar to sheep housing. In close housing pen an area of 1.80 square meter per animal with feeding and watering trough is sufficient. In open house an area of 4.5 square meter/goat is sufficient. The milch goat shed may be partitioned with brick wall, stone slab or iron tubing install for each done for individual milking and feeding. The kidding pen should be of 6'x5.5' dimensions enclosed with a fence of 4'-4.5' height. Large flocks of goats are usually kept in groups except adult male, pregnant doe, and heavy milkers which are housed individually or in small groups.

Kids may be housed in a loose box or in a large wooden box. Sufficient hay racks and watering through should be provided in every shed.

Sheds and facilities under conventional housing:

1	Doe shed	4	Kid shed	7	Milk storage room
2	Buck shed	5	Weaned sheep	8	Stores
3	Kidding shed	6	Milking shed	9	Isolation box

Floor space, feeding and watering space for sheep and goat:

Sr. No.	Types of animal	Floor space per animal (m ²)	Feeding space per animal (cm)	Watering space per animal (cm)
1.	Kid/lamb	½-1	30	3
2.	Adult female	1-1½	40	4
3.	Pregnant and lactating animals	2	50	5
4.	Adult ram	2	50	5

Feeding/watering space requirements (cm) for different categories of livestock:

Type of animal	Space per animal	Total manger length in a pen / 100 animal	Length of water trough in a pen/100 animal	Manger/water trough (cm)		
				Width	Depth	Height of inner wall
Adult cattle and buffalo	60-75	6000-7500	600-750	60	40	50
Calves	40-50	4000-5000	400-500	40	15	20
Adult sheep and goat	40-50	4000-5000	400-500	50	30	35
Lambs and kids	30-35	3000-3500	300-350	50	20	25

Questions:

Q.1. What are the objectives of housing system? What are the points you will consider while deciding the location of dairy building?

Q.2. Give the diagrammatic representation of loose housing system.

Q.3. Point out the difference between loose housing system and conventional barn system.

Q.4. What are the basic differences between housing of sheep and goat?

Q.5. Give the difference between face to face and tail to tail system of housing.

EXERCISE – 8

COMPUTATION OF RATION FOR LIVESTOCK

Objectives:

- To provide balanced ration to farm animals in view of production.
- Scientific approach for feeding of farm animals.
- To make economical use of available feed resources.

Principle:

Computation of ration includes translating the recommendations contained in feeding standards into actual formulation of feed mixture and feeding practices. In formulation of ration for ruminants DM, DCP, energy in terms of TDN, minerals and vitamin A is given consideration.

Formulation of Ration:

Ration may be defined as total allowance of the feed given to an animal during 24 hrs period to perform the various functions. The ration of animal may be divided for the sake of convenience into two parts, one for maintenance and other for production or reproduction whatever the case is. The word “balanced ration” means feeds or mixture of feeds which contain all essential nutrients in right quantity and in optimum proportion to meet the needs of the animal for maintenance and production.

Desirable Characteristics/Qualities of a Ration:

- Liberal Feeding: Dairy cows need all nutrients liberally incorporated in the ration for exploiting inherent capacity to the maximum. However, they should not be overfed, as it is wasteful and sometimes harmful.
- Individual Feeding: To obtain maximum profits, cows must be fed individually according to their production and physiological status instead of group feeding, because in group feeding, weaker or sicker animals get lesser feeds as against powerful ones.
- The ration should be well balanced for all nutrients required by animals. Excess of nutrients are wasteful. Any deficiency of nutrient affects health and production.
- Palatable Feeds: This affects feed consumption. Evil/bad smelling, mouldy, dusty, spoiled and inferior feeds are unpalatable.
- Variety of feed should be included in the ration: By combining many feeds in a ration, better and balanced mixture of proteins, vitamins and other nutrients are furnished. Moreover, variety of feeds in the ration makes it cheaper and palatable.
- The feeds used in the ration should be free from foreign materials like mould, dust, nails, toxins, gravel etc. It is better to clean them if necessary.
- The ration should be fairly laxative and not constipating. Otherwise it may lead to digestive trouble and depression of appetite/hunger.
- The ration should be fairly bulky, so that the hunger of animal is satisfied. If ration is more bulky, animal cannot eat sufficient quantity to fulfill its nutrient requirement.

- Allow much of green fodders: As they are rich in carotene, slightly laxative, more palatable and easily digestible. Feeding only green fodder may not supply sufficient dry matter for satisfying hunger.
- Avoid sudden changes in the diet: These may cause digestive troubles.
- Maintain regularity in feeding timings. Otherwise animals become restless and go down in production.
- Feed must be properly prepared/processed by chaffing, soaking, grinding, boiling, pelleting, mixing etc. These have special advantages associated with them.

Points to be Considered while Formulating the Ration:

- a. Live weight of the animal
- b. Age of the animal
- c. Condition of the animal
- d. Producing or non-producing
- e. Production level-high or low
- f. Types of the feed and fodders available

Ration for Dairy Cattle:

The computation of ration must be done in a systematic manner otherwise it will be a cumbersome exercise. The steps involved in ration formulation are:

- | | |
|-----------|---|
| Step-I | Determination of dry matter requirement. |
| Step-II | Distribution of required DM to different category of feeds. |
| Step-III | Determination of DCP and TDN requirement of animal for maintenance. |
| Step-IV | Determination of the DCP and TDN requirement for production or reproduction functions over and above the maintenance requirement. |
| Step-V | Sum up the maintenance requirement of nutrients with production/reproduction requirement. This will be total requirement of the nutrients for particular animal in a day for maintenance and production/reproduction. |
| Step-VI | Refer the chemical composition of the available feed resources to fulfill the DCP and TDN requirement as per the allocation of DM to particular feed category and at the cheapest price. |
| Step-VII | Calculate the nutrients supplied through roughage and concentrate according to DM allocation and also calculate the quantity of individual feedstuff on fresh and dry basis. |
| Step-VIII | Match the supply of nutrients with their requirement for one day. It should be exactly same or somewhat higher than the requirement but, if anyone is deficit then re-adjust the level of individual feed ingredient within the category and according to deficit nutrient. |
| Step-IX | Preparation of ration. |

Note: Mineral mixture @ 2 per cent and salt @ 1 per cent of the ration should be given to the animal.

Chemical composition of feedstuffs: The quantity of individual feedstuff in the ration can not be fixed until unless you have the idea about its chemical composition. Different principles of the

composition may be analyzed in the laboratory or may refer from the books. The composition of some common feed ingredients in terms of DCP and TDN is given below.

DCP and TDN content of some common feedstuffs

The nutritive value of some important feeds are as follows:

FEEDS	DM	DCP	TDN
Wheat straw	90	0.0	42
Bajra straw	90	0.8	48
Jowar straw	90	1.0	50
Rice straw	90	0.0	35
Berseem hay	90	9.0	60
Lucerne hay	90	14.0	50
Green bajra	30	1.0	15
Green jowar	30	0.8	16
Green maize	30	1.2	17
Green berseem	20	2.8	13
Green Lucerne	20	3.0	12
Guar	90	29	71
Moth	90	8	78
Barley grain	90	19	72
Wheat bran	90	10	62
Cotton seed cake	90	17	72
Groundnut cake	90	42	72
Til oil cake	90	30	78
Linseed cake	90	28	65
Gram	90	12	75
Guar churi	90	38	74
Moth churi	90	25	75
Gram churi	90	38	72

CALCULATION OF WATER AND FEED REQUIREMENT FOR DAIRY HERD

Objectives:

- To calculate nutrient requirement of cattle and buffaloes for maintenance in terms of DCP and TDN.
- To determine the requirement of DCP and TDN for bovines to perform various productive functions like growth, milk production, field work and pregnancy.

Introduction:

The nutrient requirements viz. DM, DCP and TDN vary with body weight, intensity of production, intensity of work, average daily gain and gestation month etc. The requirement of a particular animal for performing a specific function is compiled in tabular form which is known as feeding standard. Thus, the feeding standard may be defined as tabulated statement of the requirement of nutrients of animals for performing various body functions. Feeding standards broadly

are divided into three categories namely comparative, digestible nutrient type and production type feeding standards. There are various agencies in the world such as NRC, ARC, CNCPS, ICAR etc. which provide the information about the nutrients requirement of animal. The Indian feeding standards prepared by ICAR is basically based on the average value of Morrison feeding standard. ICAR (1985) feeding standard describe the nutrient requirement in terms of DM, DCP, TDN, Ca and P based on recommendations of scientific panel on nutrition and physiology. This standard includes recommendation based on experimental work carried out in India over the past several years. The figures given for TDN can be converted to DE and ME by taking 4.4 Mcal DE and 3.6 Mcal ME per kg TDN, respectively. The requirements for maintenance are the same for buffaloes as that for Indian cattle.

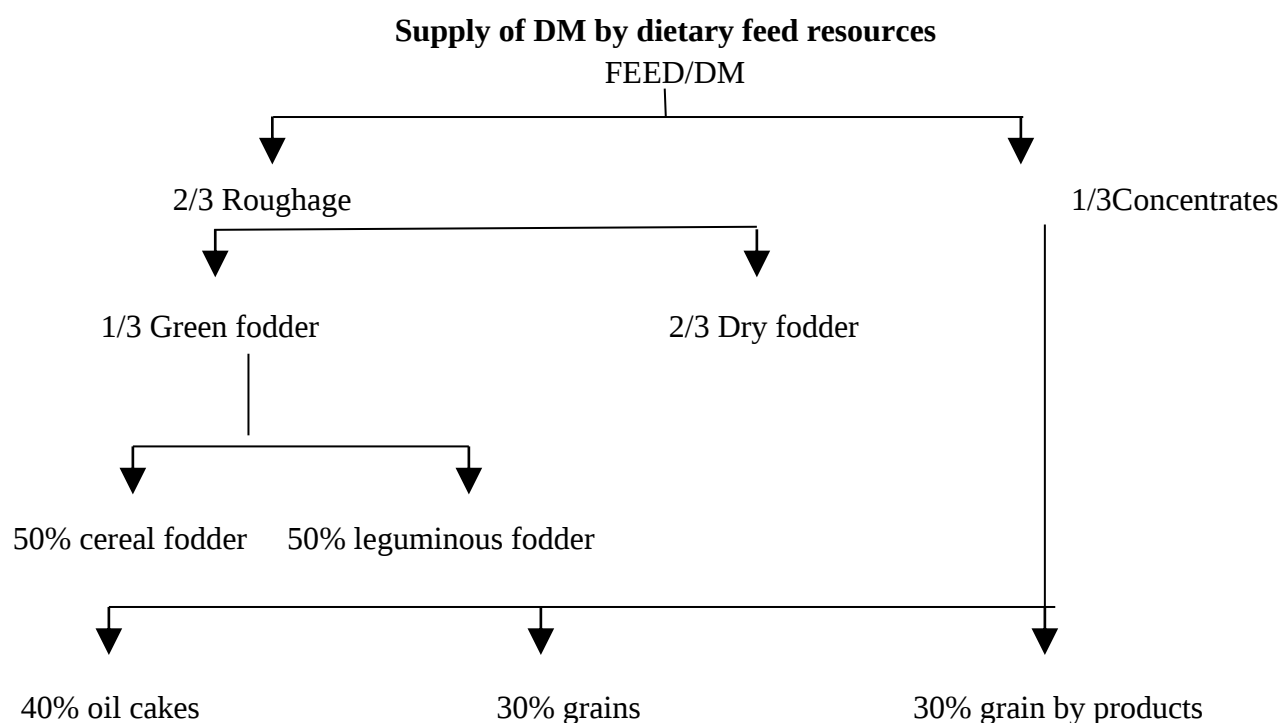
Requirement of Nutrients for Dairy Bovine:

(1) DM Requirement:

DM Requirement of different animals depends on the body weight of animal and species.

For indigenous cattle: 2.0-2.5kg/100kg BW

For cross bred cattle and buffalo: 3.0 kg/100kg BW



The DM supplied by the dietary feed ingredients will furnish the nutrients required by the animal for different body functions viz. for maintenance, milk production, pregnancy, field work etc. The requirement of DCP and TDN, which are the measures for expressing the protein and energy need of the animal, respectively, depend on the body weight and intensity of production.

a) Maintenance Requirement:

This is the minimum requirement of the nutrients for the animal to perform various vital functions of the life like respiration, circulation, transportation of nutrients, metabolism of nutrients and secretion of hormones etc. The maintenance requirement of particular animals depends on its body weight. The nutrients requirement in terms of DCP and TDN at different body weight has been compiled in the below given table.

Daily Maintenance Requirement for Various Nutrients:

B.W. (kg)	DCP (g)	TDN (kg)	Ca (g)	P (g)
250	168	2.02	6	6
300	197	2.36	7	7
350	227	2.70	8	8
400	254	3.03	9	9
450	282	3.37	10	10

b) Production Requirement: Production requirement varies animal to animal and species to species e.g. in cow and buffalo additional allowance of nutrients required to produce milk while in sheep it is for wool production and in goat for meat production. The production requirement in dairy animal get change with the level of production and not only with quantity of milk but the quality is also important specifically the fat per cent. The production requirement is given to the animal in addition to the maintenance requirement. Nutrients requirement in terms of DCP and TDN for producing 1 litre of milk with varying level of fat has been given below.

Nutrient Requirement for Milk Production:

Fat %	DCP (g)	TDN (g)
3.0	48	275
3.5	51	300
4.0	55	325
4.5	58	350
5.0	62	375
5.5	65	400
6.0	68	425

Growth: growth is a function of the nutrients, which require protein and energy in addition to the maintenance. The requirement of DCP and TDN depends on the daily gain in body weight. The table given below gives an idea about the nutrient requirement for growth at different body weight and different average daily gain.

Daily Nutrient Requirement in Terms of DCP and TDN for Growth:

B.W. (kg)	DCP (g)	TDN (g)
45	150	800
70	220	1300
100	260	1900
200	400	3000
300	470	4000

Work Allowance: The allowance for working bullocks depends on the intensity of work. The nutrient requirement describing the protein and energy requirement in the form of DCP and TDN is given in the table as under for normal working bullocks.

Daily Nutrient Requirement for Working Bullocks:

B.W. (kg)	DCP (g)	TDN (g)
200	240	2000
300	330	3100
400	450	4700
500	560	4900
600	660	5800

Pregnancy Allowance: In addition to the maintenance requirement, an additional allowance should be given to female animals during pregnancy especially in last three months for the development of foetus. Generally 140 g of DCP and 700 g of TDN daily is sufficient for the pregnant animal.

Breeding Bull: The nutrient requirement for nutrients again depends on the body weight of animal, which must be given in addition to the maintenance requirement.

Daily Allowance for Breeding Bull over and Above the Maintenance:

B.W. (kg)	DCP (g)	TDN (kg)
400	380	3.6
500	450	4.5
600	530	5.4

Questions:

Q.1. Mention the important characteristics of ration.

Q.2. Give the partitioning of dry matter requirement of a dairy animal in chart form.

Q.3. Calculate the nutrient and water requirement of an animal weighing 400 kg and giving 10 liters of milk and animal is in advanced pregnancy stage?

Q.4. Compute a balanced ration for a cow weighing 500 kg and producing 10 liters of milk/day with 5% milk fat. The feedstuffs available are wheat straw, green maize, concentrate feed and ground nut cake.

EXERCISE - 9

FORMULATION OF CONCENTRATE MIXTURE

Concentrates:

They are characterized by high nutrient density, high dry matter, less bulkiness, longer lifespan and low crude fibre. Concentrate can broadly be divided into two categories; Energy source and Protein source: Energy sources includes: different cereals and pulse grains, roots and tubers, grain by-products and mill by-products while protein sources are different oil cakes, maize gluten feed/meal, cotton seed meal, sunflower, groundnut meal, soya meal, copra meal, yeast, fish meal etc.

Compound Feeds:

- a) **Commercial Dairy Feeds:** This is produced on an industrial scale that involves the combination of many ingredients blended and mixed in proportions in accordance with dairy cattle feeding specification.
- b) **Home-Made Dairy Feeds:** These are formulations by the farmer on the farm using locally available raw materials as well as external ingredients.

Concentrates are low-fiber, high-energy feeds. They may be low, medium, or high protein. Most often they are fed to raise the energy level of the ration for dairy cattle and to compensate for any other deficiencies that remain beyond those provided by the forage portion of the ration.

1. Energy—Non-fibrous carbohydrates (NFC) and fat
2. Protein—Crude protein, degradable intake protein (DIP), soluble protein (SP), and undegradable intake protein (UIP)
3. Fiber—Neutral detergent fiber (NDF) and acid detergent fiber (ADF)
4. Macrominerals—Calcium, phosphorus, magnesium, potassium, sodium, sulphur and chloride
5. Microminerals—Manganese, copper, zinc, iron, selenium, cobalt and iodine
6. Fat-soluble vitamins—Vitamins A, D, and E

Concentrates may serve as carriers for various feed ingredients such as vitamins and minerals (macro and micro), as well as a variety of feed additives. Proper preparation and processing of grains, feed ingredients, or a concentrate mix are essential. Concentrates must be palatable to attain required levels of feed intake. Proper processing and attention to particle size are important for palatability and ruminal degradation of nutrients. Concentrates should meet nutritional and performance needs at a reasonable cost. Purchased feed, including limited amounts of forage, may represent 40 to 55% of the total expenses on farms.

Types of Concentrate Ingredients:

Concentrate ingredients can be divided into three basic groups: energy sources/cereal grains, protein sources, and by-product feeds. The feed type and the manner of preparation influence how the dairy cow uses these ingredients.

1. **Energy sources** - Cereal grains, barley, corn, milo, oats, rye, triticale, and wheat are the most common cereal grains. The general nutritive characteristics of these grains are: high in energy and low in fiber and protein. Comparable level of phosphorus when compared to forages and low in calcium. The energy that cereal grains supply comes in the form of fats, starches, and sugars.

2. Protein sources - the most commonly used protein sources come from either plant or animal origins. Using sources that are high in protein quality are essential when formulating concentrate mixtures. Protein quality refers to the types, amounts, and ratios of peptides and amino acids that are in a feedstuff. Therefore, it is recommended to feed various protein sources to animals so they receive adequate levels, both ruminally and post-ruminally, of the essential and limiting amino acids. Urea is the exception because it is not a protein supplement, but a source of nitrogen. This nitrogen is converted to ammonia, which is used by the rumen bacteria for protein synthesis. Urea works well in mixtures with plant proteins if soluble protein is needed, and it often lowers feed costs. There are numerous sources of protein supplements available to producers that can be fed to meet an animal's requirement for crude protein.

3. By-products - The most commonly used by-products are derived from cereal grains. The process used to produce the by-product feed will determine how it can be used in ration formulation(s). Some contain high levels of fat, which can make a ration more energy dense. Others may supply the diet with undegradable, degradable, or soluble protein at various levels. Some contain relatively high NDF (Neutral Detergent Fibre) content and are used to balance rations for total NDF. Some supply high levels of minerals or vitamins to the ration. By-product feeds often are available in wet form. Higher variability in moisture content may necessitate periodic testing of dry matter and nutrient content. These products are usually economical if trucking costs are not prohibitive.

Example/Composition of a concentrate mixture:

Ingredient	%
Maize germ	43
Wheat pollard	16
Wheat bran	26
Sunflower meal	5.5
Cotton meal	6.75
Lime	0.5
DCP	1
Common salt	1
Premix	0.25
Total	100

Nutritional value: 10.5 ME/Kg (Energy), CP=14-16%, Cal = 0.7% & P=0.5%

Importance of Compound Cattle Feed in Milk Production: Concentrate or compound cattle feed is a balanced source of essential nutrients required for body maintenance, growth and milk production. It is manufactured using good quality grains, oil cakes/meals, brans, molasses, common salt, minerals and vitamins. It is comparatively cheaper and highly palatable to the animals.

Recommendations for Feeding Concentrate/Compound Cattle Feed:

- Compound cattle feed of appropriate quality keeps animals healthy and increases milk production.
- Compound cattle feed contains protein, energy, minerals and vitamins required for the growth, maintenance and milk production of animals. It is advantageous to feed extra cattle feed to pregnant animals for proper development of foetus.
- It increases reproductive efficiency, milk production as well as fat content of milk.
- Growing animals should be fed 1 to 1.5 kg of compound cattle feed daily.
- Milking animals should be fed 2 kg of compound cattle feed for body maintenance and additional 400 g to cows and 500 g to buffaloes for every litre of milk produced.
- In addition to this quantity, 1 kg compound cattle feed and 1 kg good quality oil cake should also be given to pregnant animals during the last two months of pregnancy.

Ingredient	Content as per cent in		
	Formulation I	Formulation II	Formulation III
Maize	10	10	8
Ground nut cake	—	—	3
Cotton seed cake	5	5	5
Sunflower cake	10	10	7
Rice bran	5	—	10
Wheat bran	5	10	—
Ground nut hul bran	5	5	3
Tapioca waste	4	5	8
Deoiled Rice bran	37.5	36.5	37.5
Molasses	13	13	13
Urea	1.5	1.5	1.5
Calcite	2.0	2.0	2.0
Salt	2.0	2.0	2.0

Questions:

Q.1. Define concentrates and mention the importance of concentrate feeding in dairy livestock.

Q.2. What are the different feed ingredients required for formulating the concentrate mixtures.

Q.3. Formulate the concentrate mixture from the locally available feedstuffs.

EXERCISE – 10

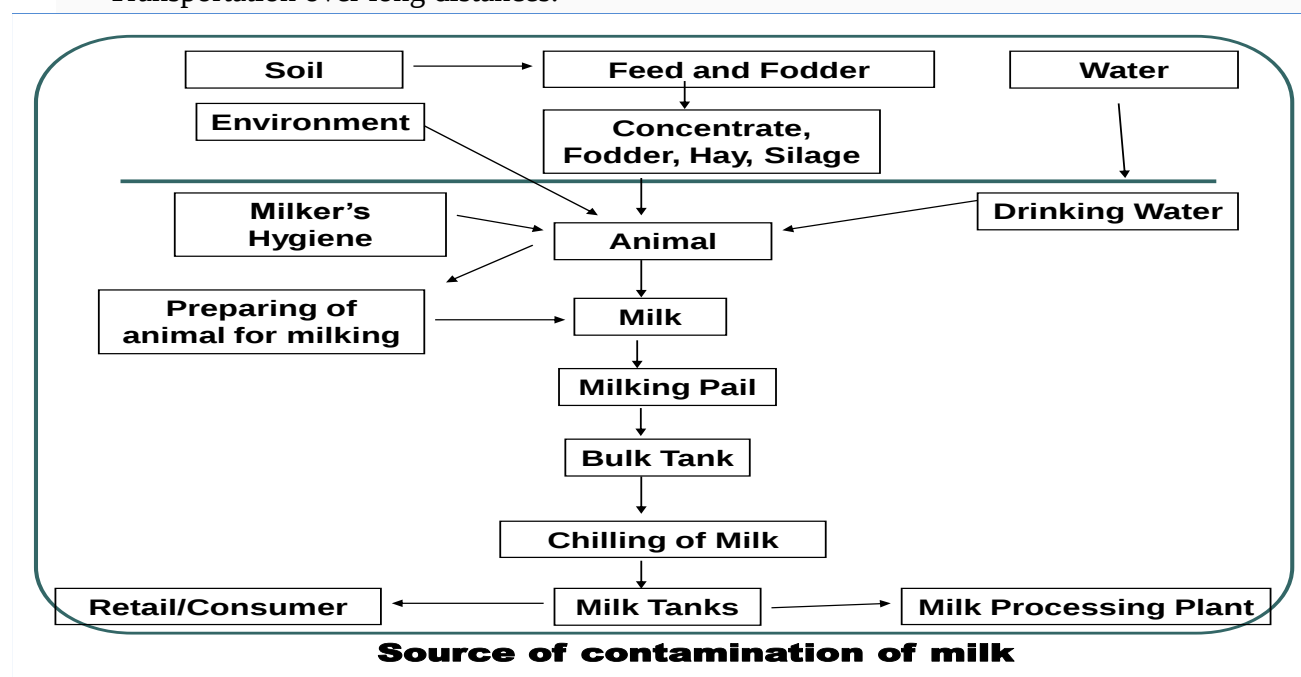
CLEAN MILK PRODUCTION

Milk is an important food commodity and there can be adverse effect on its quality if proper care is not taken during production, procurement and transit. Milk is a raw material, and from it milk products like ghee, powder, butter, paneer, curd, buttermilk, sweets etc is being manufactured. Quality of all products depends on process and raw material. If raw material has good quality, then finished product will have better quality.

“Clean milk” – Milk drawn from the udder of healthy animals, which is collected in clean, dry milking pail and free from extraneous matter like dirt, dust, flies, hay, manure etc.” Clean milk has a normal flavour with low bacterial count and is safe for human consumption.

Clean Milk production is very important for dairy farms maintained on commercial lines. Milk is highly perishable commodity. Unclean milk deteriorates quickly and produces diseases if consumed. Therefore utmost care has to be taken in production, storage and transport of milk. The animals should be maintained in hygienic environment for production of quality milk. Without production of clean milk there is no use of maintaining high yielding cows and good feeding practices.

- Clean Milk Production – beneficial to both producers and consumers.
- Safe for human consumption.
- Better keeping quality.
- High commercial value.
- Protection against diseases like typhoid, dysentery, diphtheria, septic sore throat etc.
- Helps to produce good quality dairy products.
- Transportation over long distances.



Several Practices should be Practised for Production of Clean Milk:

Maintenance of Sheds:

The sheds should be maintained in good hygienic conditions to keep the animals clean. The dung should be disposed off immediately and there should be proper drainage for the dung, urine, and waste waters going out of the sheds. The manure pit should be a little far off to prevent flies and insects entering into the sheds. Before milking the animals, the sheds should be kept clean and dry. After every day milking the sheds should be cleaned thoroughly, dried and disinfected.

Cleaning of the Animal:

At the time of milking, the animals should be cleaned thoroughly to remove any dirt and dung sticking on the thighs and udders. Potassium permanganate solution can be used to clean the udders. After cleaning the thighs, udders and teats should be dried with a clean towel. The animals should be kept quiet during the milking process. A soft music in the sheds can be played to keep the atmosphere serene and quiet. Further the milking should be practiced at fixed hours every day so that the animals get accustomed for milking at that time. Feeding concentrates at the time of feeding also helps to make the animals quiet and cooperate with the milking people.

Cleanliness of the Milking Personnel:

Along with the animals the milkers should maintain cleanliness. They should wash their hands with an antiseptic solution and kept dry. They should cut their nails close to prevent any injuries to the teats. They also should wear a cap to prevent hair falling into the milk. They should be free from infectious diseases. It is better to avoid any form of coughing or sneezing during milking hours.

Cleanliness of the Milking Pails:

The milking pails used for milking should be cleaned well with warm water and washing soda. After washing they are again washed with plain water thoroughly and dried by keeping upside down. The mouths should be closed with lids and kept ready for the next milking. While transferring the milk into the transport cans the milk should be strained through a clean cloth to remove any particles. After milking, the milk pails should be kept in a cool place and should not be exposed to direct sunlight. If the milk is to be transported to long distance it is cooled in a refrigerated room to prevent spoilage.

Milking Methods:

Milking should be done using the full hand method. Pressing the teats using the thumb (Knuckling method) is not a good practice. It should be avoided otherwise the teats get damaged and mastitis may develop. The milking should be completed as quickly as possible in about 5-8 minutes. Milking should be done completely and if milk is left in the udder it will become a source of infection and causes mastitis to develop. The first milk should be tested for presence of mastitis every time prior to milking. If suspected for mastitis the particular quarter should not be milked and treated.

Questions:

Q.1. Define clean milk and write the difference between normal milk and clean milk.

Q.2.What is the managerial factors you will consider while producing clean milk at your farm?

EXERCISE – 11

MILKING METHODS

Pre-Requisites for Good Milking:

- Milking is an art requiring experience and skill.
- Milking should be done gently, quietly, quickly, cleanly and completely.
- Cows remaining comfortable yield more milk than a roughly handled and excited cow.
- Maintenance of clean conditions in the milking barn results in better udder health and producing milk that remains wholesome for longer period.
- The milking process should be completed within 5 to 8 minutes.
- Complete milking has to be done. If any residual milk is left it may act as nidus for mastitis causing organism and the overall yield also getting affected.

Preparation for Milking - Dairy Cows and Sheds:

- Milking barn should be thoroughly washed and scrubbed after each milking and kept clean and dry before the next milking starts.
- Dusty feed and silage should be avoided in the milking barn.
- The hindquarters, thighs and udder should be washed thoroughly before milking.
- If more hair growth is seen in the udder region, it should be clipped periodically.
- Buffaloes should be invariably washed before milking.
- Just before milking udder should be wiped in dry cloth.
- The teats should be dipped in weak antiseptic solution.
- In cold weather, warm antiseptic solution can be used.

Preparation for Milking - Milkers and Pails:

- Milker's hands and milking pails/cans should be thoroughly washed or scrubbed and kept clean.
- Milkers should wear clean clothes and cover their heads with suitable cap so as to prevent loose hair falling in the milk
- The nails should be periodically trimmed and made smooth.
- Hands should be thoroughly washed and cleaned with antiseptic solutions.

Methods of Milking

1. Hand milking
2. Machine milking

1. Hand Milking

Hand milking is the most common practice in India. Cows are milked from left side. Stripping and full hand milking are two commonly used methods of milking. In hand milking two methods are there.

- Wet hand milking
- Dry hand milking

A. Wet Hand Milking

It is done by lubricating the milker's hand and teat either with water or oil. These make the teats dry and chaffed. Crack and sores may appear which will cause pain to the animal. Instead apply some antiseptic cream after the end of milking in such animal.

B. Dry Hand Milking

In this method, the milking operation is practised without lubrication of the milker's hand and teats. It is considered to be the best method as it doesn't cause any chaffing/sore on the teats.

Types of Dry Hand Milking

- Full hand milking
- Stripping
- Knuckling

Full Hand Method:

It is the best method as it causes minimum injuries to the teats. In this method teat is circled with index finger and thumb at the junction of teat and udder, the other portion of teat is closed with remaining fingers and pressed on all sides against the palm. Full hand milking stimulates natural suckling of a calf. Cows with large teats and buffaloes are milked with full hand method. Full hand method removes milk quicker than stripping because of no loss of time in changing the position of the hand. Even by efficient method of milking only 85% of milk comes out from udder and 15% still remains in udder which is called residual milk.

Stripping Method:

It consists of firmly seizing the teat at its base between the thumb and forefinger and drawing them down. The entire length of the teat is pressed simultaneously to cause milk ejection and to flow down in streams. The process is repeated in succession. Generally stripping method is adopted in small cows with narrow teats. Sometimes it is followed to draw the last strips of milk containing more fat. A combination of initial full hand milking method followed by stripping at the end is a good method of milking.

Firmly holding the teat between the thumb and fore finger and drawing it down the length of the teat and at the same time pressing it to cause the milk to flow down in a stream.



Stripping Method

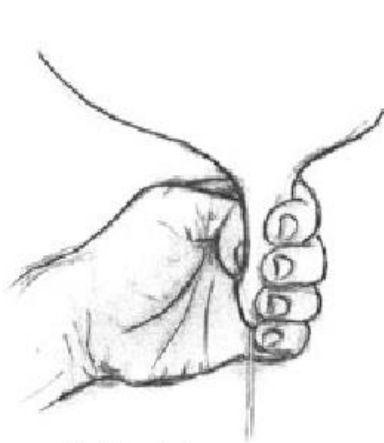
Grasping the teat with all the five fingers and pressing it against the palm does full hand milking.



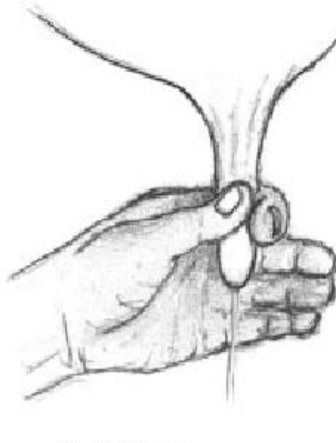
Full Hand Method

Knuckling Method:

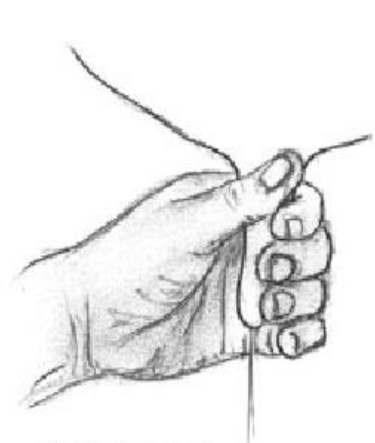
It is pressing the thumb against the teats while the teats are in between thumb and fingers. It may cause injury to the teat. This method is not advisable and is least recommended of all milking methods



A. Thumb in
Knuckling



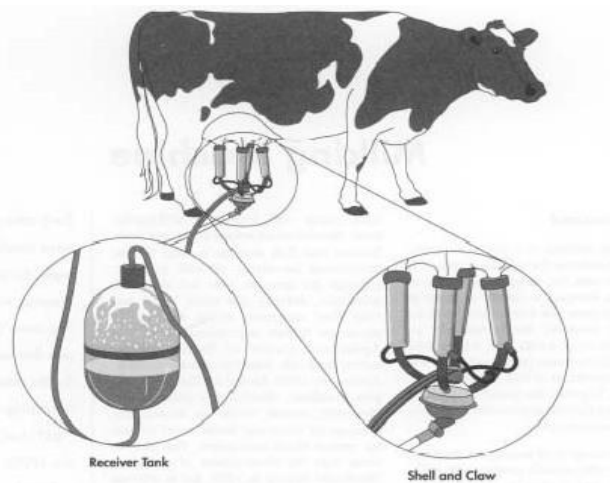
B. Pull down
Stripping



C. Full hand grip
Full Hand

2. Machine Milking

It is popularly used now-a-days in most of the western and industrialized countries. They use alternating negative and atmospheric pressure with the help of double chambered teat cup assembly, the continuous partial vacuum inside the inflatable rubber tube that is teat cup liner into which teat is inserted. A partial vacuum and normal atmospheric pressure is alternated in the space between rubber liner and metal shelf of the teat cup by means of pulsator. When negative pressure is applied between the liner and shelf, milk flows from the teat. When atmospheric pressure enters the chamber, the rubber liner inflation collapses with the result the teat is compressed and massaged. The continuous vacuum would cause congestion and irritation of teats.



Machine Milking

Factors Influencing the Efficiency of Milking Machine

Vacuum level: The degree of vacuum in a milking system during operation, expressed as inches of mercury/Kilo Pascal (mmHg/kpa) differential measured from atmospheric pressure and indicated by the vacuum gauge.

Pulsation rate: The number of cycles of alternating vacuum and atmospheric air which occur per minute. It may vary between 40 to 60 cycles per minute on most machines.

Milking or Pulsation ratio: The proportion of time spent under vacuum and atmospheric air and is usually approximately 60:40.

Ideal Practices Used in Machine Milking

- Get the cow ready by wiping and massaging the udder and teats for half to one minute. Use the cloth dipped and squeezed out of warm mild antiseptic solution.
- Strip cup test: use the strip cup, draw the first milk into the cup from each quarter and check it for any abnormality.
- Put on the teat cups promptly.
- It is a good practice using a timer to avoid over use of machine.
- Break the vacuum first. Pull down the teat cups and massage the udder with hand.
- Apply teat dips.
- Record the milk weight.
- After every milking, thoroughly and properly clean the machine
- The manufacturer's direction may be followed and service the milking machine.

Questions:

Q.1. Mention the advantages and disadvantages of different milking methods.

Q.2. How machine milking is different from hand milking?

Q.3. Write the advantages and disadvantages of machine milking.

EXERCISE – 12

ECONOMICS OF CATTLE, BUFFALO, SHEEP AND GOAT FARM

DAIRY FARMING

Introduction

Dairying is an important source of subsidiary income to small/marginal farmers and agricultural labourers. In addition to milk, the manure from animals provides a good source of organic matter for improving soil fertility and crop yields. The gobar gas from the dung is used as fuel for domestic purposes as also for running engines for drawing water from well. The surplus fodder and agricultural by-products are gainfully utilised for feeding the animals. Almost all draught power for farm operations and transportation is supplied by bullocks. Since agriculture is mostly seasonal, there is a possibility of finding employment throughout the year for many persons through dairy farming. Thus, dairy also provides employment throughout the year. The main beneficiaries of dairy programmes are small/marginal farmers and landless labourers.

Objectives:

- To increase the milk production
- To generate the self employment in rural areas
- To create awareness regarding dairy enterprise

Techno- Economic Assumptions:

- Purchase of animals: Considered animals in 2nd lactation (1st month) after calving along with female calves preferred and purchased in 2-3 batch at an interval of 3-6 months, so that herd remain in milking condition.
- Cost of animals: Crossbred dairy cows: 40,000-50,000/animal
High yielding Murrah buffalo: 40,000- 50,000/animal
- Milk production: Crossbred dairy cows: (10 litres/day/animal)
High yielding Murrah buffalo: (10 litres/day/animal)
- Milk sale price: Rs. 40/litre
- Housing: Animal shed: 500/Sq.ft
Office and other buildings: 1000/Sq.ft
- Floor space requirement:
50-60 Sq.ft/adult animals (closed)
100-120 Sq.ft/adult animal (open paddock)
20-30 Sq.ft/calf (closed)
40-60 Sq.ft/calf (open paddock)
- Lactation length: 300 days
- Dry period: 100 days
- Feeding/ration: Green fodder (20-25 kg/animal/day)-available in farm land.
Dry fodder (3-4 kg/animal/day)-available in farm land.

Concentrate (3 kg/animal/day-milking animal) - Rs. 1,000/quintal

Concentrate (1 kg/animal/day-dry animal) - Rs. 1,000/quintal

- Mortality: 3% in adult animals and 10% in calves.
- Ratio of milch animals to dry cows/buffaloes: 3:1
- Depreciation: 5% on animal shed/buildings and 10% on farm machineries and equipments, respectively.
- Bull: 1 bull for service.
- Labour: 5,000-6,000/month/labour (1 labour for 10 cow other than home labour support).
- Veterinary aid: 500/cow or buffalo/year.
- Cultivable land for fodder production: 1 acre land will support fodder production for 4 adult animals.
- Loan if taken then repayment schedule: 75% of the fixed cost. Repayment in 5/10 installments.
- Interest: 10%/year.

IF PROJECT IS 100% SELF FINANCED

Fixed/Non-recurring Expenditure:

- Cost of purchase of animals - Rs. 40,000 (Cost of one animal) x 10 (No. of animals) = 4,00,000 (4.0 lakh)
- Cost of animal shed/building – 50 (Sq.ft/animal space requirement) x 10 (No. of animals) x 500 (Construction cost/Sq.ft) = 2,50,000 (2.50 Lakh)
- Cost of farm machineries and equipments (Hand pipe, chaff cutter, milking pails etc.) = 1,50,000 (1.50 Lakh)

Total Fixed Cost Expenditure – 8,00,000 (8.0 lakh)

Variable/Recurring Expenditure:

- Green and dry fodder for 10 animals from self cultivated fodder field (3 Acre land will support 10 animals fodder requirement throughout the year) will cost around – 1,00,000 (1.0 Lakh)
- Concentrate feeding of 10 animals for a year will cost – 10 (No. of animals) x 3 (Kg/animal/day) x 300 (feeding days) x 10 (Cost of conc. feed/kg) = 90,000 (0.90 Lakh)
- Labour cost – 1(No. of labour) x 5000 (salary/month) x 12 (month) = 60,000 (0.60 Lakh)
- Electricity and water charges for a year – 50,000 (0.50 Lakh)
- Miscellaneous expenses (veterinary aid, depreciation on building and equipments etc.) - 50,000 (0.50 Lakh)

Total Variable Cost Expenditure – 3,50,000 (3.50 lakh)

Total Cost/Expenditure = Fixed Cost (Fc) + Variable Cost (Vc) = 8,00,000 + 3,50,000 = 11,50,000 (11.50 Lakh).

Income Generation:

- Through sale of milk – 10 (No. of animals) x 10 (Litre of milk produced/animal/day) x 300 (Lactation length) x 40 (Milk sale price/litre) = 12,00,000 (12.0 Lakh)
- Sale of calves and heifers – 50,0000 (0.50 lakh)
- Sale of dung – 10 (No. of animals) x 20 (Kg of dung produced/animal/day) x 365 (days) = 73,0000 kg of dung/year will cost around = 36,500 (0.36 lakh) (Rs.500/1000kg of dung)
- Sale of gunny bag = 2,000 (0.02 Lakh)

Total Income Generation = 12,88,000 (12.98 lakh)

Profit (cost benefit analysis) = Total income – Total expenditure = 12,88,000 (12.88 lakh) - 11,50,000 (11.50 lakh) = 1.38 lakh

Profit for first year will be – 1.38 lakh

Loan repayment (in case loan has been taken for establishment of dairy enterprise):

If project is financed by bank (bank has given loan – 75% of fixed cost that is 75% of 8.0 lakh = 6.0 lakh to be paid in 5 installments at 10% interest rate): Loan repayment will be in the year end.

First installment = 6.0/5 = 1.20 lakh (Will remain same for 5 years)

Interest for first year = 10 x 6,00,000 /100 = 60,000 (0.60 lakh)

Interest for second year = 10 x 6,00,000 -1,20,000/100 = 48,000 (Calculate similarly for remaining three year).

Loan Repayment Schedule:

Particulars	1 st Year	2 nd Year	3 rd Year	4 th Year	5 th Year
Loan amount (Lakh)	6.0	4.80	3.60	2.40	1.20
*Net income (Lakh)	1.38	-	-	-	-
Installment amount (Lakh)	1.20	1.20	1.20	1.20	1.20
Interest amount (Lakh)	0.60	0.48	0.36	0.24	0.12
Installment + Interest amount (Lakh)	1.80	1.68	1.56	1.44	1.32
Net profit/year (Lakh)	-0.42	-	-	-	-

Model Scheme on Goat

Goat rearing plays an important role in the national economy. It provides gainful employment and income to the weaker sections especially the rural poor. Goat is probably the only animal which is bred for multiple objectives, viz., meat, hide, milk, manure and hair. Due to versatile characteristics and utilisation, goat is often called 'poor man's cow' in India. Goat meat is usually low in fat and is commonly called chevon. Goat meat is preferred to mutton in India. Being the principal meat producing animal in India, goat meat is commonly preferred to other meat with better prices irrespective of caste and religion.

Why Goat Farming?

Rearing of goats is considered a very lucrative animal husbandry activity and more and more farmers and educated unemployed class-persons are attracted towards this industry. The reasons are:

- i) Fast multiplication of their number.
- ii) Comparative low investment and assured market.
- iii) Relatively less accommodation required and low cost of maintenance.
- iv) Ability of goats to thrive on relatively uncommon feeds or fodder not considered by cows.
- v) Lesser problems of diseases control due their clean habits in small and medium size units.
- vi) High nutritive value and higher mineral content of milk making its use desirable for growing children, old and sick persons.

Objectives:

- i) To undertake the task of setting up a goatery by adopting modern and scientific management.
- ii) To provide gainful employment to the rural poor.
- iii) To increase red meat production in the state to improve the availability and consumption of goat meat of improved variety.
- iv) To generate impact employment and enhancing the scope of goat meat processing.

Techno-Economic Parameters:

Parameters	Goat Breed
Rearing System	Semi-intensive
Does no's	100
Bucks no's	5
Kidding interval	8 Months
Maturity age	10 to 12 Months
No of kidding per year	1.5 kid
Avg litter size (Chances of single, twinning, triplet and quadruplet per delivery)	2 no's
Kidding rate	90 %
Death rate in kids	15 %

Goat Farming Requirements

Here below are some figures of this project report:

Space required per head for does	10 sq feet
Space required per head for buck	15 sq feet
Space required per head for kid	5 sq feet
Cost of construction	Rs. 180 per sq feet
Cost of green fodder growing	Rs. 5000 per acre in a season
Cost of equipment	Rs. 20 per adult goat
Concentrate feed required for bucks (for two months)	8 kg per month
Concentrate feed require for adult does (per kidding)	7 kg per month
Concentrate feed required for kids (for one month)	4 kg per each kid
Requirement of labour	1 no's
Labour cost	Rs. 6000 per month
Total cost of buying concentrate feed	Rs. 16 per Kg
Insurance	5 % of total value of the Goats
Cost of veterinary aid	Rs. 50 per year (on each adult goat)

Income from Goat Farming:

Market price of adult buck (11 month age)	Rs 3000
Market price of adult doe (11 month age)	Rs 2500
Income from selling gunny bags	Rs. 20 per gunny bag
Manure income is not considered as it is utilized for fodder preparation	—

How much you are going to earn from your goat farm every year?

Particulars	1st Year	2nd Year	3rd Year	4th Year	5th Year	6th Year
No. of bucks purchased	5	—	—	—	—	—
No. of does purchase	100	—	—	—	—	—
No. of kidding per year	1.5	1.5	1.5	1.5	1.5	1.5
No. of female kids (newborn)	135	135	135	135	135	135
No. of male kids (new born)	135	135	135	135	135	135
No of female kids (died at 15 %)	20	20	20	20	20	20

No of male kids (died at 15 %)	20	20	20	20	20	20
Female adult (no's), available for selling	Give the kid time to grow their market age	115	115	115	115	115
Male adult (no's), available for selling	Give the kid time to grow their market age	115	115	115	115	115

Cost of Expenditures:

Specification	Total Amount (Rs.)
Cost of constructing low-cost Shed (for 100 Does)	180000
Cost of constructing low-cost Shed (for 5 Bucks)	13500
Cost of constructing low-cost Shed (for 230 Kids) (Space requirement for kids is 4 sq. feet)	166000
Cost of essential equipment	10000
Cost of purchasing 5 bucks	25000 (Rs. 5000 per Buck)
Cost of purchasing 100 does	300000 (Rs. 3000 per Doe)
Cost of light fitting, & etc	90000
TOTAL CAPITAL COST	784100
Cost of Working Capital	
Labour salary	84000 of 1 year (Rs 7000 per month)
Cost of shedding	13800
Insurance Cost	16250 (5 % of total goat's value)
Goat fodder cost (of Does)	21600
Goat fodder cost (of Buck per kidding)	1200
Cost of growing green Fodder (in 4 acres @ Rs. 5000 per acre in each season)	20000
Miscellaneous Cost	13050
Total Working Capital	145900
TOTAL PROJECT COST	930000

Particulars	1st Year (Rs.)	2nd Year (Rs.)	3rd Year (Rs.)	4th Year (Rs.)	5th Year (Rs.)	6th Year (Rs.)
Labour Cost	84000	84000	84000	84000	84000	84000
Insurance Cost (5 % of Total goat value)	16250	16250	16250	16250	16250	16250
Cost of Growing Green fodder	40000	40000	40000	40000	40000	40000
Fodder Cost	36600	36600	36600	36600	36600	36600
Other Cost	14000	14000	14000	14000	14000	14000
Total Investment	166850	166850	166850	166850	166850	166850
Income by Selling Gunny Bags	1000	1000	1000	1000	1000	1000
Income from selling (male goats @ Rs. 3000 per buckling	—	320000	320000	320000	320000	320000
Income from selling (female goats @ Rs. 2500 per buckling	—	280000	280000	280000	280000	280000
Income from Ending stock (5 buck & 100 does @ 2500 per adults and 230 kids @ 1500 per kid)	—	—	—	—	—	607500
Total Income	1000	587000	587000	587000	587000	1340000
Gross profit	-166390	421000	421000	421000	421000	1200000

Goat Farming: Profit or Loss?

Specification	1st Year	2nd Year	3rd Year	4th Year	5th Year	6th Year
Initial Investment	784100	—	—	—	—	—
Recurring Cost	167000	167000	167000	167000	167000	167000
Total Investment	950000	170000	170000	170000	170000	170000
Benefit	1000	600000	600000	600000	600000	1400000
Pure Benefit	-940000	430000	430000	430000	430000	1230000

Questions:

Q.1. What are the assumptions you will made before starting your dairy farm?

Q.2. What are the assumptions you will made before starting your goat farm?

Q.3. Why goat is known as poor man's cow?

Q.4. How goatery is different from dairy farming?

EXERCISE – 13

SAMPLING AND TESTING OF MILK FOR FAT AND TOTAL SOLIDS

Objectives:

- To get representative sample of entire batch of milk and milk product
- To get correct results of ingredient/s to be estimated

The milk of mammalian animals contains similar ingredients but their quantities differ. Among all the milk ingredients fat content is highly variable. The legal standards of the different types of milk are based on average composition, which are used to protect the quality of milk adversely affected by various type of adulteration. Therefore analysis of milk ingredients are required to determine the variations in composition and quality affected by adulterations.

Apparatus:

- Dipper for fluids
- Plunger for mixing
- Milk sampler
- Sample bottles

Procedure:

1. Mix the fluid milk thoroughly by milk plunger to distribute milk fat properly
2. Collect homogenous milk sample of 250 to 500 ml in flasks for complete routine analysis or in sample bottles. About 50 ml is necessary for specific analysis

Precautions:

1. Make milk homogenous by through mixing before sampling.
2. Agitators or plunger for mixing should be sufficient size and weight to bring about through mixing and easy to move rapidly in milk by operator.
3. Milk churns easily at around 27°C, avoid taking sample at this temperature to avoid foaming, whipping and churning.
4. In case milk can not be made homogenous due to large volume or any other reason, collect 250 ml in milk samples from different places to be mixed together.
5. Milk samples from bottled milk or tetra packs/poly packs are withdrawn at random.
6. Quantities of milk samples withdrawn must be proportional to the quantities contained in containers.
- 7 Milk bottle are kept at low temperature for some time, be heated in water bath up to 40°C to melt the fat prior to mixing and sampling.
8. Avoid violent shaking to prevent foaming, whipping and churning.

Objective:

To Analyze the Fat Content of Milk

Principle:

This method involves dissolving solids not fat chiefly in sulphuric acid and liberating the fat from emulsion by breaking the film around the fat globules. Thus heat is created to keep fat in liquid state. Use of amyl alcohol is made to reduce surface tension of fat globules thus helping in separation of fat from non fat substance. The concentration of sulphuric acid prevents churning of fat thus facilitate to clear fat column. Quick separation is aided by

centrifugal force taking advantages of wide differences in specific gravity of fat (0.9) and acid fat free milk mixture (1.43).

Apparatus:

1. Gerber milk butyrometer (22 ml cap. Graduated stem calibrated to 8% fat)
2. Automatic tilt measure or pipettes for acid (10 ml) and amyl alcohol (1 ml)
3. Pipette 10.75 ml for milk
4. Butyrometer stoppers
5. Butyrometer stand
6. Water bath
7. Gerber centrifuge 1200 rpm

Reagents:

1. Sulphuric acid: Concentrated sulphuric acid is suitable diluted to give an acid with sp gr. 1.807 to 1.812 at 27°C which corresponds to 90 to 91 percent H_2SO_4 .
2. Amyl alcohol: Sp. gr. 0.805 at 27°C. It should be clear, colourless liquid free and furfural, acids etc.

Procedure:

- Place the butyrometer in a stand upwards open.
- Transfer 10 ml of Gerber H_2SO_4 measured with acid pipette or automatic tilt measure into clean and dry milk butyrometer, with care not to wet the neck of butyrometer with acid.
- Prepare a homogenous sample of milk after warming at 27°C on water bath.
- Pipette out 10.75 ml well mixed sample of milk and transfer carefully and very slowly into butyrometer from inside wall, without wetting the neck and also not allowing it to mix with acid.
- Add 1 ml of amyl alcohol with a pipette or tilt measure taking care not to wet the neck of butyrometer with alcohol, to form a layer on the top of milk.
- Close the butyrometer by lock stopper using key and tighten it.
- Mix the contents by shaking the butyrometer at 45° angle until all visible curd has been dissolved. Now invert the butyrometer 3 to 4 times to ensure thorough mixing.
- Now place the butyrometer in the centrifuge with narrow graduated stem pointing out towards the centre. Counter balance by placing another loaded butyrometer exactly opposite side.
- Close the lid of centrifuge and run at 1100 to 1200 rpm for 5 minutes. Switch off the current and allow stopping by it.
- Remove the butyrometer and place it in a water bath at 65°C for 5 minutes, see that water level in bath remains at a level enough to cover the fat column in butyrometer.
- Remove the butyrometer from water bath, wipe off with a duster/cloth to dry holding it vertically all the times with graduated stem.
- Use a lock stopper key to manipulate stopper by pushing or pulling carefully to adjust the fat column in graduated stem against zero graduation mark, keeping at an eye level.
- Take the reading of the fat column which is a clear golden/yellow.

Notes:

- If acid used is too strong, it causes dark colouration of fat column due to charring.

- If the acid is weak, it would cause the colour to become light and curd particle would gather beneath the fat column giving wrong results.
- Make fat determination always in duplicate.
- Always take care not to wet the neck of butyrometer otherwise it may hold on in position while mixing the content.
- Use glass bulb pipette for sucking H₂SO₄ and amyl alcohol.

Objective:

Determination of Total Solids in Milk

Principle:

Total solid of milk means the residue left after complete evaporation of water from milk, which includes fat, protein lactose and mineral matter of milk.

Materials needed:

1. Oven
2. Pipette
3. Balance
4. Desiccator
5. Moisture cup

Procedure:

- Bring sample to about 20°C, mix well until homogenous by pouring into clean receptacle and back repeatedly, and promptly weigh or measure test portion. If lumps of cream do not disperse, warm sample in water bath to about 38°C and keep mixing until homogenous. Where particle and fat remains dispersed, cool warmed samples to about 20°C before transferring test portion.
- Weigh 2.5 to 3.0 preferred samples into weighed flat bottom dish.
- Heat on steam bath for 10-15 minutes exposing maximum surface of dish bottom for evaporation.
- Heat for 3 hours in hot air oven at 98 to 100°C.
- Cool in dessicator and weigh quickly.
- Repeat heating, cooling and weighing until the loss in weight between successive weighing does not exceed 0.5 mg. the lowest weight should be recorded. Report percent residues as total solids.

Observations:

Weight of empty moisture cup	= W ₁ g
Weight of moisture cup+ milk	= W ₂ g
Weight of milk taken	= W ₂ -W ₁ g
Weight of moisture cup + total solids	= W ₃ g
Weight of total solids in milk	= W ₃ -W ₁ g

Calculation:

$$\text{Per cent total solids in milk} = \frac{W_3 - W_1}{W_2 - W_1} \times 100$$

Notes:

- Do not exceed temperature of oven more than 100°C as higher temperature will cause charring of solids.
- In case of sour milk, the result is usually low on account of losses of volatile matter.

Use of (Hydrometer) Lactometer in Detection of Quality of Milk

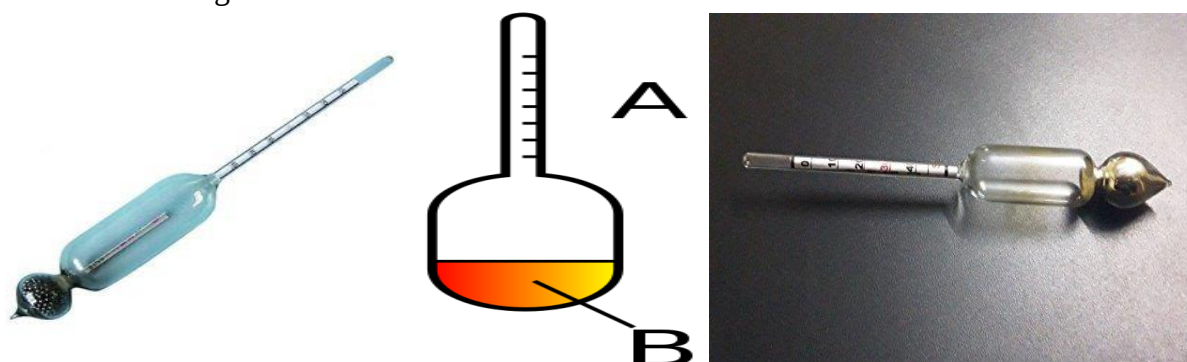
A hydrometer is an instrument used to measure the specific gravity (or relative density) of liquids; that is, the ratio of the density of the liquid to the density of water. A hydrometer is usually made of glass and consists of a cylindrical stem and a bulb weighted with mercury or lead shot to make it float upright.

The difference between hydrometer and lactometer is that- hydrometer is an instrument that floats in a liquid and measures its specific gravity on a scale while lactometer is a device that estimates the cream content of milk by measuring its specific gravity.

Principle:

They both work on Archimedes principle. Using this, they are used to calculate the density of milk (lactometer) and other substances. Lactometer and hydrometer are based on density of substance. Lactometer examines the purity of milk by density of milk. If we added water into the milk, lactometer shows the least readings.

A lactometer is used to check purity of cow's milk. The specific gravity of milk does not give a conclusive indication of its composition since milk contains a variety of substances that are either heavier or lighter than water.



Lactometer indirectly measures the cream content of milk. The more cream, the lower the lactometer floats in the milk. A Lactometer is a little glass instruments that tests the purity of milk based on density/buoyancy and works on the principle of the specific gravity of milk. Average specific gravity of buffalo milk is 1.033 and average specific gravity of cow milk is 1.032.

Milk is heavier than water.

The average specific gravities are: Cow Milk: 1.028 to 1.030. Buffalo Milk: 1.030 to 1.032
Skim Milk: 1.035 to 1.037.

The specific gravity of milk is influenced by the proportion of its constituents (eg. composition), each of which has different specific gravity approximately as follows.

Water : 1.000	Fats : 0.930
Protein : 1.346	Lactose : 1.666
Salts : 4.12	SNF : 1.616

As the milk fat is lighter constituent, the more there is of it the lower the specific gravity will be and vice versa. However, although buffalo milk contains more fat than cow milk, its specific gravity is higher than the latter, this is because buffalo milk contains more solids-not-fat as well, which ultimately results in a higher specific gravity.

The specific gravity of milk is decreased by

Addition of water 2. Addition of cream (fat) 3. Increased temperature.

The specific gravity of milk is increased by

1. Addition of separated milk 2. Removal of fat 3. Reduction of temperature.

The specific gravity of milk is calculated by the following formula.

Sp. Gravity of milk is = $1 + \text{CLR} / 1000$ When CLR = Corrected Lactometer Reading.

As the temperature of expression is 60° F. if the temperature is more than 60° F, add 0.1 for every 1° F above 60° F to the lactometer reading or subtract 0.1 for every 1° F below 60° F.

Some Test to Detect Adulteration in Milk:

Following are some test to detect adulteration in milk (catch the infringers red handed).

1. **Water** – The presence of water can be detected by putting a drop of milk on a polished slanting surface. The drop of pure milk flows slowly leaving a white trail behind it, whereas milk adulterated with water will flow immediately without leaving a mark.
2. **Starch** – Add a few drops of Iodine solution to few ml of milk. If the mixture forms blue colour, it's a indication that milk is adulterated with Starch.
3. **Urea** – Take a teaspoon of milk in a test tube. Add half teaspoon of soybean or arhar powder. Mix up the contents thoroughly by shaking the test tube. After 5 mins, dip a red litmus paper. After half a minute, change in colour from red to blue indicates the presence of Urea in milk.
4. **Detergent** – Shake 5-10 ml of sample with an equal amount of water. Formation of lather indicates the presence of detergent.
5. **Synthetic Milk** – Synthetic milk has a bitter taste, gives a soapy feeling on rubbing between the fingers and turns yellowish on heating.

In view of above, testing the milk taken from milkman/purchased from market in regular interval for one or more of adulterant is necessary.

Questions:

Q.1. Write the principles of fat determination of milk.

Q.2. Enlist the various reagents used in milk fat estimation.

Q.3. Write the principles of working of lactometer.

Q.4. Write the complete procedure of milk total solids determination.

Q.5. Enlist the different adulterants used for adulteration of milk.