



Dairy Farming

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PREFACE

Indian Agriculture has made rapid stride in the last half century with a significant achievement in food grain production of 257.6 million tonnes (2015-16) which was found to be successful in keeping pace with the rising food demands of a burgeoning population of the country crossing of over 1.2 billion. However, agriculture is the major source of livelihood system of tribal farmers of NEH region that supports major family income source in which Animal Husbandry sector serves as the secondary source of income mainly for small and marginal farmers. Due to non-vegetarian food habits of majority of tribal population in NEH region, there is immense demand for meat, egg, and fish products and by products in the local markets. At present our district has 360 cross breed and 22979 Indigenous cattle breeds respectively with milk production of 3672 ltrs and 13788 ltrs per annum. But, there exists a wide gap between the production and demand of dairy and fish products. This is mainly due to maintenance of large scale indigenous cattle breed under traditional method with hardly any scientific inputs in feeding, housing and health management practices of these rearing animals. This type of less capital consuming intensive farming system is found to be not remunerative as performance of animals becomes very poor in terms of production and productivity thus affecting the development of livestock sector.

In addition, majority of farmers are not coming forward to take initiatives to take up livestock sector as a vibrant and lucrative enterprise for livelihood security due to several factors such as fear of mass mortality of animals due to outbreak of disease, poor credit facility, lack of support from government agencies, lack of awareness on schemes & programmes among farmers. However, there is lot of scope for improvement of performance of animal through maintaining improved breeds with better management practices. In this context, the present manuscript in the form of a book entitled "Dairy Farming-An approach for poverty alleviation of tribal farmers" covering different aspects of dairy farming will no doubt act as a guide to the extension professionals in A&H sector and KVK scientists to perform their duties effectively by extending best service to the dairy farmers of the region.

I express my heartfelt thanks to scientists namely Dr. S.S. Hanah, Dr. D. Medhi and Mr. M. Hussain from ICAR-National Research Centre on Yak, Dirang, Arunachal Pradesh and Dr. Dipankar Hazarika and Mrs. Nanang Tamut from Krishi Vigyan Kendra, Lower Dibang Valley, Arunachal Pradesh for contribution of relevant and most appropriate chapters that meets the current needs of farming communities.

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Chapter 1

SYSTEM OF HOUSING FOR DAIRY ANIMALS

S. S. Hanah, S. Deori, D. Medhi, Joken Bam and T.J. Ramesha

The main purpose of livestock production is to convert the energy in feed into products that can be utilized by human beings, such as milk, eggs, meat, wool, hair, hides and skins, draught power and manure (fertilizer). Traditional, extensive livestock production involving indigenous breeds and low-cost feeding will usually have low performance and can therefore only justify minimal, if any, expenditure for housing. However, where improved breeds, management and feeding are available it will usually be economically beneficial to increase the production intensity. Although this can be facilitated by, among other things, the construction of buildings and other livestock structures to provide for some environmental control, reduced waste of purchased feedstuffs and better control of diseases and parasites. For example, a relatively well constructed building for calving, farrowing, lambing etc. will provide a high level of environmental control and may improve the survival rate of neonatal animals, sufficiently to justify the cost and add to the profitability of the production unit.

The livestock animal has a certain fixed behavioral patterns, such as pecking in chickens and nursing in mammals. This behavior can influence the design of structures, as demonstrated in the examples given below. Cattle normally live in herds but, when giving birth, cows attempt to find a quiet, sheltered place away from the disturbance of other cows and humans. The cow needs to be alone with

her calf for some time after birth for the cow/calf bond to be established. When a cow that is confined in a loose housing system is approaching calving, it should be removed from the herd and placed in an individual pen. Hens spend considerable time in the selection of a nest, which is on the ground. Nesting is characterized by secrecy and careful concealment. Hens in deep-litter systems therefore, sometimes lay eggs on the floor instead of in the nest boxes, especially if the litter is quite deep or there are dark corners in the pen.

Sows are nest-builders and should be transferred to clean furrowing pens one to two weeks before giving birth, and given some bedding with which they can build a nest. Oestrus, especially in gilts, is increased by the smell, sight and physical presence of a boar. Therefore, gilts and sows waiting for mating should be kept in pens adjoining the boar pen.

Cattle prefer to be able to see while drinking therefore, more animals can drink at once from a long, narrow trough than from a low round one. With cattle (and hens), feeding is typically a group activity, therefore space at the feed trough must be provided for all the animals at one time.

To prevent wasting feed, a trough should be designed to suit the particular behavior pattern that each species exhibits while feeding, i.e. pecking in hens; rooting with a forward and upward thrust in pigs; and wrapping their tongue around the feed (grass) and jerking the head forward in cattle. Sheep are vigilant and tight-flocking, and respond to disturbances by fleeing. Moreover, they move best from dark into light areas and dislike reflections, abrupt changes in light contrast and light shining through slats, grates or holes. Therefore, when designing the structures, all the species specific characters should be taken into account.

The welfare of an animal is very important while planning and designing of suitable housing accommodation for any livestock. Improper planning in the arrangement of animal housing may result in additional labour charges and that curtail the profit of the owner. As the principal function of any system of housing for animals are: (i) Provision a congenial environment for better growth,

reproduction and production performance (ii) Provision of desirable working conditions for labour and supervisory staff and (iii) integration of housing with feeding, watering, milking and manure handling systems. In other words, housing management is more or less synonymous to the system of management of animals. The animal house should be properly located, constructed spaced out and grouped. The animal house may be constructed in different shape, type, etc. but health and comfort of the animals should receive special attention. Further a good animal house must permit a dry and comfortable surface for the animals to rest, that does not permit breeding of internal and external parasite and other pathogens within the shed. The good manager plan and build the animal house to reduce heat gain and promote heat loss from the structure of the house by radiation and conduction during summer. During winter the structures, especially those parts that come in constant physical contact with animals, like floor and walls, should not get too cold and should give protection from the cold winds.

Wherever they are housed animals are entitled to the Five Freedoms. Basic requirements such as an agreeable physical environment are necessary, and the animal should be well cared for. The Five Freedoms are a set of five basic rules concerning the welfare of animals. They apply to the housing of both large and small animals. They are as follows:

1. Freedom from hunger and thirst
2. Freedom from discomfort
3. Freedom from pain, injury and disease
4. Freedom to express normal behavior
5. Freedom from fear and distress

Type and system of housing for animals:

The single housing system may not be wholly suitable for all agro-climatic zones in India, as the climate varies from region to region. Housing of the animal is therefore to be planned and designed as per the agro-climatic conditions prevailing in a particular area. The most widely prevalent practice

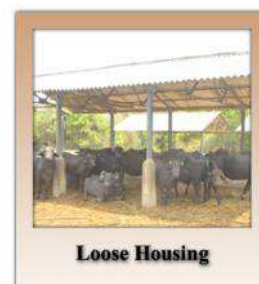
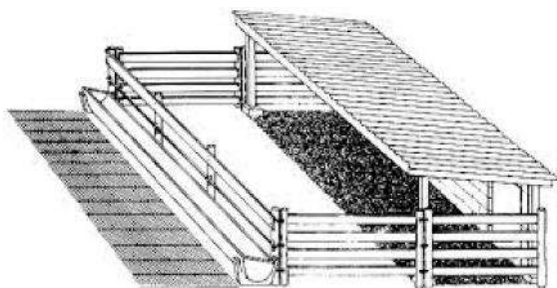
in this country is to tie the cows with rope on a Katcha floor except some organized dairy farms belonging to government, co-operatives or military where proper housing facilities exist. It is quit easy to understand that unless cattle are provide with good housing facilities, the animals will move too far in or out of the standing space, defecating all round and even causing trampling and wasting of feed by stepping into the mangers. The animals will be exposed to extreme weather conditions all leading to bad health and lower production. For dairy cattle, it may be successfully housed under a wide variety of conditions, ranging from close confinement to little restrictions except at milking time. However, two types of dairy barns are in general use at the present time.

1. The loose housing barn in combination with some type of milking barn or parlor.
2. The conventional dairy barn.

Each system has its own advantages and limitations. The final decision can be based upon the prevailing environmental condition of a particular area.

Loose housing

- It is a system of housing in which animals are kept loose in an open paddock in group (40-50) throughout the day and night except at the time of milking and some other specific purposes like treatment, breeding etc., when the animals are required to be tied.
- Common shelter is provided along one side of open paddock under which animals can retire when it is very hot or cold or during rains, enclosed by brick wall or railing.
- Common feed manger and water tank along with covered standing space is provided and concentrates are fed at the milking time which is done in a



separate milking barn or parlour in which cows are secured at milking time and are milked.

Advantages

- Cost of construction is cheaper.
- Future expansion is possible.
- The animals will move freely so that it will get sufficient exercise.
- The animal can be kept clean.
- Common feeding and watering arrangement is possible.
- Clean milk production is possible because the animals are milked in a separate milking barn.
- Oestrus detection is easy.
- less prone to fire hazards to animals
- At least 10-15 percent more stock than standard can be accommodated for shorter period.

Disadvantages

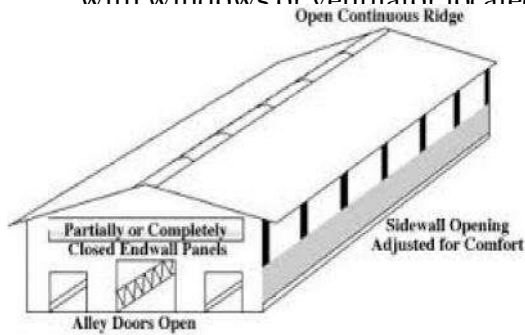
- It is not suitable for temperate Himalayan region and heavy rainfall areas.
- It requires more floor space.
- There is competition for feed.
- Attention of individual animal is not possible.
- A separate milking barn is needed for milking of animals.

Conventional barns or Stanchion barns

On the other hand in the conventional or stanchion barns closed system there is greater protection during winter season but proportionally the cost is very high.

- In this system of housing, the animals are confined together on a platform and secured at neck by stanchions or neck chain.
- The animals are fed as wells as milked in the same barn.

- These barns are completely covered with roofs and the sidewalls are closed with windows or ventilator located at suitable places to get more ventilation



The same type of housing can be utilized for tropical region with slight modification

Advantages

- The animals and men caring for animals are less exposed to harsh environment.
- The animals can be kept clean.
- Diseases are better controlled.
- Individual care can be given.
- Separate milking barn is not required.

Disadvantages

- Cost of construction is more.
- Future expansion is difficult.
- Not suitable for hot and humid climatic conditions

Generally under conventional barn system animal are arranged in a single row if the numbers of animal are less, say 10 or in a double row if the herd is a large one. In double row housing, the animal should be so arranged that the

animal face out (tail to tail system) or face in (head to head system) as preferred. Ordinarily, not more than 80 to 100 cows should be placed in one building.

Advantages of tail to tail system

1. 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 15% 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.
2. In cleaning and milking the cows, the wide middle alley is of great advantage.
3. Lesser danger of spread of diseases from animal to animal.
4. Cows can always get more fresh air from outside.
5. The manager can inspect a greater number of milkmen while milking. This is possible because milkmen will be milking on both sides.
6. Any sort of minor disease or any change in the hind quarters of the animals can be detected quickly and even automatically.

Disadvantages

1. Spreading of diseases through digestive and reproductive system is high
2. Drainage channel is not exposed to sunlight.
3. Feeding of animals is laborious

Advantages of face to face system

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

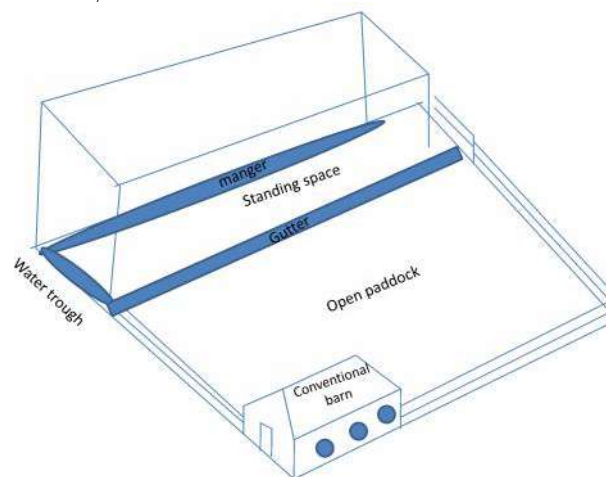
Housing at heavy rainfall areas:

The design of typical loose housing structure for the adult animals would be similar to general loose housing system except additional provision of covered resting area in one side of the paddock which will provide sufficient dry area for the animals during rainfall and provide protection against strong wind. The floor of the resting area should be slightly elevated from open

paddock and one side should be closed with brick wall which will work as wind break.

Temperate high altitude areas:

In temperate area, partially loose housing along with the closed conventional system of housing is desirable. In this system due attention is given to protect animal from heavy snow fall, rain and strong wind. Tail to tail system of conventional barn, completely roofed and enclosed with side wall is suggested with adequate provision of tying, feeding, watering and milking inside of the barn. Open paddock area with continuous manger in one side along with covered standing space is provided attached to the barn for housing during warm/comfortable weather. In addition, the following important aspects also need adequate attention while deciding about the housing structure for dairy animals.

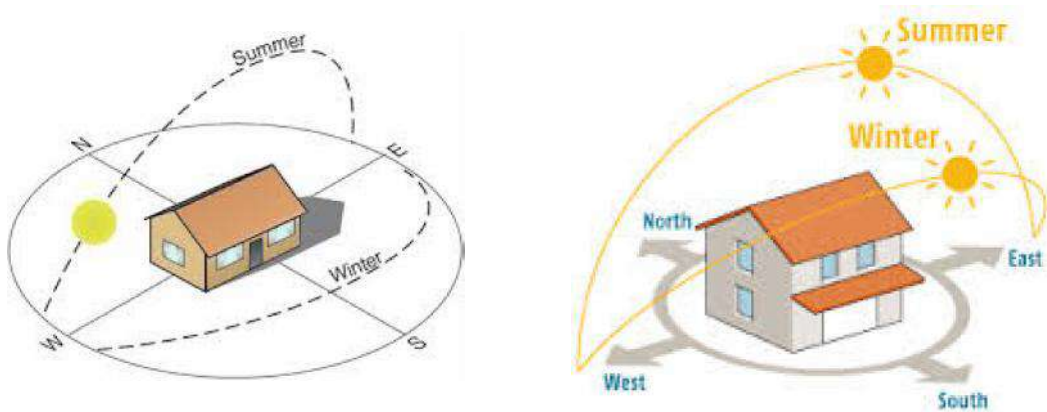


N.B: the same housing designed can be constructed in mid altitude region

Orientation of animal house:

In general, animal sheds are located with long axis east to west the paddock side facing the north to get direct sunlight during winter and to prevent entry of direct sunlight into the shed during other seasons. In deciding which orientation to build, the following factors need be considered:

-
- With the east-west orientation the feed and water troughs can be under the shade which will allow the cows to eat and drink in shade at any time of the day. The shaded area, however, should be increased to 3 to 4m² per cow. By locating the feed and water in the shade, feed consumption will be encouraged, but also more manure will be dropped in the shaded area which in turn will lead to dirty cows.
 - With the north-south orientation, the sun will strike every part of the floor area under and on either side of the roof at some time during the day. This will help to keep the floored area dry. A shaded area of 2.5 to 3m² per cow is adequate if feed and water troughs are placed away from the shaded area.
 - If it is felt that paving is too costly, the north-south orientation is the best choice in order to keep the area as dry as possible.
 - In regions where temperatures average 30°C or more for up to five hours per day during some period of the year, the east-west orientation is most beneficial.



Space requirement:

The Indian Standards Institution (ISI) has brought out certain standards of space requirement for farm animals. These standards are basically for loose housing.

Type of animals	Floor space requirement m ²		Maximum No. of animals/pen	Height of shed at cm
	Covered area	Open paddock		
Bulls	12.0	24.0	1	175 cm in medium and heavy rainfall and 220 in dry 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	
Old heifers	2.0	4.0	30	

Type of animals	Space per animal (cm)	Total manger length in a pen for 50 animals	Total water tank length in a pen for 50 animals	Dimensions of manger/tank(cm)		
				Width	Depth	height of inner wall
Adult cattle & buffaloes	60-75	3000-3750	300-375	60	40	50
Calves	40-50	2000-2500	200-250	40	15	20

Flooring materials:

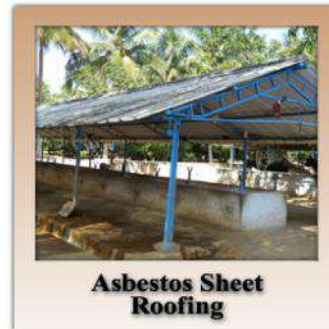
Different materials are used for animal house flooring. The choice depends on availability and cost of the materials. Commonly used materials are: cement concrete floor, vitrified paving bricks, stones, building bricks and gravel

Roofing materials:

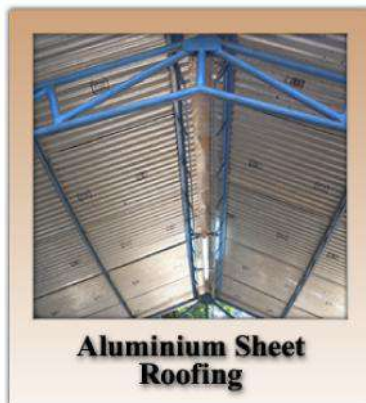
Different materials are used as roof covering. Careful selection of material is essential in tropical building to prevent the solar radiation. It is preferable to have material with low conductivity of heat. The commonly used roof materials are,



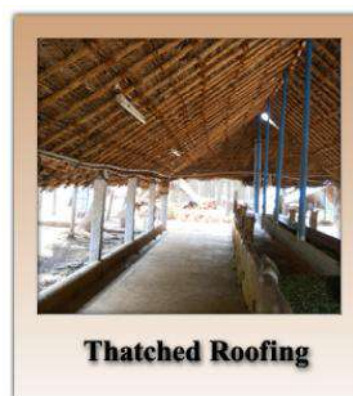
Tiles Roofing



Asbestos Sheet Roofing



Aluminium Sheet Roofing



Thatched Roofing

Sanitation in livestock housed:

Sanitation is another important point in managing the livestock house for eliminations of all micro organisms that are capable of causing disease to the animals. Dry floorings keeps the houses dry and protects from foot injury and breeding of pathogenic organism. Similarly the presence of flies and other insects in the livestock house not only , disturbs the animals but also spreads deadly diseases to the animals.

Sanitizers:

Sunlight is the most potent and powerful sanitizer which destroy most of the disease producing organism. Disinfection of animal sheds means making these free from disease producing bacteria and is mainly-carried out by sprinkling chemical agents such as bleaching powder, Iodine and Iodophor, sodium carbonate, Washing soda, Slaked Lime (Calcium hydroxide), Quick Lime (Calcium oxide) and phenol.

	Name of sanitizer	Composition and activity
1	Bleaching powder	- Called calcium hypo chloride. It contains upto 39 % available chlorine which has high disinfecting activity
2	Iodine and Iodophor	- Commercially available as Iodophores and contains between 1 and 2 % available Iodine which is an effective germicide.
3	Sodium carbonate	- A hot 4 % solution of washing soda is a powerful disinfectant against many viruses and certain bacteria.
4	Slaked lime and quick lime	- White washing with these agents makes the walls of the sheds and the water troughs free from bacteria.
5	Phenol	- Phenol or carbolic acid is very disinfectants which destroy bacteria as well as fungus

Insecticide:

Insecticides are the substances or preparations used for killing insects. In dairy farms, ticks usually hide in cracks and crevices of the walls and mangers. Smaller quantities of insecticide solutions are required for spraying. Liquid insecticides can be applied with a powerful sprayer, hand sprayer, a sponge or brush; commonly used insecticides are DDT, Gramaxane wettable powders, malathion, Sevin 50 % emulsifying concentration solutions. These are highly poisonous and need to be handled carefully and should not come in contact with food material, drinking, water, milk etc.

Procedure

- Remove the dung from the floor and urine channel with the help of a shovel and basket (iron) and transfer it to the wheel - barrow.
- Remove the used bedding and leftovers from the mangers in a similar way.
- Empty the water trough and scrape its sides and bottom with the help of a floor brush.

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

Conclusion:

Safety and ease in handling a comfortable shed for protection from weather and a provision for exercise are the key points while planning housing accommodation for the livestock. The response of the animal to its environment is complex both in its biological responses and in the description of the environment. Knowing the factors that cause stress to the animal in mid and high altitude will greatly help the manager to plan properly for the construction of animal's house.

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Chapter 2

Feeds and Feeding strategies for Dairy Animals

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The economic development of the farmers in most of the developing countries, livestock plays a vital role by providing its contribution through draft power, manure, fuel and fertilizers in addition to different animal product like meat, milk, egg, wool etc. Unlike western countries we are unable to provide cereals to our livestock and fed mainly on low quality roughages with natural grazing with supplementation of some agro-industrial by-products like cereal straws, sugarcane by-product etc which are deficient in protein, energy, minerals and vitamins. Sometimes, due to seasonal influences also the quality of grazing gets low and livestock productivity gradually declines.

An animal's diet must contain the essential nutrients in appropriate amounts and ratios for achieving proper maintenance and productivity. Feeding a balanced diet, avoiding over or under feeding with abundant supplies of cool and clean water will help to optimize feed and nutrient use on an animal, which also reflects on their productivity. The diets of ruminant normally consist mainly of fibrous plant material that requires prolonged chewing, fermentation and soaking before its nutrients available for digestion and absorption and their rumen acts as a huge fermentation vat where the fibrous plant materials processed for

digestion and broken down into a mixture of volatile fatty acids (VFA), that absorbed into the body. Besides, energy and protein their diets must consists of different types of minerals and vitamins to perform various vital activities and protect their body against diseases. However, a single feed ingredient cannot provide all the nutrients required for their body maintenance and productivity hence needs to provide a combination of different ingredients.

Feedstuffs available for livestock:

Various feed ingredients available for preparation of the animal feeds falls into two major categories namely roughage/forage and concentrates depending on their bulkiness and chemical composition. Though, no two feeding stuffs are alike in composition and characters, but in practical feeding, substitution of one feedstuff can be possible with another depending upon the nutrient composition, market price and availability in a particular region. Therefore, it is necessary to know the categories of the feed stuffs with in which substitution are justified for the feeds having same nutritional properties. The overall classification of animal feedstuffs can be done as follows-

A) Roughages: Roughages are bulky feeds containing relatively large amount of less digestible material i.e. crude fibre more than 18% and low (about 60%) in total digestible nutrients (TDN) on air dry basis. These are subdivided in to two major groups (succulent and dry) based on their moisture content. Succulent feeds usually contain moisture from 60-90%, where as dry roughages contain only 10-15% moisture. For the sake of convenience, succulent feeds are again classified into pastures, cultivated fodder crops, tree leaves, silage and root crops. Dry roughages are dried plant materials like straws, hays, stovers etc that's preserved for usage in scarcity or any unforeseen climatic conditions. Fodder tree leaves and root crops like turnip, tapioca, sweet potatoes etc are also used as green roughage for feeding dairy animals.

B) Concentrates: Are the feed or feed mixture which supplies primary nutrient (proteins, carbohydrates and fat) at higher levels but contains less than 18% crude fibre and more than 60% TDN. It can be classified as energy rich and protein rich concentrates. The crude protein is less than 18% in energy rich concentrates and more than 18% in protein rich concentrates.

Energy rich concentrates

includes cereal grains viz. Maize, Barley, Rice, Oats and the millets like Ragi, Jowar, Bajra etc, which are rich in carbohydrates. Mill by-products like bran (rice and wheat), flour, hull, polishing etc are also used as a part of concentrate mixture and are also included under this category. Besides, molasses, the by-products in sugar factories can be used in feeds as binding agent for pelletization which increases the palatability and energy contents of the diets.

Protein rich concentrates: Can also be sub-divided as follows-

- a) **Plant Origin:** The by-products after removing oils of plant origin are important plant protein supplements viz. **Oil seed cakes** like Ground nut, cotton seed, linseed, mustard, soybean etc. **Pulses** can also be used for livestock feeding, but cost is the barrier. Brewer's yeast and grains, by-products of wine industry etc can also be used as protein supplements.
 - b) **Animal Origin:** The by-products of slaughter houses like meat, blood and bones can be dried and made in to powders to be mixed in concentrate feeds.
 - c) **Marine Origin:** Dried fish, algae etc can also be used in livestock feeds.
 - d) **Avian Origin:** viz. feather meal, hatchery wastes etc are crushed and mixed in concentrate mixture.
- C) **Feed supplements:** These includes-

Mineral Supplements:

Based on the work done in India on the mineral elements profile in the feeds and fodder, ISI has recommended the mineral mixture for feeding of dairy cattle and poultry. Many mineral mixtures are marketed under different trade names. Generally salt, calcium carbonate, zinc sulphate and copper sulphate supplements improve production and reproduction.

Vitamin Supplements:

Various vitamin supplements for poultry, pigs and cattle are marketed in India under different trade names like Rovimix for cattle, Vit.AB₂D₃ for poultry etc.

D) Feed additives:

Several feed additives like hormones, antibiotics, enzymes, probiotics etc are also used now-a-days in livestock feed as growth promoter and to increase the milk secretion. Though recently in some parts some objections have been raised for uses of certain additives but no legislation has been passed on restricting their use in our country till date.

Feeding management:

For maintaining the better availability of nutrients from feed supplied to the animals many interventions like use of Feed choppers/chaff cutters, improved feed troughs, improved forages qualities etc were applied in India as well as other countries. To achieve better productivity of the animals balanced feeding is necessary and an imbalanced feeding may leads to overfeeding of certain nutrients whereas others may lacks. A balanced ration should provide protein, energy, minerals and vitamins from dry fodders, green fodders, concentrates, mineral supplements etc., in appropriate quantities to enable the animal to perform optimally and remain healthy whereas imbalanced feeding results in low milk production, poor growth and reproduction, milk production of animals lower than their genetic potential, excessive amounts of pollutants released into the

environment and lower profit to farmers. Overfeeding can be harmful to animals as well as the environment. Animals that become over conditioned or obese may be unproductive and at greater risk of health problems. Excess feed is often wasted and may remain in the feeding area, become contaminated, and end up in the manure pile. If all nutrients are in a perfect balance, then there will be no excess and no wastage. It is impossible for all nutrients to be in a perfect balance in commercial or practical diets, but we want to come close to meeting an animal's nutrient requirements. If the diet is balanced except for one underfed nutrient, then the entire production of the animal will be limited to the level of that "limiting nutrient" and all other nutrients will be wasted. If nutrients are overfed, or if feeding is mismanaged on an individual farm, this will result in more nutrients to manage in manure or as spoiled feed. While these nutrients can be applied to crop or hay ground to raise feed, it is important to try and keep this recycling loop as balanced as possible to avoid build-up of excess nutrients. Proper animal feeding and management practices can ensure that feed nutrients are not wasted, not overfed, and feed efficiency will be optimized on the farm.

Feeding of dairy animals:

The feeding of dairy animals could be divided into two stages i.e. pre-ruminant (up to three months) and ruminant (after three months) stage.

Pre-ruminant/Calves Feeding:

A well planned systematic feeding management of a calf is very much essential to optimizing the weight gain in adults because higher the plane of nutrition, the earlier is the onset of puberty, thus quicker the return on capital. The first two to three months of life is the critical period to achieve the objective. But at the same time they should not be too fatty, that's interfere with reproduction.

Feeding of any animal starts before its born and thus the expected mother needed to supply some extra nutrients providing concentrates at the rate of 0.25 percent of their body weight (Santra *et al.*, 2012). A little quantity of green fodders

should be fed during last two months of gestation so that the colostrums produced immediately after parturition become rich in Vitamin A.

Feeding schedule of calves from birth to 3 months:

The feeding of calves immediately after birth, should starts with colostrum, the first milk of mother as it is high in lacto-globulin that's provide antibodies to the calves. Besides, it is high in nutritive values and could provide a balanced feed to the calves. It has also laxative effects that help in removing the meconium (the first faeces). The high content of vitamins (A, D and E) and minerals (Ca, Mg, Fe and P) also helps the calf to resist infections. However, over feeding of colostrums may leads to calf scour. The colostrums may be substitute with the mixture of lukewarm water 275ml, one raw egg (55g), castor oil 3ml, whole milk 525ml fortified with 10000 IU of Vit A and 80mg of feed grade antibiotics in absent of dam or insufficient. The mixture should be fed at 40°C after proper mixing in one meal. Likewise, calf should be fed two to three times daily for three days (Reddy, 2003).

A major portion of the requirements for the pre-ruminant calves are met by whole and skim milk. After parturition, colostrums should be fed within first 1-2 hour of birth and is continued till 3 days of age. In commercial dairy farming, the calves should be weaned at 4th day and from 4th day they should be fed with the restricted amounts of dam's milk, which is high in nutritive value and could serve as almost complete feed for the calves. The whole milk should be fed to the calves @ 1/10th of body weight up to first 3 weeks, 1/15th of body weight up to 5th week and 1/20th of body weight with gradual tapering up to 60 days of age. After 60 days it is not necessary to feed whole or skim milk, but to be fed with calf starter with sufficient quantity of good quality green grasses or hays. The total quantity of milk (whole + skim) should not increase beyond 140 kg in 60 days time in case of hybrid calves. Milk diet must be supplemented with calf starter and little good quality hay from 10th days of age.

Table 1: Feeding schedule of calf from birth to 3 months of age

<u>Age of calf</u>	<u>Colostrums/ Whole milk</u>	<u>Calf starter</u>	<u>Good quality hay</u>
1-3 rd day	Colostrums @ 1/10 th b. wt	—	—
4-14 th day	Whole milk @ 1/10 th b. wt	—	—
15-21 st day	Whole milk @ 1/10 th b. wt	A little	A little
22-35 th day	whole milk @ 1/15 th b. wt	100 g	<i>Ad lib</i>
Up to 2 months	Whole milk @ 1/20 th b. wt	250 g	<i>Ad lib</i>
<u>2-3 months</u>	Little or no milk	500 g	<i>Ad lib</i>

* The schedule is satisfactory to produce a daily growth rate of 0.5kg in crossbred calves
Introduction of solid feeds (roughage/concentrates) at an early age in calf's diets helps in early

Introduction of solid feeds (roughage/concentrates) at an early age in calf's diets helps in early establishment of the microbial population and development of rumen, resulting in utilization of coarse fodders and Non-Protein Nitrogenous (NPN) compounds and can synthesis vitamin B and microbial protein from simple nitrogenous components at an early age (Reddy, 2003).

Methods of feeding milk:

The schedule quantity of boiled milk is to be fed at body temperature of the calf making into two halves (morning and evening) so that it reduces the chances of indigestion problem. Some feed grade antibiotics like Aurofac/ Terramycin may either be given with milk or mixed with calf starter. Calves may require little training during first few days after birth for consuming milk from pail, but afterwards they start consuming their quota quickly.

The whole milk may also be substituted with calf replacer which resembles milk in its broad chemical composition and biological value and fed to calf to replace milk from the economic point of view. This can be practiced immediately after colostrums feeding. The amount of milk replacer is gradually increased with a simultaneous decrease in the amount of whole milk. Milk replacer is usually fed in the gruel form and it is based on skim milk powder which usually comprises at least 50% of the total dry matter.

Feeding calves from three months to maturity:

From third month onwards, cultivated green grasses can be given @ 2kg per day, raising the quantity to 5-10 kg at 6 months of age. Concentrate mixture containing 16% DCP and 70% TDN may be offered @ 0.75 kg, 1 kg and 1.5 kg per calf during 4th, 5th and 6th months of age. The quantity of concentrate mixture is to be adjusted depending upon the quality and quantity of forage offered. The calves can be maintained on high quality roughage ration plus a minimum amount of concentrate so as to affect economy in maintenance.

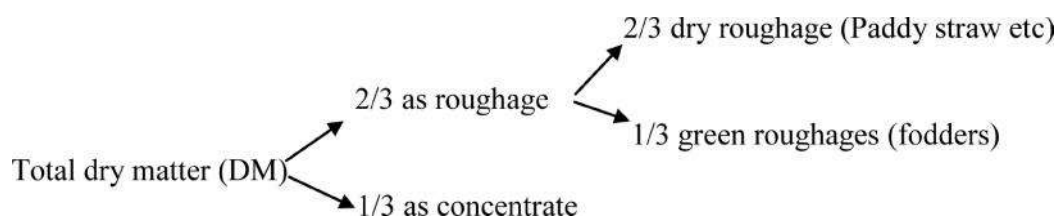
After 6 months of age, individual feeding of calves may be discontinued and the males and females should be kept in separate paddocks and their feeding should do accordingly.

Assuming a daily body weight gain of 0.45 kg from the 6th to 24th month of age (Maturity age in indigenous breeds), 2 kg concentrate mixture with 16% DCP and 70% TDN and 15-20 kg of green fodder should be provided to each calf. If leguminous folders are available in plenty, then the amount of concentrate mixture can be reduced to 1 kg per day. When the main roughage is a straw or stover, 2.5 kg of concentrate mixture should be given daily to calves of 6 months to 1 year of age and up to 3 kg for older growing stock. Buffalo calves are generally heavier than cattle calves of the same age. So this fact has to be kept in mind while formulating ration, and feeding schedule should be adjusted according to their body weight and age. Young males to be used for draught purpose can be fed solely on green foddors and hay from 1 year of age. To induce rapid growth rates fattening calves reared for meat purpose should be fed on rations that's contain at least 50% more DCP and TDN than in growing ration.

Feeding of adults:

The daily feed requirements of an individual animal in 24 hours i.e. ration may be given in a single or in portions at intervals. In computation of ration for dairy animals prime consideration is to be ascertaining to meet up the total requirement in terms of dry matter, digestible protein (DCP) and energy (TDN)

for 24 hours. The requirement of the quantity of dry matter depends on the body weight of the animal and also with the nature of production. In general cattle eat daily 2.0 to 2.5kg dry matter for every 100kg live body weight and the whole dry matter allowances should be divided as follows:



Feeding of dairy cattle and buffalo by thumb rule:

Avoiding the difficult calculations for feeding dairy animals on the basis of their dry matter, digestible protein (DCP) and energy (TDN) requirements, farmers can apply a thumb rule to feed their dairy animals satisfactory, in which they should prepared a **concentrate mixture** first in such a way that 3.5-4kg of it can support 10kg of milk production when fed over the maintenance ration. The mixture may be composed of crushed maize 40-50%, Wheat/rice bran 15-20%, Oil cakes 30%, Mineral mixture 2% and salt 1%. Generally this concentrate mixture should contain 14-16% DCP and 68-72% TDN. The dairy animals can be fed according to their body requirements as follows-

i. Maintenance ration:

Feed stuffs	For Local/Zebu cattle	For crossbred Cattle/ Buffalo
a. Hard grain mixture	1-1.25kg	2.0kg daily
b. Paddy/wheat Straw	4.0kg	4.0-6.0kg daily

ii. Extra allowances during pregnancy: During the last trimester of pregnancy, an extra 1.25 and 1.75kg concentrate is recommended for zebu cattle and crossbred, respectively.

iii. Extra allowances for milk production: An additional amount of 1kg concentrates for every 2.5kg of milk yield over and above the maintenance

requirements in case of zebu cattle (4% fat) or 1kg concentrate per 2.0kg of milk yield in case of buffaloes (6% fat).

In addition for pregnant and milk producing animals, sufficient quantity of green grasses should be supplied as per their consumption limits. So, on the basis above, the whole dairy stock have to be divided by the farmers and prepared the required quantity of concentrate feed taking care of sufficient storage of paddy straws and green grasses. Besides, some special attention should also be given in feeding of high yielding dairy animals especially during pregnancy and lactation.

Feeding of pregnant dairy animals:

Pregnant animals after 6 months of pregnancy (last trimester), as it is the active growing period of the foetus inside (about 60% growth occurs during the last 3 months of pregnancy) needs special feeding called “**steaming up**”. It means feeding of extra amount of concentrates to pregnant animals to meet the heavy demands of un-burned foetus. During this period the cow is generally in dry condition and should build up the body reserves lost in early lactation and there should be regeneration of mammary tissues. During this period, body weight of the cow should be increased by 20-30 kg, to enable the animal to with stand the stress of parturition and to maintain the persistency of milk production during the subsequent lactation. In this method, dry pregnant cows are offered extra quantities of concentrates which increase gradually during the last 6 week of pregnancy. Normally 50% of DCP and 25% of TDN of the maintenance requirements are fed above the maintenance requirement and to cover these nutrients 1-1.5 kg of additional concentrate mixture over the maintenance ration should be fed.

Feeding pregnant heifer:

Under standard farm practices, heifers conceive at the age of active growth i. e. at 15-18 months. Therefore nutrient is required both for growth of foetus as well as for the heifer itself. Cereal forage or a mixture of leguminous fodder and straw at 1:1 ratio on DM basis or 7:1 ratio on fresh basis should be fed

ad libitum supplemented with 1 kg of concentrate per day. In the last 2-2.5 month of gestation period an extra 2-3 kg concentrate may be fed for normal growth of the foetus as well as the heifer. During the last 3 days prior to calving the amount of concentrate mixture should be reduced and a little warm bran is to be fed to keep the animal in laxative condition before calving.

Conclusion:

The requirements of different nutrients of dairy animals depends on their species, sex, age, stage of growth and production etc and although no single feed ingredient could provide all the nutrients required for them in spite of lots of region specific feed ingredients available all over the world. However, their feeding should always aim to provide a balanced diet with abundant supplies of clean and fresh drinking water so that they could get sufficient nutrients as per their requirements. Their rations must be adjusted according to their age, body weights and to achieve optimum productivity.

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Chapter 3

Livestock Health Management Practices

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Agriculture forms prime income source for the regional farming communities, while livestock sector act as secondary agriculture that supports good income source for small and marginal farmers of the district. As majority of farmer's rear animals under traditional system, there is high risk of outbreak of several diseases that in turn results in poor production and productivity of livestock.

There are several diseases that affect the livestock and causes decrease in production and productivity in the sector. In this chapters some important Viral, Bacterial and Parasitic diseases which commonly affect the livestock are discussed below.

Viral Diseases:

1. Foot- and- Mouth Disease (FMD): Foot and mouth is a contagious viral disease occurring in all cloven footed animals.FMD is rarely a fatal, except in case of very young animals, which may die without showing any symptoms. Dairy cattle are the most severely affected, showing a fall in milk yield, abortion, sterility etc. Incubation period of the disease is usually 3 to 8 days.



In the beginning of the disease, it is characterized by formation of vesicular lesions, followed by erosions of epithelium of the mouth, noses, muzzle, feet, teats and udder. In early stage, a rise in temperature is noticed and the animal is dull and off its food, sudden drop in milk yield. Blisters formation, usually within a few hairs, most frequently on the upper surface of tongue, pain in feet, separations of hoof at the junction of coronary hoof border is also marked. If the mouth is examined, in early stages, blisters on the dental pad inside the lips, and sometimes on the muzzle, will be found, as well as there on the upper surface of the tongue.

Preventive Measures:

- Mouth lesions should be washed with alum solution, or a potassium permanganate. Lesions of the legs may be washed with phenyl. If the lesions are affected with maggot, oil turpentine or dressol in swab application may kill the maggot.
- Milk for human use from affected cows should be boiled before use.
- Regular vaccination of animals with proper vaccine and dose.

Vaccination Schedule :

Strains - O, C, A-22, Asia-1.

Dose - 3 ml S/C for cattle, buffaloes and calves

1 ml S/C for sheep, goat

Primary vaccination - 4 months of age.

Booster vaccination - 3 weeks after primary vaccine

Re-vaccination - Every nine month after booster

2. Vesicular Stomatitis:

It is an infectious viral disease of bovines, horse and pig caused by Rhabdo virus. The virus is transmitted through some vector like flies, mosquitoes etc.

Incubation period is 24 to 48 hours.

The disease is not fatal. Lesions are found in the oral of tongue, dental pad; Fall in milk production.

Preventive Measures:

Antiseptic mouth wash with potassium permanganate dilute 1 in 1000

3. Rabies: It is a highly fatal, infectious viral disease of mammals most often transmitted through the bite of a rabid animal. Transmission of rabies virus usually begins when infected saliva of a host is passed to an uninfected animal.

The disease occurs in furious and dumb form. In the furious form, increased nervousness, elevated body temperature and animal is excitable and attempts to bite everybody. There may be clamping of jaws, dribbling of saliva and in dogs number of barks changes into a definitely high tone bark. In dumb form there is increasing paralysis of limbs and a far in off look the eyes. Paralysis of jaw muscle, dribbling of saliva.

Clinical symptoms of sheep is very similar to that of cattle who suffer with incoordination, axorixia, trembling, low production, salivation, grinding of teeth, hallowing, vocal cord paralysis. Affected goats are commonly aggressive, and continuous bleating is common. Mostly horses are lacking in distinctive nervous initially, but include to paralysis forum of disease.

Control Measures:

There is no treatment for rabies after symptoms of the disease appear. However, rabies vaccine that provides immunity to rabies when administered after an exposes (post-exposure prophylaxis) or for protection before an exposure occur (pre-exposure prophylaxis).

First vaccination is given at 3 months age, followed by booster after 1 month, then annually pre-exposure prophylaxis consists of three doses of rabies vaccine is given on days 0, 7 and 21 or 28. Booster should be given annually. In addition, after a bite of rabid animal, wash the wound thoroughly with soap and water, and apply antiseptic dressing.

4. Blue Tongue:

It is an infection viral disease of sheep but occasionally cattle and goat are affected. In cattle; the disease mostly remains subclinical form. The disease is

characterized by high fever, catarrhal inflammation of the buccal neuron membrane and nasal mucous membrane; lameness due to inflammation of the coronary bands and sensitive laminae of the feet. Stress factors like lower plane of nutrition, worm burden, inclement weather, fatigue due to transportation etc., have been found to be conducive factors for high susceptibility to infection.

Control Measures:

- There is no specific treatment after the symptoms occur, but antiseptic should be given through parenteral route to check secondary bacterial infection. Localized lesions may be treated with topical antiseptic preparations.
- Prevents exposure to insect vectors by spraying repellents in animal at night and avoidance of low, marshy areas are recommended as prophylactic measures.
- Vaccination is the satisfactory method to control.

Bacterial Disease:

1. **Anthrax:** Acute widespread infectious disease of herbivorous animal (cattle and sheep) caused by bacteria *Bacillus anthracis*. Other animals like goats, horse, pig may get the infection. This is a zoonotic disease and has occasionally been recorded in dogs. This disease is also known as splenic fever due to extensive enlargement of spleen.

Symptoms:

There is elevation of body temperature (104° to 108°C). Animal refuses to eat and there is development of bloat, muscular tremor, distressed breathing, extreme dyspnoea leads to mouth breathing. Oozing of blood from all the natural orifices. The blood used to contain significant number of anthrax bacilli. Death usually takes place within 48 hours. Subacute form characterized by oedema. In anthrax carcass decomposes rapidly with formation of gas and distension of abdomen. Blood is dark red or black in appearance and does not clot rapidly. Due to lack of oxygen the blood is dark in colour. Animals that die suddenly with

bloody discharges from mouth, nostrils, anus must be suspected to have died in anthrax.

Control Measures:

- The anthrax infected carcasses should not be opened.
- The fodder from infected pasture should be destroyed and not to be given to the susceptible animals.
- The strict quarantine arrangement should be made in the anthrax prone areas
- Care should be taken to destroy the dead body by deep burial with lime.
- The adjacent areas of the dead and infected animals should be thoroughly disinfected by applying 3% per acetic acid or 10% caustic soda or 10% formalin 3% per acetic acid is considered as an efficient sporicide
- Persons handling the anthrax infected animals should adopt adequate sanitary measure for their own safety.

2. Mastitis:

Mastitis, term which denote inflammatory condition of the udder. It is characterised by physical, chemical, microbiological changes in the milk include change in colour, change in consistency and presence of abnormally large number of leukocytes. It is recognised one of the most costly disease affecting dairy cows. All breeds of dairy cows, buffaloes, goats, sheep, pig, horse are susceptible. High yielding cows are more commonly affected than low yielders. Large no. of species of microorganisms are responsible as cause of mastitis. They are bacteria, fungus, mycoplasma and virus.



The affected animal shows a very high rise in temperature (106-108⁰ F), remain off fed. The udder is swollen and extremely painful. There is cessation of milk secretion and exudates are often blood stained. In acute form systemic reaction are not seen. Milk may be replaced by yellow or brown fluid with flakes or clots. Chronic mastitis is the terminal stage of disease. Udder becomes hard

due to fibrosis. The supra mammary lymphnodes become palpable. The quarter may become thickened, firm, and nodular. Milk appears as yellowish fluid or white with clots and flakes.

Treatment:

- Isolation of the affected animal should be made from rest of the herd.
- Intra mammary antibiotic preparation should be used for local treatment
- Hot fomentation- Fomentation with magnesium sulphate is done to relief inflammation.
- Drugs used as intramammary infusion
 - Pendistrin- SH(penicillin, streptomycin)
 - Nefuran- Intramammary(Nitrofurazon, Furazolidine)
- Vaccines- An autogenous bacterin against *staph.aureous* has been used when the infectious organism is highly antigenic. But, in general vaccination so far is of little value in controlling mastitis due to diversity of bacterial strains and their antigenic properties.

3. Black Quarter:

Acute infectious but not contagious disease of cattle, goat and sheep. The disease is characterized by developed of focal gangrenous and emphysematous myolitis. The disease produces severe toxemia with a very rapid course and high mortality. Black quarter is caused by *clostridium chauvoei*. Cattle is the most susceptible host but the infection may spread to other animal due to traumatization of the muscles. The incubation period is 2 to 5 days. In cattle, first symptom is a rise of temperature, which may be as high as 106°C or 108°C. The appetite is lost and there is stiffness or lameness of the limb. Most commonly the lesions are located on the thigh, buttocks, shoulder, necks and more rarely in the intermandibular space or in the tongue. Swellings are hot and painful in the early stage and become cold and painless



latter. The muscle tissues are swollen, dark in colour and turn dry. On pressure swelling emit crackling or crepitation sound due to emphysema. In sheep, there is extensive haemorrhagic oedema in the sub cutaneous tissues following a wound, Muscles of shoulder, thigh and neck are usually affected. Large crepitating swelling with most characteristics necropsy findings. Affected muscles are infiltrated with yellowish exudates was bubbles accumulate between the muscle fibres. Due to haemorrhage affected tissue turn black. Aromatic odour emanates from the muscle.

Treatment:

Satisfactory response has been reported from the use of penicillin, aureomycin and oxytetracycline. Penicilline is extensively used and considered as a drug of choice.

Control Measures:

- The dead body should be burnt or buried.
- The calf and sheep should not be allowed to graze in endemic pasture.
- All the animals of the endemic zone should be vaccinated with suitable vaccines.

4. Haemorrhagic Septicaemia

It is an acute contagious disease of bovine caused by *pasteurella multocida* and *pasteurella haemolytica*. The term pasturellosis was referred to designate an acute septicaemia disease occurring most often in cattle, buffalo, camel, sheep, goat and pig.

Infection is mainly by ingestion of contaminants food, water etc. Infection may be introduced by introduction of carrier animals into the herd. Incubation period is 2 to 5 days. Onset of the disease is marked by high rise of temperature. There is dribbling of saliva, thick discharge and membrane became deep red. Swelling appears in the dewlap, in the throat between maxilla pulse rapid, respiratory distress, liquid stool mixed with mucous. In the region of head, neck and throat there is swelling due to sub cutaneous oedema consisting of gelatinous

material. All the lymphatic glands are swollen and haemorrhagic. Muscles may be oedematous.

Disease can be diagnosed from the symptoms. Culturally the organism can be cultivated in blood agar from heart blood or from tissues.

Treatment:

Injection oxytetracycline or tetracycline 2mg per 1b body weight is highly effective.

Control Measures:

The effective control lies with institution of adequate management rational executions of vaccines and care in the transportation of animals. Adopt a programme of compulsory annual vaccination of all animals in areas, including those of livestock farms, to be carried out a month or two before the onset of monsoon.

All the bovines should be vaccinated before monsoon.

Parasitic Diseases :

1. **Fascioliosis**- *Fasciola gigantica* and *F. hepatica* occur in buffalo, cattle, sheep and goat and are considered to be one of the most economically important parasites of Indian livestock. The developing young parasites move around in the tissues of the liver doing extensive damage before settling down in the bile ducts as adults. The infection produces inflammation, fibrosis, cirrhosis, blockage of the ducts etc. Secondary infection or concomitant infections are very common and apparently several pathogens already present become very active when liver fluke is also present.

Symptoms:

The animals becomes inactive and shows distended abdomen, ascites, anaemia, anorexia, diarrhoea, loss of weight.

Diagnosis:

Initially no clinical signs appear, but these may be similar to those to other helminthic infections. The faeces should be examined for the presence of eggs.

The eggs have yellowish green colour as compared to the almost colourless eggs of amphistomes which they otherwise resemble. Several immunodiagnostic methods are also available.

Treatment :

- Carbon tetrachloride is still in use because of its efficacy and low cost, though it can be very toxic and even lethal. The dosage by oral route is 1-2.5ml to sheep and goat, 5-10 ml to cattle and buffalo.
- Hexachloroethane is given as a single dose orally @ 175-200 mg/kg. It should be mixed with bentonite.
- Albendazole are also effective.
- Hexachlorophene is given @ 15-20 mg/kg either subcutaneously as oily mixture or orally.

Control Measures :

It can be controlled in 3 ways

1. Prevention of infection
2. Treatment of infected stock
3. Control of wild mammals that serve as reservoir hosts.

Since the livestock acquires infection by eating the vegetation on which the metacercariae are present, the animals should be prevented from grazing low lying areas, as also on the banks of ponds and slow moving shallow rivers and streams.

2. Ascariasis: Ascarid worm are very host specific. Different species of *Ascaris* affect the specific hosts like *Ascaris swum*-pig

Parascarisequorum-Horse, Zebra.

Toxocaravitulorum- Buffalo and Cattle

Tocaracanis-Dog and fox

Toxocaravitulorum is an important cause of mortality in buffalo calves. In pigs and horses the only route of infection is by ingestion of larvated eggs. As

ascaris eggs are very resistant and can overcome winter. Pigs and horse may in the absence of good hygiene become infected at all period of the year. In older animals no clinical signs are observed but infested animals continue to contaminate their surroundings and are important link in the chain of infection.

T. vitulorum and *T. canis* are present in greatest number in the colostrums. So if the dam is not properly dewormed colostrums may be a potent source of infection to the calf and pups.

The clinical signs of ascariasis in pigs depend on the severity of the infection. Young pigs are mainly affected. Newborn pigs which heavily infected show signs of pneumonia, specially cough and exudates in the lungs. Heavy infections with adult worms produce diarrhoea and this having a marked effect on growth rate. The adult parasites in the intestines cause catarrhal enteritis which produces diarrhoea which may be foetid in odour and pale in colour. Important clinical sign of cattle and buffalo are diarrhoea and emaciation. Infected calves in their breathing emit butyric acid odour. In dog, affected animals are pot-bellied or the abdomen is tucked up. There is usually emaciation, anaemia, restlessness and diarrhoea or constipation. Diagnosis can be done from clinical signs or examination of faeces for presence of ascaris eggs.

Treatment:

- Piperazine compounds are widely used for the removal of ascarids in swine at the dose rate of 100-200mg/kg body wt.

Control Measures:

- Thorough cleaning and disinfection of the maternity stall after each foaling.
- Frequent disposal of faeces from the stable is most important because this is the source of infection.
- Weakly removal of manure from the pasture.
- Drinking water and feeds should not be contaminated with faeces.

2. **Amphistomiasis:**

Amphistomiasis is an important pathological condition particularly of ruminants caused by migrating paramphistome flukes. Outbreak occurs more commonly in drier months, immediately after heavy rains or flood. All ages of cattle, sheep, goats and wild ruminants grazing near water or land liable to flooding may be affected but younger animals are more susceptible than the older ones, persistent foetid diarrhoea, depression, dehydration and anorexia followed by sudden frequent death are the important clinical signs. Animals become very thirsty and drink frequently, submaxillary oedema and pale mucous membrane.

Treatment:

- Two doses of oxclozanide 18.7 mg/kg body wt. two days apart give consistent result against immature paramphistome in cattle.
- In areas where paramphistomes are regular problem, a treatment between the seasonal peaks in the availability of metacercariae will reduce the number of eggs falling on the pasture and hence minimise the opportunity for snails to become infected
- During an outbreak it is essential to remove animals from the infected pasture. Discourage grazing on green pasture surrounding tanks, ponds, pools and bank of river and the animal should be restricted on high lands particularly in amphistome prone areas.

3. **Tapeworm Infestation:** Ruminants and horses are infested mainly by cestodes common tapeworm of ruminants are *Moniezia expansa*, *Moniezia benedine*, *Stileria hepatica*. Animals get infected when they accidentally swallow the infested mites while grazing the pasture. The mature tapeworms develop inside the primary host. Calves, kids, lambs below 6 months of age exhibit changes in the organs. Digestive disturbances including constipation, mild diarrhoea, dysentery.

Treatment:

- Praziquantel @ 3.75 mg/kg b. wt. is highly effective against *Moniezia spp.*

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- Some benzimidazole compound such as albendazole, fenbendazole, mebendazole, oxbendazole are effective in ruminants.
 - Number of the mites can be reduced by thorough ploughing of permanent pasture and residing.

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Chapter 4

EMBRYO TRANSFER TECHNOLOGY IN ANIMALS

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With the ever increasing demand of the milk and milk industry, technology has also grown to a level of excellence for meeting the requirements of such demands. With the advancement of science and technology, newer and newer approaches are being made for the production of such livestock that would be able to compensate such growing demands. Among such production technologies *in vitro* maturation and embryo transfer technology (ETT) may be said to have taken an upper hand and thus paving a way for the development of the 'Animal Husbandry' sector.

In animal husbandry, breeding and selection for special phenotypic characteristics or superior performances has been conducted by the humans for many years leading to the development of several artificial reproductive technologies (ART). For the veterinarian ARTs like artificial insemination, ETT including superovulation and oestrus synchronization, *in vitro* production and manipulation of embryos including production of transgenic embryos and chimera, oocyte recovery and oocyte transfer. In this regard cryopreservation of oocytes and embryos plays a vital role in production of offspring using such technologies.

Embryo transfer technology is the most advance technique in animal biotechnological research, and it has attained such perfection that it can now be

used on a commercial scale. ETT is the transfer of embryos from one female (donor) to another (recipient) and is a useful tool when it is desirable to separate fetal and maternal genetic effects. Such procedures are useful under some circumstances to produce offsprings from females which able to produce fertile gametes but are not able to carry a pregnancy to term. Interspecies ETT may provide an avenue for propagation of endangered species and lessen the risk of new disease organism being introduced into the herd by bringing in embryos that develop to term *in-uteri* of females already in the herd.

A female animal has a natural ovulation pattern. But in some animals, particularly in cattle, sheep and horses, there is a physiologically low ovulation rate. Thus to increase the ovulation rate of the females of such species a treatment is intended by the use exogenous gonadotropic hormones. Such treatment is called as superovulation and is intended to increase the ovulation rate as well as the number of available oocyte in the female donor animal without disrupting the physiological and endocrinological processes associated with oocyte maturation, ovulation, fertilization and embryonic development.

The different hormones used for superovulation are pregnant mare serum gonadotropins (PMSG), follicle stimulating hormone (FSH) and crude pituitary extract containing both FSH and luteinizing hormone (LH). In a variable dose rate in some animals use of these hormones between 3-5 days prior to oestrus leads to a considerable increase in the ovulation rate, but in some species this response is unpredictable due to refractile nature of the species. In addition to the health and physiological status of the animal, factors like genetic variability, variable potency of commercially prepared hormones etc. are also responsible for increasing or decreasing the ovulation rate. The use of prostaglandin (PGF) and its synthetic analog in the luteal phase of oestrus cycle for synchronization of oestrus in animals has largely helped to overcome the variable superovulatory response in animals. But repeated injection of the hormone (in large scale superovulatory programme) should be avoided in order to prevent the

development of antibody in the donor female.

After the superovulatory regime, the donor animal shows normal oestrus and at this time she should be allowed to breed naturally or, inseminated by artificial method. The ovulated animal usually shows ovulation for an extended period of time, and thus she should be inseminated twice 12-24 hours after signs of oestrus are shown.

Following superovulation, the embryos are recovered from the donor animals using surgical (like midventral laparotomy) or, non-surgical technique. In small animals like sheep and goat, surgical method is the method of choice, but in large animals both the methods are equally effective. However, considering the pre and post operative preparations, care, treatment and expenditures, non-surgical method is the method of choice in large animals under farm conditions, when collection is desired on commercial basis. In different animals, there is difference in the time of migration of the fertilized ova from the fallopian tube to the uterus of the donor animal. Thus the exact time of embryo collection is different in different animal. For a successful embryo collection from a donor animal, knowledge of the reproductive cycle and its associated terms/conditions should be well known by the collector.

The embryo from the donor animal is then collected (by an expert) in a collection media and after it's appropriate processing, the embryo is transferred to the recipient animal. Before transferring of the embryo, the recipient too, like the donor is synchronized with exogenous drugs like $\text{PGF}_2\alpha$. One important point to note here is that certain requirements with regards to parity, age, fertility, temperament etc. of the recipient animal is to be considered before the embryo is transferred into her body. If the embryo is to be transported to a long distance (before transferring it into the recipient), or, if it is to be transferred later, then cryopreservation (-196°C) technique is used taking into consideration the other prevailing factors and conditions. The transfer of the isolated embryo in the uterus of rabbit for transportation is also possible.

After successful transfer of the embryo into the recipient's body, the embryo is allowed to develop to term after which the young animal is delivered either normally or through surgical method.

With the advancement in science and technology, now-a-days, it is also possible to know the sex of the embryo isolated from the donor animal. This pre-sexing is done either by cytogenic or by immunogenic method. Splitting of the embryo at certain stage of its development is also now possible, which (the splitted embryo) when transferred to the recipient mother produces identical twins in the recipient mother.

In addition to these, expression of a desired characteristic into the developing embryo can also be done by the production of transgenic animals, where the specific gene of interest is injected in the nucleus of the embryo isolated from the donor animal. Such embryos when develops to term in the recipient's uterus, the offspring expresses the character of the gene transferred. Thus ETT has emerged out to be a useful technique in order to preserve important genetic material in outbreak of serious diseases, for conservation of germplasm, to introduce new breeds with desired traits, for commercial breeding purpose, for movement of livestock at the embryo level, for research purposes etc.

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Chapter 5

Preparation of value added product (Paneer) from Cattle Milk

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In the district, there is immense demand for milk and their byproducts. Addition to this we have adequate numbers of indigenous cattle, where cattle milk is not consumed by local tribes (Idu –Mishmi) due to religious taboo. Hence, there is lot of scope for utilization of milk to prepare value added products. One of the best & highly preferred products of milk in the local market is Paneer, which can be used as a vegetable and in preparation of various kinds of snacks.

Method of Preparation

For preparation of paneer, hot milk is added with citric acid at the rate of 1.2-1.5g/l for coagulation. The mixture is thoroughly stirred and then curdled material is poured on the muslin cloth. Later, excess water is removed by pressing for about 30 minutes with a heavy material. The Paneer thus obtained is further cooled by keeping in cold water of 6-8^oc temperature and stored in water till further use. Water should be changed daily to avoid further fermentation process. Finally it is cut in required shape and size for further use.

Ingredients Required

1. Milk -1 litre
2. Citric acid/Lemon juice- 1.2-1.5 gms

Materials Required

1. Spatula
2. Steel Pan
3. Muslin Cloth (for straining)

Steps involved in Preparation

Milk
↓
Boil sufficiently
↓
Add citric acid/Lemon juice
↓
Stirr thoroughly
↓
Curdle material is poured to the muslin cloth
↓
Tie and Press curdle material with a heavy material
↓
Keep curdle material for 30 minutes
↓
Keep in/Store in cold water till further use.

PHOTO GALLERY



Pouring of curdle material to the muslin cloth



Tie and Press curdle material with a heavy material



Prepared Panner Product