Principles of Livestock Production and Management

(DIPLOMA IN AGRICULTURE)

COURSE NO: LPM 2.1, CREDIT HOURS: 2 + 1 = 3

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SYLLABUS
LPM 2.1: Principles of Livestock Production and Management
Credit hours: 3(2+1)

THEORY
- Domestication and utility of farm animals and their role in Indian economy.
- History and Importance of co-operative movement of dairy sector in India.
- Animal husbandry methods in India.
- Common terms pertaining to different species of livestock.
- Utility classification of breeds of Indian cattle. Familiarization with cattle, buffaloes, sheep and goat breeds of Gujarat.
- Common feeds and fodders, their classification and utility.
- Preservation and storage of fodder/forage as silage, hay and haylage.
- Reproduction in farm animals (Ruminants).
- Housing principles, space requirements for different species of livestock (Ruminants).
- Management of calves, growing heifers, dry and pregnant animals and milch animals.
- Prevention (including vaccination schedule) and control of important diseases of livestock.

PRACTICAL
- Study of external anatomy of cattle and its importance in selection.
- Judging and Pairing of bullocks.
- Measuring and weighing.
- Use of common restraints used in different animals.
- System of identification of livestock.
- Determination of age of cattle.
- Methods of securing and casting of animals.
- Identification of common feeds and fodders.
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CHAPTER 1
DOMESTICATION AND UTILITY OF FARM ANIMALS AND THEIR ROLE IN INDIAN ECONOMY

Origin of Livestock:
Livestock are domesticated animals raised in an agricultural setting to produce commodities such as food, fiber and labour. Livestock are generally raised for profit.

Animal Husbandry is a component of modern agriculture. It can be defined as an art and science of keeping or raising the domesticated animals most profitably or economically. It also includes handling and marketing of livestock and livestock products. It is said to be an art because skill is required in sound application of basic principles of animal sciences, viz, breeding, feeding, housing, management and health care of animals in a perfectly suitable manner to a particular situation.

Mammals: Cattle, buffalo, sheep, goat, pig, horse and camels.

Avian: Poultry

Mammals are the animals in which the females possess paired mammary glands which secrete milk for nourishment of their young ones. Mammals are viviparous as they give birth to fully developed young ones whereas, Aves are the birds, which possess paired wings for flying and are oviparous i.e. egg laying. Mammals and birds have originated from reptiles by evolution. Evolution is defined as a gradual process of development of modern species of plants and animals from their earlier primitive forms by:
(i) Hereditary transmission of slight variation in successive generation (from generation to generation).
(ii) Mutation
(iii) Natural selection

All types of mammals and birds have originated/evolved from reptiles by evolution. Evolution took place 7 crores years ago. Hoofed animals (ungulates) were evolved before 4.5 to 5 crores years. Mammals and Avian class animals are better suited to terrestrial life than any of other class of vertebrates.

Domestication of Livestock:

Domestication: Making the animals to adopt their life in intimate contact with human beings and that too for their benefit. The benefits men derive from animals include food, fertilizer, fuel, cultivation, transport, protection, sports and games etc.
Advantages of Domestication:
(i) Nomadic life: Prior to domestication of animals, man was living nomadic life. Domestication of animal helped man to live settled life. It leads to the establishment of small villages which later on developed into towns and cities.
(ii) Land management: The grazing of livestock is sometimes used as a way to control weeds and undergrowth. For example, in areas prone to wild fires, goats and sheep are set to graze on dry scrub which removes combustible material and reduces the risk of fires.
(iii) Animal proteins and dairy products: It helped in easy and assured supply of animal proteins. Animals convert grasses and fodders into milk and meat. Mammalian livestock can also be used as a source of milk, which can in turn easily be processed into other dairy products, such as yoghurt, cheese, butter, ice cream, kefir, and kumis.
(iv) Woolen clothes: In cold countries people started domestication of sheep and started preparing clothes from wool. Livestock produce a range of fiber/textiles. For example, sheep and goats produce wool and mohair; cows, deer, and sheep skins can be made into leather and bones, hooves and horns of livestock can be used.
(v) Transport: Domestication of horses and camels helped in speedy movement of men.
(vi) Motive Power: Animals like bullock, horses and camels became the source of motive power to perform various agricultural operations like transport, cultivation, irrigation etc.
(vii) Mastery over environment: Domestication also helped man in getting mastery over environment and utilize the available resources.
(viii) Fertilizer: Manure can be spread on fields to increase crop yields. This is an important reason why historically, plant and animal domestication have been intimately linked. Manure is also used to make plaster for walls and floors and can be used as a fuel for fires. The blood and bone of animals are also used as fertilizer.
India’s Mega Diversity of Livestock:
Several species of domesticated animals have originated here. The genetic diversity within these species is astonishing. Some examples are:

<table>
<thead>
<tr>
<th>Animal</th>
<th>Breeds</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cattle</td>
<td>26</td>
</tr>
<tr>
<td>Goats</td>
<td>22</td>
</tr>
<tr>
<td>Sheep</td>
<td>40</td>
</tr>
<tr>
<td>Poultry</td>
<td>18</td>
</tr>
<tr>
<td>Buffalo</td>
<td>8</td>
</tr>
</tbody>
</table>
The Beginning of Animal Husbandry:
Animal-rearing has its origins in the transition of cultures to settled farming communities rather than hunter-gatherer lifestyles. Animals are ‘domesticated’ when their breeding and living conditions are controlled by humans. Over time, the collective behaviour, life cycle, and physiology of livestock have changed radically. Man in Old Stone Age (10000-8000 B.C.) made no attempt to domesticate animals but used to eat those animals that he was lucky to hunt. In the New Stone Age (8000-6000 B.C.) man changed from hunter to husbandry man of animals by domestication. Domestication came after food cultivation.

Domestication of Animals:

<table>
<thead>
<tr>
<th>Species</th>
<th>When (Years from present time)</th>
<th>Where</th>
<th>Why (Reason for domestication)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dog</td>
<td>8500-9000</td>
<td>East Asia</td>
<td>Pet, Companion</td>
</tr>
<tr>
<td>Goat</td>
<td>8500-9000</td>
<td>Southwest Asia</td>
<td>Food, Milk, Clothing</td>
</tr>
<tr>
<td>Pig</td>
<td>8000-9000</td>
<td>Eastern Anatolia</td>
<td>Food &amp; Sports</td>
</tr>
<tr>
<td>Sheep</td>
<td>6000-7000</td>
<td>Southwest Asia</td>
<td>Food, Milk, Clothing</td>
</tr>
<tr>
<td>Cattle</td>
<td>6000-6500</td>
<td>Southwest Asia, India, North Africa</td>
<td>Religious reasons</td>
</tr>
<tr>
<td>Chickens</td>
<td>5000-5500</td>
<td>India, Sumatra</td>
<td>Cockfight Shows, religion</td>
</tr>
<tr>
<td>Horse</td>
<td>4000-5000</td>
<td>Eurasian Steppes Mountain</td>
<td>Transportation</td>
</tr>
</tbody>
</table>

General Utility of Livestock and Poultry:
1. Cattle: For milk, meat (beef/veal) and motive/draft power for agriculture.
2. Buffaloes: For milk, meat (beef/veal) and motive/draft power for agriculture in humid high rainfall areas.
3. Sheep: For wool, meat (mutton), skin and hide, manure/night folding.
4. Goat: For milk, meat (chevon), hair, skin and hide and manure.
5. Rabbit: For wool/fur, meat, lab animal and recreation.
6. Pigs: For meat (pork) and bristles.
7. Poultry: For eggs, meat (broiler), lab animal and for recreational purpose.
9. Camel: As motive power for transport of men/goods in arid zones, water lifting, crushing oilseeds, sugarcane etc. Popularly called “Ship of desert”.
10. Yak: For milk, meat and as source of motive power for transport of goods/men in hilly tracts and cold countries.
Present Status and Scope of Animal Husbandry in India:

India is an agricultural country. Animals are kept under mixed farming system. Animal products are widely used in human diet, so development of animal husbandry is recognized very well. A.H. is also recognized for animal power for farming and adoption of better land use pattern. Animals utilize agricultural byproducts and agro-industry byproducts and convert them into valuable products. A.H. also provides employment to rural people. Large scale animal industry (dairy, leather, meat and animal feed industry) also provide employment to people.

The country has total land area of 328.8 million hectares, of which 143 million hectares is under cultivation and of this approximately 60 million hectares (gross) is irrigated. Less than 5% of the irrigated area is under fodder crops.

In spite of largest livestock wealth as number, species, breeds in India, the level of production of livestock products (milk, meat, wool, eggs) is most unsatisfactory. This may be due to the poor feed resources availability, tropical diseases, as well as poor attention being paid to organize breeding. The livestock provide protective food in the form of meat, milk, eggs etc. They provide motive power to farmers and rural poor’s. They also provide valuable byproducts in the form of skins, fibers, organic manures and other usable items (Feather, bone, horns, hairs etc). Livestock contributes 27% of total agricultural income and 8.9% to the total gross domestic products in country. Their contribution to rural employment is relatively large being 29%. The majority (62%) of small and marginal farmers and landless labourers have livestock specially cattle and buffaloes. Dairy development programmes taken up under the operation flood benefited to these classes very much. A.H. thus offers a vast scope for application of science and technology to the problems of food, hunger and rural employment.

Animal Husbandry is a supplementary occupation to agriculture in our country. It is a part of life in rural people. It provides cash insurance in case of crop failure to the farmers. A.H. provides better support in poverty elimination. Co-operative dairy activity provides strong way of progress to rural economy. Overall 27.28% income to farmers generated from dairy business. Our country stood first in milk production since 1998 in the world.

Animal Husbandry section generates 156680 crores income from livestock. Dairy industry encompass 7.0 crores family in the country. Despite a higher growth rate, the per capita availability of milk in India is 252 grams per day which is lower than the world average of 265 grams per day.
Our country has 16% cattle, 17% goat, 4% sheep and 57% buffaloes of the world. We produce 7.11% milk of cattle. 61.95% milk of buffaloes, 21.52% milk of goat of the world. Dairy development rate was 4.5% in last two decade as against 2.2% in agriculture. Most of the nomadic tribes and people living on edges of villages depend on sheep and goat rearing.

**Role of Animal Husbandry in National Economy:**

- India is an agricultural country with agriculture based economy.
- Cattle and buffaloes are the backbones of Indian agriculture/dairying industry.
- It is densely populated and has limited land resources. More than 70% of the population depends directly or indirectly on agriculture for their livelihood.
- Nearly 12% of the total national income is derived from animal husbandry.
- Livestock, especially dairy cattle and buffaloes are useful to Indian economy in the following ways:
  1. Provide protective food in the form of milk and meat.
  2. Provide motive power for agriculture.
  3. Provide supplementary income to the farmers.
  4. Provide valuable organic manure and fuel.
  5. Utilize unproductive land.

Animal Husbandry and Dairying play an important role in development of India’s economy. Animal Husbandry, Dairying and Fisheries sectors play an important role in the national economy and in the socio-economic development of the country. These sectors also play a significant role in supplementing family incomes and generating gainful employment in the rural sector, particularly, among the landless laborers, small and marginal farmers and women, besides providing cheap nutritional food to millions of people. Livestock are the best insurance against the vagaries of nature like drought, famine and other natural calamities. Highlighting the importance of the livestock sector in the Indian economy, the Annual Report as per Central Statistical Organization (CSO) states that the value of output from livestock sector at current prices was about Rs. 4,59,051 crore during 2011-12 which is about 25.6% of the value of output from the agriculture and allied sector.

The present contribution of livestock to the national economy is estimated to be Rs.18000 crores, mainly from milk and milk products (70 per cent); meat and meat products (11.5 per cent); poultry (8.8 per cent) and dung
for fuel (7.8 per cent). In addition, the value of other animal products as eggs, wool, leather goods etc, makes the total of Rs.18000 crores. Apart from above items, the value of draught power from 88 million bullocks including 8 million buffalo bullocks indispensable to agricultural operations is of the order of Rs. 5000 crores. In 2008-09, this sector contributed 108.5 million tonnes of milk, 55.6 billion eggs, 42.7 million kg wool and 3.8 million tones of meat. Several measures have been initiated by the government to increase the productivity of milch animals, which has resulted in increasing the milk production significantly from the level of 102.6 million tonnes at the end of the tenth plan (2006-07) to 127.9 million tonnes at the end of the eleventh plan (2011-12). Poultry development in the country has shown steady progress over the years. Egg production was around 66.45 billion in 2011-12. The poultry meat production is estimated to be about 2.47 million tonnes.

According to 2001 census, the livestock population was estimated at 495 million comprised of 203.1 million cattles, 98.1 million buffaloes 60.7 million sheep, 120.3 million goats and 13.1 million pigs. The others were estimated at 3.6 million and total of poultry birds at 489 million.

Cattle and Buffaloes:

India has 14 per cent of the world’s cattle and 57 percent of the world’s buffalo population. India continues to be the largest producer of milk in the world and India produced 13.1 per cent of the total milk produced in the world. Hence, India has attained the first rank in milk production in the world. At present the first five countries in the world producing maximum milk are India, USA, Russia, Germany and France. At the beginning, production of milk was only 17 million tonnes (MT) in 1950-51 in India. Now it is increased to 108.5 million tonnes in 2008-09. World milk production is estimated at 693 million tonnes during 2007-08 and Indian milk production stands at 104.8 million tonnes. Several measures have been initiated by the government to increase the productivity of milch animals, which has resulted in increasing the milk production significantly from the level of 102.6 million tonnes at the end of the tenth plan (2006-07) to 127.9 million tonnes at the end of the eleventh plan (2011-12). India, the largest producer of milk in the world, is set to produce over 133 million tones milk during 2012-13. The per capita availability of milk in India is 330 grams per day. The average milk production of a milking cow is only 173 kg and that of buffalo is about 500 kg milk per lactation in India which is far below than world average.

Poultry:

Poultry is one of the fastest growing segments of the agricultural sector in India today. Their growth rate has been rising at 8 to 10 percent per annum. As a result, India is now the world’s fifth largest egg producer and the
eighteenth largest producer of broilers. Table eggs and broiler meat are the major end products of the poultry sector in India. The organized sector of poultry industry is contributing nearly 70% of the total output and the rest 30% in the unorganized sector in India. The Andhra Pradesh, Tamil Nadu and Maharashtra producing nearly 70% of the country's egg production. Egg production has increased from 21 billion in 1990-91 to 66.45 billion in 2011-12. Poultry development in the country has shown steady progress over the years. The poultry meat production is estimated to be about 2.47 million tonnes. Export of poultry products was currently at around Rs. 457.82 crore in 2011-12 as per the report of Agricultural and Processed Food Product Export Development Authority (APEDA). The value of output from eggs was Rs 17,803 crore for 2011-12.

**Meat Production:**

The meat products industry in India is largely in the un-organized sector. With rapid urbanization, higher income levels and changes in lifestyle, market for scientifically produced and hygienically packed meat and meat products are expanding rapidly. Cattle, buffaloes, sheep, goat, pigs and poultry are the types of animals which are generally used for production of meat. Flesh foods/meat and meat products are rich in protein and are good sources of vitamin B12 which is absent in plant food. There is a huge scope for expanding exports, especially in buffalo and poultry meat, eggs and dairy products. The country has 3,600 slaughter houses, 9 modern abattoirs and 171 meat-processing units licensed under the meat products order. The meat production has registered a healthy growth from 2.3 million tonnes at the end of Tenth Five Year Plan (2006-07) to 5.5 million tonnes at the end of the Eleventh Five Year Plan (2011-12). The Annual growth rate for meat production in 2011-12 was about 13%.

Out of total meat produced in India, 54% is from mutton and chevon (Sheep and goat meat, respectively), 26% from beef (buffalo meat), 13% from chicken and 7% from pork (Pig meat). Even though 70% of India populations consume meat the per capita availability of meat is less than 5 kg per year as compared to world’s average of 14 kg per year. In meat and meat processing sector, poultry meat is the fastest growing animal protein in India. The estimated production of meat was 6.5 million tonnes during 2007-08. According to APEDA (Agricultural and Processed Food Product Export Development Authority), the export of buffalo meat was increased from (Rs.1536.77 crore) in 2003-04 to (Rs.3549.70 crores) in 2007-08. The value of output from meat group in 2011-12 was Rs. 83,641 crore.
Fish Production:

India has an about 8041 km of coastline and about 5.70 million hectare of fresh water area suitable for fisheries production. Fishing, aquaculture and allied activities are reported to have provided livelihood to over 14 million persons in 2006-07. At present, India's total fish production is about 76.21 thousand tonnes. This sector has great potential to export their fish and fish products. Since 1991, overall export of fish is raised at considerable rate. According to the data provided by ministry of agriculture and commerce of India, the export of fish and fish product increased from last ten years. India is the second largest producer of fresh water fish in the world.

Fish production has increased from 41.57 lakh tonnes (24.47 lakh tonnes for marine and 17.10 lakh tonnes for inland fisheries) in 1991-92 to 86.66 lakh tonnes (33.71 lakh tonnes for marine and 52.95 lakh tonnes for inland fisheries) in 2011-12. The value of output from fisheries sector was about Rs 76,699 crore during 2011-12 which is about 4.15% of the value of agricultural and allied sector output.

Projected Changes in Livestock Population (Million):

<table>
<thead>
<tr>
<th>Category</th>
<th>2007</th>
<th>2020 (Projected estimates)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cross Bred cattle</td>
<td>33.06</td>
<td>65.30</td>
</tr>
<tr>
<td>Indigenous cattle</td>
<td>166.02</td>
<td>161.37</td>
</tr>
<tr>
<td>Buffaloes</td>
<td>105.33</td>
<td>115.60</td>
</tr>
<tr>
<td>Sheep</td>
<td>71.56</td>
<td>74.78</td>
</tr>
<tr>
<td>Goat</td>
<td>140.53</td>
<td>142.23</td>
</tr>
<tr>
<td>Pigs</td>
<td>11.13</td>
<td>11.91</td>
</tr>
<tr>
<td>Fish**</td>
<td>7.13</td>
<td>12.38</td>
</tr>
</tbody>
</table>

**million tonnes

*Crossbreds double, poultry 1.6 times, fish 1.7 times
CHAPTER 2
IMPORTANCE OF CO-OPERATIVE MOVEMENTS OF DAIRY INDUSTRY IN INDIA

History of Co-operative Dairies

Before independence, when dairy co-operatives did not exist, the milk producers of villages were exploited by the middlemen and milk traders. The producers were getting very less price for milk. The purchase of milk from all producers and that too throughout the year was also not guaranteed. In turn, the middlemen and the milk traders were earning the big share at the cost of milk producers and consumers.

Amul has been an instrumental for the movement of dairy co-operatives in India and many other developing countries. Major national leaders, viz. Shri Sardar Vallabhbhai Patel and Shri Morarjibhai Desai were involved in its establishment (in 1946) and development. The main objective in mind of founders of Amul was to protect the average milk producer at the village level from the over exploitation by the ruthless milk traders.

From the experience of Amul, the idea of co-operative dairying had got a momentum/boost. The milk co-operatives like Amul, popularly known as “Anand Pattern” has been replicated in the other districts of Gujarat, also in other states of India and in many other developing countries. The leading milk co-operative unions in Gujarat are Amul, Dudhsagar, Sabar, Banas, Sumul and Panchamrut dairies.

Impact of Dairy Co-operatives in India

The milk co-operatives of India have had multifaceted impact on the economy and social life of rural people, as under.
1. Apart from providing supplementary income to the farmers, it has encouraged commercial milk producers around urban areas.
2. The co-operative dairying also provided women with new roles and functions in animal health, care and management, feeding, breeding and interesting thing is their participation in various decision-making bodies.
3. Women’s deeper involvement in animal health care & management had direct effect on their notions of family health care, family planning and nutrition.
4. Dairy co-operatives have given many political leaders and taught lessons of democracy and building complex organizations uniting a large number of rural communities.
5. The taboo of untouchability to SC vanished from rural areas, - an indirect impact of joining a common queue in front of the village milk society.
6. Many members of milk co-operatives have become questioning and critical to the officer-bearers for the performance of the co-operatives.

7. The co-operatives also have some impact on development of roads, schools, health centers, vari ghrus etc.

THE THREE-TIER STRUCTURE OF DAIRY CO-OPERATIVES (AMUL MODEL/ANAND PATTERN)

The Amul Model is a three-tier cooperative structure. This structure consists of a Dairy Co-operative Society at the village level affiliated to a Milk Union at the District level which in turn is further federated into a Milk Federation at the State level. Milk collection is done at the Village Dairy Society, milk procurement and processing at the District Milk Union and milk and milk products marketing at the State Milk Federation. The structure was evolved at Amul in Gujarat and thereafter replicated all over the country under the Operation Flood Programme, it is known as the ‘Amul Model’ or ‘Anand Pattern’ of Dairy Co-operatives.

The main functions of the VDCS (Village dairy cooperative society) are:
- Collection of surplus milk from the milk producers of the village, and payment based on quality and quantity,
- Providing support services to the members like veterinary first aid, artificial insemination services, cattle-feed sales, mineral mixture sales, fodder and fodder seed sales, conducting training on animal husbandry and dairying.
- Selling liquid milk for local consumers of the village.
- Supplying milk to the District Milk Union.

The main functions of the District Co-operative Milk Producer's Union (Dugdh Sangh) is:
- Procurement of milk from the Village Milking Societies of the District.
- Arranging transportation of raw milk from the VDCS to the Milk Union.
- Providing input services to the producers like veterinary care, artificial insemination services, cattle-feed sales, mineral mixture sales, fodder and fodder seed sales.
- Conducting training on cooperative development, animal husbandry and dairying for milk producers and conducting skill development and leadership development training for VDCS staff and Management Committee members.
- Providing management support to the VDCS along with supervision of its activities.
- Establish chilling centers and dairy plants for processing the milk received from the villages.
- Selling liquid milk and milk products within the district.
• Process milk into milk products as per the requirement of State Marketing Federation.
• Decide on the prices of milk to be paid to milk producers as well as the prices of support services provided to members.

The main functions of the State Co-operative Milk Federation (Federation):
• Marketing of milk and milk products processed/manufactured by Milk Unions.
• Establish a distribution network for marketing of milk and milk products.
• Arranging transportation of milk and milk products from the Milk Unions to the market.
• Creating and maintaining a brand for marketing of milk & milk products.
• Providing support services to the Milk Unions and members like technical inputs, management support and advisory services.
• Pooling surplus milk from the Milk Unions and supplying it to deficit Milk Unions.
• Establish feeder-balancing dairy plants for processing the surplus milk of the Milk Unions.
• Decide on the prices of milk and milk products to be paid to Milk Unions.
• Decide on the products to be manufactured at Milk Unions and capacity required for the same.
• Designing and providing training in cooperative development and technical and marketing functions.
• Conflict resolution and keeping the entire structure intact.

Today, there are around 176 cooperative dairy Unions formed by 1.25 lakh dairy co-operative societies, having a total membership of around 13 million farmers on the same pattern, who are processing and marketing milk and milk products profitably, be it Amul in Gujarat or Verka in Punjab, Vijaya in Andhra Pradesh, Milma in Kerala, Gokul in Maharashtra, Saras in Rajasthan or a Nandini in Karnataka.

National Dairy Development Board (NDDB)

The success of Amul and similar other district milk co-operative dairies in Gujarat was dramatic. Late Shri Lal Bahadur Shashtri, Ex-Prime Minister of India while his visit to Kaira district, was impressed by the development achieved through “Anand Pattern” of milk co-operatives. With his blessings an autonomous body NDDB was established under Ministry of Agriculture, GOI, in 1965, with two main objectives at that time.

1. To replicate the “Anand Pattern” of co-operative dairying all over India, and
2. To provide on request the information skill and technical services to speed up the development of system for milk procurement, processing and marketing.

NDDB is having its HQ at Anand with branch divisions in all 4 metropolitan cities of India. Recently, it is also given responsibility of creating infrastructure for “Anand Pattern” of co-operatives for vegetable oils, vegetables, fruits etc.

**Gujarat Dairy Development Corporation (GDDC)**

“Anand Pattern” of district dairy co-operatives came up with the initiatives of milk producers in Kaira, Mehsana, Sabarkantha, Banaskantha, Baroda and Surat districts of Gujarat. However, dairying on co-operative lines could not come up due to lack of initiatives from milk producers in the other parts of Gujarat. Hence, GOG has established GDDC to initiate viable dairy co-operatives in these districts with its HQ at Gandhinagar. GDDC has two main objectives;

1. To take over sick dairies from the Unions and make them economically viable.

2. To establish a new dairy and related infrastructure in non-initiative district and handover viable dairy to the district co-operative union.

Until now, GDDC has established and handed over 3 viable dairies to district milk unions in Panchamahal, Bharuch and Valsad. At present GDDC is handling 9 dairies in Ahmedabad, Gandhinagar, Kutch and all 6 districts of Saurashtra.

**Gujarat Co-operative Milk Marketing Federation (GCMMF)**

It is a federation (mega-union) of all district milk unions in Gujarat (HQ at Anand) functioning with the main objective of preventing unhealthy competition in marketing their products. The GCMMF is coordinating and marketing various dairy products produced at all the districts milk union with common trade names of Amul and Sagar in the larger interest of milk producers only.

**National Co-operative Dairy Federation of India Ltd (NCDFI)**

It is a federation of all state co-operative milk marketing federations. The NCDFI is thus an apex body for marketing milk of millions of rural milk producers in India. The NCDFI is having HQ at Anand and working for promoting production and marketing not only of dairy products, but also of vegetable oils, vegetables, fruits and other agricultural commodities. It is successfully coordinating marking, balancing and buffering dairy products and vegetable oils since its inception. It is on way to establish a national **milch grid**: – flow of milk and milk products from high producing areas to low producing areas or from low demand areas to high demand areas.
CHAPTER 3
ANIMAL HUSBANDRY METHODS IN INDIA AND ABROAD

The species of livestock which are important in India are cattle, buffalo, sheep and goat. These animals are kept by various categories of people viz. professional breeders, farmers, landless labourers and city milk producers. In European countries, they are reared under ranching, semi-ranching or stall feeding system depending upon the agro-climatic conditions and ranch/pasture available.

1. Professional Breeders:

(A) Cattle: Professional breeders are the races/communities of people who have taken livestock production as their ancestral profession, i.e. profession from generation to generation. In Gujarat, these are called Bharwad, Rabari, Charan, Ahir, Mohammedan etc. They are generally landless and follow nomadic to semi nomadic life in search of grazing and water. They maintain large herds/flocks (50-150) of their animals mainly cattle, sheep and goats on public grazing lands.

Professional breeders are not the owners of public grazing land; hence they cannot do anything to maintain or improve such land. There is total neglect of public grazing lands in India. Indeed they are misused by the public and are therefore deteriorating very fast and are rendered almost useless for the grazing purpose.

In most parts of our country the rains are also seasonal from June-July to Sept-Oct. Therefore good amount and quality of pasture is available only upto Dec-Jan. Thereafter it deteriorates and very little grazing is available in summer months. As the professional breeders are landless, poor and live nomadic life, they do not purchase or store the fodder for the period of scarcity.

Their animals are good in condition and cows give good amount of milk during monsoon and winter. But in summer they are reduced to skeletons. In the years of low rainfall or famine/drought, professional breeders and their animals are put to miserable situation. They are forced to migrate in search of grazing land and water with their animals over hundreds of miles. During the migration many animals even die.

Professional cattle breeders derive their income from sale of milk or ghee and sale of male calves to the farmers. Because of nomadic and semi-nomadic life and also because their animals are half starved, their income from sale of milk or ghee is relatively less as compared to that from sale of male
calves. They also change their breeding bulls every three years to prevent inbreeding.

Since last few years, because of receiving better price of milk from city people, there is tendency among the professional cattle breeders to live settled stationary life particularly around large towns and cities where they maintain their animals on semi ranching system i.e. partly on grazing and partly on stall feeding of purchased or home grown fodders.

(B) **Sheep:** Shepherds also lead migratory or semi migratory life and maintain their flocks practically entirely on grazing i.e. by ranching system. The sheep are maintained by grazing them on public lands during monsoon. During winter and summer, the sheep flocks kept in plains live on stubbles of crops, weeds in the fields and weeds in and around hedge land and fences. Sheep flocks in the Himalayan foot hills are grazed on plains in winter and on the mountain ranges at higher altitudes in summer.

The yield of fleece (Wool covering on the body) of our sheep is very low. Also the fleece is coarse and of mixed type i.e. containing wool and hair fibres. Sale of fleece and sale of lambs and cull ewes are the principal sources of income. Sale of milk and income derived from night folding of sheep in fields are also other sources of income.

(C) **Goats:** Professional breeders maintain goats in large flocks. Goat is a browsing animal. It likes to feed on thorny and other bushes and creepers in the hedge land and fences of fields and pastures. Because goats are more active as compared to sheep, they are grazed on slopes and tops of hills and mountain ranges. Sale of milk and kids is main source of income of professional goat keepers.

2. **Landless Labourers:** This section of rural community is generally agricultural labourers. They work in farmer’s field on daily wages as casual labour. They live stationary life and keep 1-2 buffaloes or cattle and 1-5 goats. Whenever public grazing land is available they maintain these animals on grazing. When such grazing is not available or when it becomes scarce, the cattle and buffaloes are maintained on weeds and stubbles collected from farmer’s field.

The goats are maintained by grazing on pasture, bushes and on creepers in the hedges of the roadsides. They are also grazed by tethering on hedge land and fences of farmers fields where these labourers go for work. In addition, the animals are also fed lopping of edible tree leaves. Milk from cows and buffaloes and kids of goats are the principal items of sale/income to them, whereas, milk from goats is generally used for family consumption, not sold.

3. **Farmers:** Farmers are the owners of the cultivable land. They live stationary life. They generally keep 1-3 buffaloes. In the areas where extensive public
grazing lands are available they keep cows also. They maintain them partly on grazing and partly on stall feeding. The by-products of food crops i.e. straws are generally fed to the animals at home. Some farmers grow special fodder crops like lucerne, jowar, bajra, maize etc for feeding of the animals. Milking cows/buffaloes are given concentrates. Thus the animals kept by farmers get sufficient uniform food all throughout the year, hence their health and production are superior as compared to the animals of professional breeders. The principal source of income of farmers is the sale of milk and ghee.

4. City Milk Producers: The land is scarce and costly in cities. Therefore very less space is available for housing of animals and for storage of feeds. But because of high price of milk in cities some businessmen in cities keep 5-25 or more cows and buffaloes. They maintain them practically entirely on stall feeding of purchased fodder and concentrates. Generally, they purchase and store dried baled pasture grass. They feed more concentrates to their animals as concentrates are easily available, need less storage space and are relatively cheaper. Fodder is costly in cities.

City milk producers purchase animals just before or soon after calving from their home tracts. They send dry animals back to rural areas for salvage (raising unproductive animals of city milk producers on contract basis by village folks till they become productive) or sell them. The animals sold are generally slaughtered. The young ones of milking animals, especially males generally die due to unhygienic conditions, negligence and starvation, as it is very costly to rear the young ones in cities. Sale of milk is the principal source of income to city milk producers.

LIVESTOCK PRODUCTION SYSTEMS/ANIMAL HUSBANDRY METHODS IN ABROAD

Broadly the systems of managing livestock in foreign countries can be enumerated as following:

1. Ranching system or extensive system
2. Stall feeding system and
3. Semi-ranching or semi-intensive system.
4. These systems differ from one another principally in providing food to the livestock. They also differ, more or less, in providing drinking water, shelter and food to the livestock.

Ranching System or Extensive System:

Ranch is a very vast, semi-jungle, grazing land on which livestock are raised. Ranching system most commonly refers to sheep and cattle farming in areas with low agricultural productivity. Under extensive farming system livestock are raised in a very vast, semi-jungle, grazing land. Under this farming system of management animals are maintained all the year round on pasture
grazing only. Very little or no supplemental feeding of fodder or concentrates is done, depending on the rainfall and the type of pasture (Sparse or dense). Beef cattle (Angus, Hereford) or fine wool sheep (Merino, Rambouillet) are maintained under this farming system.

**Beef cattle ranches:**

Ranches are located in the interior places, away from towns or cities. Tall and dense forage is available on beef cattle ranches. The soil of the ranches is generally shallow and surface undulating. There is a marked seasonal variation in the quality of the forage available from the ranch. Hence it is generally not suitable for keeping dairy cows, as dairy cows need practically uniform plane of nutrition throughout the year. It is customary to keep beef cattle on the ranches. Beef cattle ranches are found in the countries of Europe, USA, Canada, Australia etc. Area of such ranches is 450 hectare or more.

A ranch is divided into several compartments by fencing. Provision for drinking water is made by means of ponds. Mostly cattle live only on grazing. No special sheds or structures are constructed for shelter. Shades of trees provide some shelter. On such a ranch, nearly 1000-1500 heads of cattle are maintained. Breeding bulls are kept along with the cows in the breeding season. Sale of feeder calves and cull cows is the principal source of income to the ranchmen.

**Sheep ranches:**

On ranches which are arid and where short, sparse natural grasses grow, sheep are maintained. Large animals cannot thrive on such pasture. Sheep ranches may be having rocky, mountainous topography, where large animals-cattle find it difficult to climb the slopes. The conditions on such ranches are generally adverse, hence fine wool sheep breeds like Merino; Rambouillet etc. which are hardy and which have banding instinct are generally raised. In countries of Europe, USA, Canada, South Africa, Australia etc., very large flocks of sheep are reared on ranches.

**Stall Feeding System:** This is a system of managing animals without any grazing, so it is also known as zero grazing system. Intensive animal farming practices can involve very large numbers of animals raised on limited land which requires large amounts of food, water and medical inputs (required to keep the animals healthy in cramped conditions). Very large or confined indoor intensive livestock operations (Particularly descriptive of common US farming practices) are often referred to as factory farming and are criticized for the low level of animal welfare standards and associated pollution and health issues.

*This is also known as Stall feeding system/Labour intensive/Feed lot/Zero grazing system.* This is a system of managing animals without grazing completely under confined condition. Animals are fed roughage and grains in the mangers located in the stalls of the animals. Animals get sufficient and uniform
food throughout the year. These animals are kept in sheds-byres and are completely protected from climatic elements. This system is employed where land is of very good quality-fertile, deep and leveled, very costly and scarce. Dairy cattle, mutton sheep (Deccani, Nellore) and pigs are generally managed under this farming system.

**Advantages**
- More milk production.
- More health care facility.
- Lesser land requirement.
- More employment generation as more labour is required.
- An opportunity to capture methane emissions which would otherwise contribute to global warming. Once captured, these emissions can be used to generate heat or electrical energy, thereby reducing local demand for fossil fuels.

**Disadvantages**
- Less cost effective.
- Labour requirement is more.
- Requirement of more, food, water and medical inputs for animals.

**Semi-Intensive System**
This is a system of managing livestock which combines the desirable elements of both, viz; extensive and intensive livestock farming system. In this system animals are given feed both by grazing as well as by stall feeding. When grazing is ample and nutritive, no stall feeding is done i.e. during this period animals are maintained entirely on grazing. As the quality of grazing goes down, in addition to grazing, supplemental feeding-stall feeding of fodder is done. Concentrate mixture may also be fed to maintain the level of production. In semi-intensive system, animals are kept loose, except a little tying at milking time. Provision of drinking water for animals is made. No elaborate housing facilities are provided but better protection from climatic elements is provided by manufacturing some sheds and shelters as compared to extensive system. Dairy cattle, medium wool sheep breeds e.g. Dorset, Suffolk, Cheviot, South Down etc.), feeder lambs and feeds calves etc. are maintained by semi-intensive system.
CHAPTER 4
COMMON TERMS PERTAINING TO VARIOUS SPECIES OF LIVESTOCK

COMMON ANIMAL HUSBANDRY TERMS

(1) Humped Cattle: Indian cattle, Brahma or indigenous cattle having hump. Spp. Indicus.
(2) Humpless Cattle: European or exotic or foreign cattle having no hump Spp. Taurus.
(3) Castration: The act of rendering the gonads of an animal nonfunctional generally it is used for males.
(4) Calving Interval: Interval between two successive parturition in cows and buffaloes.
(5) Lactation Period: Period during which the animal gives milk i.e. from day of calving to last day of giving milk in cattle 290-330 days (standard 305 days).
(6) Dry Period: Period in which animal do not gives milk i.e. from last day of giving milk to subsequent calving.
(7) Service Period: Period between calving to successful service i.e. animal became pregnant.
(8) Gestation Period: Date of successive service up to parturition i.e. period during animal remain pregnant.
(9) Breed: A group of animals of a species having similar physical and economical character.
(10) Prolificacy: Ability to produce large number of offspring.
(11) Avian: A generic description of birds in general.
(12) Bovine: A generic name of cattle.
(13) Broiler: A chicken rose especially for meat purpose.
(14) Broody: A hen which attempts to incubate its egg.
(15) Browse: Fodder obtained from eating leaves and twigs of bushes by goat and camel.
(16) Carcass: The dressed body of slaughtered animal or dead animal.
(17) Concentrate: Feed stuff low in fiber and high in digestible nutrients.
(18) Crossbred: The offspring resulting from the mating of male and female of different breeds.
<table>
<thead>
<tr>
<th></th>
<th>Term</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>19</td>
<td>Cull</td>
<td>To dispose of the poorer animals in a herd or flock.</td>
</tr>
<tr>
<td>20</td>
<td>Fleece</td>
<td>The total wool coat of a sheep.</td>
</tr>
<tr>
<td>21</td>
<td>Flush</td>
<td>To increase feeding level of females just prior to breeding.</td>
</tr>
<tr>
<td>22</td>
<td>Gestation</td>
<td>The time period between conception and parturition or is the condition of female when developing foetus is present in the uterus.</td>
</tr>
<tr>
<td>23</td>
<td>Heat/Estrus</td>
<td>Period when female will accept service by male.</td>
</tr>
<tr>
<td>24</td>
<td>Insemination</td>
<td>To place semen in female reproduction tract.</td>
</tr>
<tr>
<td>25</td>
<td>Litter</td>
<td>A group of young ones born to one mother at one time or materials placed on floor to absorb moisture.</td>
</tr>
<tr>
<td>26</td>
<td>Livestock</td>
<td>A collective term to denote those animals kept on a farm for productive purposes.</td>
</tr>
<tr>
<td>27</td>
<td>Natural service</td>
<td>Insemination of female by the male.</td>
</tr>
<tr>
<td>28</td>
<td>Parturition</td>
<td>The general term about process of giving birth to young one.</td>
</tr>
<tr>
<td>29</td>
<td>Purebred</td>
<td>The offspring of the mating of a male and female of the same breed.</td>
</tr>
<tr>
<td>30</td>
<td>Restrain</td>
<td>To stop the movements of an animal so it can be examined or treated.</td>
</tr>
<tr>
<td>31</td>
<td>Roughage</td>
<td>Feed stuffs high in fibre and low in digestible nutrients.(&gt;18% Crude Fibre)</td>
</tr>
<tr>
<td>32</td>
<td>Semen</td>
<td>The discharge ejaculated from the testes and accessory sex glands of the male which includes sperm and accessory fluids.</td>
</tr>
<tr>
<td>33</td>
<td>Shear</td>
<td>To remove the fleece from a sheep.</td>
</tr>
<tr>
<td>34</td>
<td>Sire</td>
<td>The male parent of the calf.</td>
</tr>
<tr>
<td>35</td>
<td>Dam</td>
<td>The female parent of the calf.</td>
</tr>
<tr>
<td>36</td>
<td>Steaming Up</td>
<td>To give extra-feed to milk producing animal 6-8 weeks prior to parturition.</td>
</tr>
<tr>
<td>37</td>
<td>Tusk</td>
<td>Elongated or enlarged permanent canine tooth, usually seen in boars.</td>
</tr>
<tr>
<td>38</td>
<td>Udder Kinch</td>
<td>A rope tied around the body just in front of the hips and udder to prevent kicking.</td>
</tr>
<tr>
<td>39</td>
<td>Vice</td>
<td>A habit or action of animals that is harmful to itself or to others.</td>
</tr>
</tbody>
</table>
(40) **Yearling**: A bovine in its second year of life which has not yet produced young one.

(41) **Crone**: An old broken mouthed ewe, which has been retained in breeding flock, beyond the normal time, because of her excellent breeding performance.

(42) **Gimmer**: A female sheep between first and second shearing.

(43) **Seggy**: A ram castrated after service.

(44) **Puberty**: It is the period when reproductive tract and secondary sex organs/characteristics start to acquire their mature form.

(45) **Runt**: The smallest and last born piglet in a litter.

(46) **Brood Mare**: Mare kept for breeding purpose.

(47) **Free Martin**: A female calf when born along with male calf usually sterile with abnormal genitalia is known as free martin.

(48) **Hybrid Animal**: Animal born due to mating of animals of different species.

(49) **Mule**: Animal produced by mating of male donkey (Ass) and female horse (Mare).

(50) **Hinny**: Hybrid animal produced by mating of Jennet (She donkey) with stallion (Male horse).

(51) **Domestication**: Means making the animals to adopt their life in intimate contact with men for their benefit.
## COMMON TERMS USED IN LIVESTOCK PRODUCTION:

<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>Details</th>
<th>Cattle</th>
<th>Buffalo</th>
<th>Sheep</th>
<th>Goat</th>
<th>Pig</th>
<th>Horse</th>
<th>Rabbit</th>
<th>Poultry</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Genus and Species</td>
<td>Bos. indicus</td>
<td>Bubalus. bubalis</td>
<td>Ovis. aries</td>
<td>Capra. hircus</td>
<td>Sus. domesticus</td>
<td>Equus. caballus</td>
<td>Oryctolagus. cuniculus</td>
<td>Gallus. domesticus</td>
</tr>
<tr>
<td></td>
<td>Generic name</td>
<td>Bovine</td>
<td>Bovine</td>
<td>Ovine</td>
<td>Caprine</td>
<td>Porcine</td>
<td>Equine</td>
<td>Leporidae</td>
<td>Avian</td>
</tr>
<tr>
<td>2</td>
<td>Act of parturition</td>
<td>Calving</td>
<td>Calving</td>
<td>Lambing</td>
<td>Kidding</td>
<td>Farrowing</td>
<td>Foaling</td>
<td>Kindling</td>
<td>Hatching</td>
</tr>
<tr>
<td>3</td>
<td>Young one of either sex</td>
<td>Calf (&lt;1yr)</td>
<td>Buffalo calf (&lt;1yr)</td>
<td>Lamb (&lt;6 months)</td>
<td>Kid (&lt;6 months)</td>
<td>Piglet/Pigling (&lt;8 wks)</td>
<td>Foal (&lt;1yr)</td>
<td>Kit</td>
<td>Chick (&lt;8 wks)</td>
</tr>
<tr>
<td>4</td>
<td>Female young one up to parturition</td>
<td>Heifer (&gt;1yr)</td>
<td>Buffalo heifer (&gt;1yr)</td>
<td>Ewe lamb/Gimmer</td>
<td>Doeling/Goatling (&gt;1yr)</td>
<td>Gilt</td>
<td>Filly (&gt;1yr)</td>
<td>Doeling (&gt;2 months)</td>
<td>Pullet/Grower (18-22 wks)</td>
</tr>
<tr>
<td>5</td>
<td>Male young one housed for future breeding</td>
<td>Bull calf (&lt;1yr)</td>
<td>Buffalo bull/calf (&lt;1yr)</td>
<td>Ram lamb/Tup lamb</td>
<td>Buckling (&gt;6 months)</td>
<td>Boarling</td>
<td>Colt</td>
<td>Buckling (&gt;2 months)</td>
<td>Cockerel (18-22 wks)</td>
</tr>
<tr>
<td>6</td>
<td>Adult female parturated at least ones</td>
<td>Cow</td>
<td>Buffalo</td>
<td>Ewe</td>
<td>Doe/Nanny</td>
<td>Sow</td>
<td>Mare</td>
<td>Doe</td>
<td>Hen (&gt;21 wks)</td>
</tr>
<tr>
<td>7</td>
<td>Adult male used for breeding</td>
<td>Bull</td>
<td>Buffalo Bull</td>
<td>Ram/Tup</td>
<td>Buck</td>
<td>Boar</td>
<td>Stallion</td>
<td>Buck</td>
<td>Cock</td>
</tr>
<tr>
<td>8</td>
<td>Castrated male</td>
<td>Bullock/Steer (&gt;2yr)</td>
<td>Buffalo Bullocks (&gt;2yr)</td>
<td>Wether/Wedder</td>
<td>Wether/Wedder</td>
<td>Stag/Hog (&gt;1yr)</td>
<td>Gelding/Geld</td>
<td>Neuter</td>
<td>Capon</td>
</tr>
<tr>
<td>9</td>
<td>Meat</td>
<td>Beef</td>
<td>Cara beef</td>
<td>Mutton</td>
<td>Chevon</td>
<td>Pork</td>
<td>Cheval</td>
<td>Vanison</td>
<td>Chicken</td>
</tr>
<tr>
<td>10</td>
<td>Group</td>
<td>Herd</td>
<td>Herd</td>
<td>Flock/Band</td>
<td>Flock/Band</td>
<td>Herd/Drove/Stock</td>
<td>Stable/Herd/Stock</td>
<td>Warren/Flock/Band</td>
<td>Flock</td>
</tr>
</tbody>
</table>

21
UTILITY CLASSIFICATION OF BREEDS OF CATTLE:

Breeds of Cattle:
There are 28 well defined cattle breeds classified as milch, draught and
dual purpose and are usually named after area, location and habitat they occupy.
India possesses 7.75% of world and 32.11% of Asian breeds of cattle.

Utility Classification of Cattle Breeds:
(A) Bos. indicus: Indian cattle, humped cattle.
Utility: Milk production, draught purpose.

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.
(iii) The bullocks are slow workers.
(iv) These animals are preponderous in build with pendulous dewlaps and
sheath and loose skin.
Breeds: Red Sindhi, Sahiwal, Gir, Deoni, Gaolao. (5 breeds)

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, Hariana, Ongole, Tharparkar, Rathi, Mewati, Nimari (7
breeds).

3. Draught Purpose Breeds: Useful for agriculture works (16 breeds)
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.
Salient features are:
- Well proportionate body.
- A long barrel tight sheath and skin, fast gait and alertness
Photographs of Breeds of Cattle

(B) **Bos Taurus**: Humpless cattle, European cattle.
Useful for milk production as well as for beef purposes.

1. **Milch or Dairy Breeds**: For milk purpose.
   **Features**:
   (i) Cows produce more than 3000 liters milk per lactation.
   (ii) Low milk fat content 3.5 to 5.0 %.
   **Example**: Jersey, Guernsey, Holstein Friesian, Brown Swiss, Ayreshire.

2. **Dual Purpose Breeds**: Milk and beef purpose.
Features:
(i) Cows produce 2000-3000 liters milk per Lactation.
(ii) Weight gain more quickly and efficiently than milch breeds. Growth rate is faster.
(iii) Males, unwanted heifer and cows are sold as beef animals.
Example: Red Dane, Milking shorthorn.

Features:
(i) The cows are not milked.
(ii) Cows are maintained for producing young ones.
(iii) Young ones are sold for slaughter after certain age and weight.
Example: Aberdeen Angus, Hereford, Santa Gertrudis.

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 breed 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.

### Cattle Breeds

<table>
<thead>
<tr>
<th>Breed</th>
<th>Milch purpose</th>
<th>Dual purpose</th>
<th>Draught purpose</th>
</tr>
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<tbody>
<tr>
<td>North Gujarat</td>
<td>--</td>
<td>Kankrej</td>
<td>--</td>
</tr>
<tr>
<td>Gujarat</td>
<td>Gir</td>
<td>--</td>
<td>Dangi</td>
</tr>
<tr>
<td>India</td>
<td>Red Sindhi,</td>
<td>Tharparkar,</td>
<td>Amritmahal,</td>
</tr>
<tr>
<td></td>
<td>Sahiwal, Deoni,</td>
<td>Haryana,</td>
<td>Khillari,</td>
</tr>
<tr>
<td></td>
<td>Gaolao</td>
<td>Ongole, Rathi,</td>
<td>Kangayam</td>
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<tr>
<td></td>
<td></td>
<td>Mewati, Nimari</td>
<td>Nagori, Malvi,</td>
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<td></td>
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<td></td>
<td>Ponwar, Siri</td>
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### Buffalo Breeds

<table>
<thead>
<tr>
<th>Breed</th>
<th>Milch purpose</th>
</tr>
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<tbody>
<tr>
<td>North Gujarat</td>
<td>Mehsana, Banni</td>
</tr>
<tr>
<td>Gujarat</td>
<td>Jaffarabadi, Surti</td>
</tr>
<tr>
<td>India</td>
<td>Murrah, Nagpuri, Bhadwari, Toda, Sambalpuri, Jerangi, Kalahandi</td>
</tr>
<tr>
<td>Breeds/ Synonyms</td>
<td>Location</td>
</tr>
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<td>------------------</td>
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</tbody>
</table>
| **Kankrej**  
Synonym: Bani, Banniai, Vaghadia, Wadhiar,Kacchi (Dual purpose)  
(Total purpose) | Kankrej taluka Banaskantha, Kutch, Ahmedabad to Deesa of Gujarat (North). | The newly born calves have rusty red colour poll, adult animals are silver-grey to iron grey or steel black. Forehead is broad with short face, black muzzle and prominent eyes. Hump and dewlap are well developed. Tail is long whip like. Udder is well developed. | Male body wt. 540-590 kg  
Female body wt. 410-500 kg  
Calf wt at birth 22 to 24 kg  
Av. Milk yield 1200 to 1500 liters per lactation; Fat 4.2 to 5.0 %.  
Age at first calving 45 months  
Age for service (bull) 34 to 35 months. | Rabari, Bharwad rear these animals. | “Savai Chal” of bullock. New breeds evolved from this breed is; Indubrazil in Brazil, Santa Gertrudis in USA.  
Breeding farms: At. Sardarkrushinagar, Chharodi, Thara, Bhuj, Barkol, Mandvi (Surat) |
| **Gir**  
Synonym: Kathiawari, Bhodali, Sorathi, Desan. (Milch breed) | In Saurashtra region-Jamnagar, Junagadh, Rajkot, Bhavnagar and Amreli districts. In western India in Rajasthan, MP and Maharashtra. | Entirely deep red colour body. Bulging forehead like a shield, eyes are big almond shaped gives sleepy appearance. Hump-Dewlap and sheath are heavy and pendulous. Tail long whip like with a black switch. | Male body wt. 500-550 kg  
Female body wt.340-410 kg  
Calf wt at birth 20 to 22 kg  
Av. Milk yield 1800-2600 liters per lactation.  
AFC 46 to 57 months; Fat 4.2% to 4.8%. | Rabari, Bharwad, Ahir, Maldharis rear these animals. | “Banyan leaf” like ears  
New breeds evolved from this breed is; Indubrazil in Brazil, Santa Gertrudis in USA.  
Breeding farms: At. Junagadh, Morbi, Kandivali (Bombay), |
| **Sahiwal**  
Synonym: Lola, Montgomery, Lambibar. (Milch breed) | Punjab province of Pakistan near the river Ravi. | Medium size animals with long body. Body coat colour is yellowish red/pale red. Skin of the animal is thin and loose. Whitish ring around the eyes. Tail is very long touching to the ground. Legs are short. | Male body wt. 425-525 kg  
Female body wt. 350-375 kg  
Lactation length: 300 days  
Av. Milk yield 3000-3200 liters per lactation;  
Milk fat % - 4.6-5.2. | Rabari, Bharwad, Ahir, Maldharis rear these animals. | New breed “Jamaica Hope” (USA) - Jersey x Sahiwal.  
“Karanswiss” (India): Brown Swiss x Sahiwal at NDRI, Karnal, Haryana.  
Breeding farms: NDRI, IARI & IVRI. |
| **Tharparkar**  
Synonym: Thari, Kutchi. | Tharparkar district of Sindh province of  
Kutch. | Light grey colour with strip of light grey colour along the back, ear large semi-pendulous, Black | Male body wt. 450 to 500 kg  
Female body wt. 350 to 400 | ---- | New breed “Karan-Fries” (India) – Tharparkar x Holstein |
<table>
<thead>
<tr>
<th>(Dual purpose)</th>
<th>Pakistan, Adjoining tract of Rajasthan, Jodhpur, Jaisalmer.</th>
<th>rings around eyes. Mixture of different breeds like Kankrej, Sindhi, Nagori and Gir.</th>
<th>kg</th>
<th>AFC: 38-42 months; Av. Milk yield 500-1200 liters per lactation. Bullocks are good draft animals.</th>
<th>Friesian bulls developed at NDRI, Karnal, Haryana. Breeding farms: NDRI, Karnal LRS Patna, Bihar LRF at Chetinad, TamilNadu</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Hariana</strong> (Dual purpose)</td>
<td>Hissar, Rohtak, Gurgaon, Karnal dist. and near Delhi.</td>
<td>Long and narrow face with black muzzle, body is light grey colour, short horns, forehead flat with prominent poll. Hooves are hard and black in colour.</td>
<td>Male body wt. 360-400 kg Female body wt.300-325 kg Weight at birth- 22-23 kg Milk yield 1100-1500 liters per lactation. Milk fat % - 4.0-4.8. Calving interval - 16-20 months. Bullocks are active, powerful and willing workers.</td>
<td>----</td>
<td>Breeding farms: IVRI, Izatnagar, U.P. NDRI, Karnal, Haryana. HAU, Hissar, Haryana. Cattle breeding farm, Mathura, U.P.</td>
</tr>
<tr>
<td><strong>Red Sindhi</strong> Synonym: Sindhi, Malir, Red Karachi. (Milch breed)</td>
<td>Karachi and Hyderabad (Sindh) and Kohistan in Pakistan.</td>
<td>Mostly red, shades varying from dark red to light yellow, white spots on forehead and dewlap, forehead slightly bulging, horns short and stumpy, drooping hind quarter, pendulous udder.</td>
<td>Male body wt. 425-450 kg Female body wt. 350 kg Birth wt of calf – 19-23 kg Milk yield 1800 kg per lactation Milk fat % - 4.6-4.9. AFC: 38-41 Months Calving interval-14-16 months.</td>
<td>“Maldharis” rear these animals on grazing near water pools of canals of river Indus.</td>
<td>Breeding farms: NDRI, Karnal, AAU, Allahabad, Govt. LRS Hosur (T.N.), Export in Ceylon, Philipines, Malaya and Iraq for pure breeding and upgrading of local cattle.</td>
</tr>
<tr>
<td>Breed</td>
<td>Synonym:</td>
<td>Home tract of this breed</td>
<td>Physical Description</td>
<td>Average Milk Yield</td>
<td>Utilized for</td>
</tr>
<tr>
<td>-----------</td>
<td>-----------------------------------</td>
<td>--------------------------</td>
<td>----------------------------------------------------------------------------------------------------------</td>
<td>---------------------</td>
<td>--------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Khilar</td>
<td>Synonym: Khillari, Thillari (Draft purpose)</td>
<td>Native breed of Maharashtra state. 4 types of Khilar cattle are : Alpadi southern Maharashtra, Mhaswad Sholapur and Satara, Tapti – Satpura ranges Nakali- Adjacent to Khandesh dist.</td>
<td>Developed from ‘Hallikar’ breed. Khillari means herd of cattle. Yellowish white to grayish tan body colour. Horns are long and pointed. Eyes are prominent and fiery. Yellow patches inside ears.</td>
<td>Well known draft breed. Cows are poor milkers. Male body wt. 500-550 kg. Female body wt. 320-360 kg. AFC: 30-36 months Male calves castrated at 5 to 5.5 yrs of age. Khillari bullocks are very good for all agricultural purposes.</td>
<td>----</td>
</tr>
<tr>
<td>Deoni</td>
<td>Synonym: Dongrapatti (Dual purpose)</td>
<td>Native breed of Western Andhra Pradesh. It is an admixture of Gir, Dangi and local animals.</td>
<td>Resembles Gir breed but less bulging forehead. Horns have outward and backward curve. Body colour is black and white or red and white with irregular spots.</td>
<td>Cows are good milkers. Average milk yield: 900 kg in 300 days of lactation. Bullocks are well suited for heavy work.</td>
<td>----</td>
</tr>
<tr>
<td>Rath</td>
<td>Synonym: Rath (Dual purpose)</td>
<td>Home tract of this breed is Alwar and Rajputana region of Rajasthan.</td>
<td>Medium sized powerful cattle, well built and deep chest, straight face, flat forehead, large and wide eyes, short and pendulous ears, short tail with black switch.</td>
<td>Av. male body wt. 385 kg Av. female body wt. 326 kg Cows yield about 5.5 kg milk per day. Bullocks are powerful and active suitable for field and road work.</td>
<td>----</td>
</tr>
</tbody>
</table>
Buffaloes: Even toed ungulates (Order: Artiodactyla).

Suborder: Ruminant, Family: Bovidae. It can be further grouped into three groups.

Genus Bovina (Cattle/ Bison)
Bubalina (Asian buffaloes - angular horns)
Syncercina (African buffaloes - oval shaped horns)
(Inter breeding is not possible in above two breeds)

Asian Buffaloes (Bubalus bubalis) are of Swamp and Riverine type.

<table>
<thead>
<tr>
<th>Riverine Buffaloes</th>
<th>Swamp Buffaloes</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Chromosome number 50</td>
<td>• Chromosome number 48</td>
</tr>
<tr>
<td>• Native Indian sub continents, Egypt and Mediterranean basin of Europe</td>
<td>• South East Asia and China</td>
</tr>
<tr>
<td>• Maintained chiefly for milk production. Dual purpose animals also exhibit good meat characteristics.</td>
<td>• Minor or no role in milk production. Used for draught power, for land preparation, threshing, water lifting, oil extraction and transportation.</td>
</tr>
<tr>
<td>• Wallows in river water and in clean running water, water tank or reservoir. Feed on pasture or cultivated fodder, example: Murrah, Mehsana, Surti, Pandharpuri and Jaffarabadi.</td>
<td>• Permanent denizen of marshy lands, wallows in mud and feed on coarse marshy grasses.</td>
</tr>
<tr>
<td>• Generally found in India, Pakistan, Nepal, Bangladesh and Sri Lanka.</td>
<td>• Generally found in Malaya, Singapore, Philippines, Thailand, Indonesia and Malaysia.</td>
</tr>
<tr>
<td>• Physical characteristics: Longer body and weight more than Swamp buffaloes. Usually black sometime white makings on body.</td>
<td>• Physical characteristics: Short stocky body, short face, wide muzzle and short thin legs. Dark grey in colour normally black to albinoids occasionally.</td>
</tr>
</tbody>
</table>

Normal Habits of Buffaloes:

• They are nocturnal in habit.
• Not only do they like to wallow at night, but if left to their own devices they will mate, suckle their calves and travel more during hours of darkness than in day light.
• More like rain or water splashing and mud plastering on body.
• Poor heat resistance/tolerance due to poor heat regulating mechanism.
• Resting habits during several hours in the middle of the day.
Remarkable characters are their docility as they can be easily managed by even children and women.

**BREEDS OF BUFFALOES**

Indian buffaloes: (*Bubalus bubalis* Linn.)

Local name: Arna, Bhains, Geva, Erumai.

**Feature:**
- 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**
Seven indigenous (Desi/local) standard breeds of buffaloes:

MURRAH:
Home Tract: Hariana, Delhi, Uttar Pradesh, Rohtak, Karnal, Hissar, Gurgaon Districts of Haryana.
Synonyms: Delhi, Ravi, Kundhi.
Physical Characteristics:
- Tightly curled horns.
- Massive body, thin and long neck, small face.
- Male body wt: 540-590 kg, female: 450-475 kg.
- Hairless skin with glistening jet black body colour.
- White switch of the tail. Humped.
- Wedge shaped body. Barrel is massive and well developed.
- Straight and powerful limbs with black hooves.
Economical Characteristics:
- Milk yield per lactation – 1400 to 3000 kg in 300 days.
- Milk fat: 6.8 to 7.2%
- Average lactation length: 280-340 days and av.dry period: 150-200 days.
- Average age at first calving: 45 to 58 months.
- Inter calving period is 450 to 500 days.
Breeding Farms:
- HAU Hissar, NDRI Karnal, PAU Ludhiana, IVRI Izatnagar, CBF Meerut.

NILI RAVI:
Home Tract: Main breed of buffalo in Pakistan, distributed in Gurdaspur, Amritsar, Firozpur and Muktsar district of Punjab.
Physical Characteristics:
- Broad massive hairy forehead with prominent nasal bone.
- Tightly coiled horns, Muzzle with prominent double chin.
- Well developed udder with pink markings. White markings on the forehead, face, muzzle, legs, switch and around eyes.
- The tail is long, almost touching the ground.
Economical Characteristics:
- Age at first calving: 41-53 months.
- Lactation yield: 1600 kg. Milk fat content: 4%.
- Peak daily milk yield: 9-11 kg.
- Males are used for draught purpose.
Breeding Farms:
- Military farm Firozpur (Punjab), Buffalo farm Nabha (Punjab) and Khanna (Punjab).

Endangered Breeds: Endangered status of a breed can be determined by the size of breeding stock which can be expressed by the number of breeding females, sex ratio or effective population size. The population size of cattle and buffalo breed for normal, insecure, vulnerable, endangered and critical status as suggested by Nivsarkar and Bhat (1986) for Indian condition is given below.

<table>
<thead>
<tr>
<th>Category</th>
<th>Cattle</th>
<th>Buffalo</th>
</tr>
</thead>
<tbody>
<tr>
<td>Normal</td>
<td>25000</td>
<td>30000</td>
</tr>
<tr>
<td>Insecure</td>
<td>15000-25000</td>
<td>20000-30000</td>
</tr>
<tr>
<td>Vulnerable</td>
<td>5000-15000</td>
<td>10000-20000</td>
</tr>
<tr>
<td>Endangered</td>
<td>2000-5000</td>
<td>5000-10000</td>
</tr>
<tr>
<td>Critical</td>
<td>&lt;2000</td>
<td>&lt;5000</td>
</tr>
</tbody>
</table>

- There are 9 breeds of endangered cattle:
  Vechur, Punganur, Siri, Ponwar, Kenkatha, Nagori, Bachaur, Mewati and Kherigarh.

- There are 3 breeds of endangered buffaloes:
  Toda, Bhadwari and Nili Ravi.

Leading states in buffalo population in India:

<table>
<thead>
<tr>
<th>State</th>
<th>Population (Thousands)</th>
<th>Growth rate (%) 1992-2003</th>
</tr>
</thead>
<tbody>
<tr>
<td>Uttar Pradesh</td>
<td>22914</td>
<td>1.42</td>
</tr>
<tr>
<td>Andhra Pradesh</td>
<td>10630</td>
<td>1.61</td>
</tr>
<tr>
<td>Rajasthan</td>
<td>10416</td>
<td>3.45</td>
</tr>
<tr>
<td>Gujarat</td>
<td>7140</td>
<td>3.55</td>
</tr>
<tr>
<td>Maharashtra</td>
<td>6145</td>
<td>1.28</td>
</tr>
<tr>
<td>Haryana</td>
<td>6035</td>
<td>3.80</td>
</tr>
<tr>
<td>Punjab</td>
<td>5995</td>
<td>1.44</td>
</tr>
</tbody>
</table>

MEHSANA:
Home Tract: Originating from Inter breeding of Surti and Murrah. Breeding tract is Mehsana, Banaskantha and Sabarkantha district of North-Gujarat.

Physical Characteristics:
- Medium sized animals with long body and lighter limbs than Murrah.
- Adult male weigh: 525-575 kg and adult female weighs: 425-450 kg.
- The head is long and heavier, horns less curved at the end but longer.
• The colour is usually black to gray with white markings often on face, legs or tail tips.
• Face long and straight. Dewlap is almost absent.
• Eyes are prominent, black, bright and bulging.

**Economical Characteristics:**
• Reputed for regular breeding and high breeding efficiency. Good persistency so preferred by city milk producers.
• Milk yield 1300-1800 liters per lactation. Having shorter dry period.
• Fat % - 6.6 to 7.2, Age at first calving: 42 to 54 months. Inter calving period 450-550 days.

**Breeding Farms:**
Sardarkrushinagar Dantiwada Agricultural University, LRS, Sardarkrushinagar, Gujarat, CBF, Udaipur.

**SURTI:**
**Synonyms:** Desi, Nadiadi, Charotari, Gujarati.
**Home Tract:** Lies between Sabarmati and Mahi river. Kheda, Baroda, Bharuch, Surat district and adjoining districts of Maharashtra.

**Physical Characteristics:**
• Medium sized animals with wedge shaped body, straight back, black or brown in colour.
• Sickle shaped long and flat horns with long head.
• Two white chevrons one just around the jowl from ear to ear and other just one the brisket is the peculiarity of the breed.
• Ears are medium sized, squarely placed and drooping.
• Skin of udder is pinkish.

**Economical Characteristics:**
• 1000 to 2000 liter milk yield in 10 months lactation.
• Fat rich (8.9%) milk.
• AFC 40-50 months.
• Lactation length is 300-320 days and dry period is 150-220 days.
• Inter calving period 400-450 days. Bullocks are good for light work.

**Breeding Farms:**
• Livestock Research Station (LRS), GAU, Navsari, Gujarat.
• Buffalo Breeding Centre (AICRP) Dharwad, Karnataka.
• NDRI, Bangalore, Karnataka.
• Progeny Testing Centre, Central Buffalo Breeding Farm, Dharmod, Bharuch.
JAFFARABADI:
Synonyms: Kathiawari, Sorathi.
Home Tract: Around Jaffarabadi town in Gujarat state, Kutch, Junagadh, Jamnagar. Forest grazing buffaloes of Gir forest.

Physical Characteristics:
- It is the heaviest breed of buffaloes in the world.
- Adult male weigh: 600-650 kg, adult female weigh: 500-525 kg.
- Body colour is jet black with thick skin and scanty hair.
- Forehead is large and bulging like that of a baby elephant; horns are long, flat and loosely curved.
- Eye are sunken and small with sleepy appearance, neck and brisket are massive and well developed.
- Udder is well developed and pendulous with irregularly placed teats. Tail is long with white switch.

Economical Characteristics:
- Milk yield 1800-2700 liters per lactation. High fat % 9 to 10.
- Fat globules are big with high fat content; hence milk is very suitable for ghee making.
- Inter calving period 600 days. AFC 480 to 60 months.
- AFC is 48-54 months.

Breeding Farms:
- Cattle Breeding Farm, GAU, Junagadh.

BHADWARI:
Home Tract: Bhadwari estate of Agra district and adjoining areas of Gwalior and Etwah. Also found in the areas of Yamuna and Chambal rivers.

Physical Characteristics:
- Medium sized and wedge shaped body.
- Small head bulging towards horns. Legs are short and stout.
- Barrel is short and well developed.
- Coppery body colour. Eyes are prominent, active and bright.
- Udder is not so well developed.

Economical Characteristics:
- Average milk yield ranges from 2000-2100 kg per lactation (305 days).
- Milk fat may exceed 13% in some animals.
- AFC: 48-51 months, Calving interval: 15 months and dry period: 150 days.

Breeding Farms:
- CBF, Babugarh (Meerut), Agri. College Dairy Farm, Kanpur.
BANNI:
Home Tract: Banni area of Kutch district in Gujarat. They are also found in Sabarkantha, Surendranagar and Banaskantha districts of Gujarat.

Physical Characteristics:
- Body is medium to heavy, typical double and vertical coiling horns, strong body conformation.
- Wide head and neck is without wrinkles/folds, absence of dewlap, soft, thin and black skin.
- Mostly black in colour, in some cases copper colour or black with white markings on forehead.
- Udder is well developed, cup shaped and square.

Economical Characteristics:
- Well known for high milk production, disease resistance.
- Average daily milk yield is 9-10 kg.
- Average milk fat content is 5-6%.
- AFC is 46 months.

CLASSIFICATION OF BREEDS OF SHEEP AND GOAT
Classification of Breeds of Sheep:
According to ICAR India possess 42 breeds of sheep; which is 6.41 percent of world sheep breeds. 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.  2. Medium wool breeds.
3. Long wool breeds.  4. Crossbred type wool breeds.

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.
(iii) Produce poor quality lambs.
(iv) Sheep are hardy, hence suitable for ranches.
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).
(iii) Produce less and lower quality wool than fine wool breeds.
(iv) Produce very good quality lambs, higher prolificacy and higher growth rate.
(v) Not suitable for ranches, do better in stall feeding.

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.
(iii) Better mutton conformation.
(iv) Classified as medium wool breeds.

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.
(iii) Wool fibre diameter is more than 33 µ.
(iv) Wool is used for carpet manufacturing.
(v) Length of wool fibre is 5 to 15 cm.
(vi) Carpet wool – India, Pakistan, Newzeland, Syria, Argentina and Iraq.

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

6. Fur Wool Breeds:
Features:
(i) Skin of sheep with wool known as fur.
(ii) Skin is obtained by killing of lamb called pelt.
(iii) Used for making fancy articles, fur coat, purse, ladies wear, gloves etc.

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. Some of these are well-known but more than half of the population is on non-descript type. There are about 21 breeds of goats with specific characteristics.

(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.

**Utility Classification of Breeds of Swine (Pigs):** Domestic pigs are farmed primarily for the consumption of their flesh, called pork. The animal's bones, hide, and bristles have been fashioned into items such as brushes. Thus swine/pigs give two important marketable products viz; meat (pork) and the lard. Lard is the fat obtained from pig carcasses. It is used for cooking, making soap etc. At present swine are mainly kept for pork.

(A) **Meat Type Breeds:** Such breeds yield less than 15% lard of the carcass weight. E.g. Landrace, Duroc, Yorkshire and Tamworth (UK).

(B) **Lard Type Breeds:** The pigs of these breeds yield 15% or more lard of the carcass weight. E.g. Berkshire, Guinea Hog and Mulefoot.

**Utility Classification of Poultry:** Chickens are grown for their egg and meat. Likewise they are classified as egg-type chickens and meat-types chickens. Egg type chickens are composed of stock that has been developed for egg production and are maintained for the principal purpose of producing chicks for the ultimate production of eggs for human consumption. Breeds of meat type chickens primarily include broilers, fryers, roasters, and other meat type chickens. Here broilers and other chickens are raised for their meat. Broilers are genetically selected for fast growth and raised for meat rather than eggs.

- **Commercial Broiler Strains:**
  E.g. Cobb, Hubbard, Lohman, Anak 2000, Avian -34, Starbra, Sam rat etc.

- **Commercial Layer Strains:**
  E.g. BV-300, Bowans, Hyline, H & N nick, Dekalb Lohman etc.

  India has made considerable progress in broiler production in the last two decades. High quality chicks, equipments, vaccines and medicines are available. With an annual output of 41.06 billion eggs and 1000 million broilers, India ranks fourth largest producer of eggs and fifth largest producer of poultry broiler in the world. The broiler production has also sky rocketed at an annual growth rate of about 15 percent at present.

**Based on Utility Poultry Breeds are Classified into:**

(A) **Egg Purpose:** Producing more than 180-200 eggs per head per year and weighing 2-3 kg. E.g. White leghorn.
(B) **Dual Purpose:** Producing nearly 150 eggs per head per year and weighing 3-4 kg. E.g. Rhode Island Red.

(C) **Table Purpose:** Producing less than 100 eggs per head per year and weighing 3.5-4.5 kg. E.g. Brahma, Cochin.

**Classification of Camels:** The Indian camels are divided into two types depending on the work they perform, viz;

(A) **Baggage Camels:** These are robustly built than riding camels. These can carry 3-4 quintals of load over a distance of 35 km in a day with an average speed of 3-4km per hour. E.g. Bikaneri camels.

(B) **Riding Camels:** These can cover about 50 km per day for several days at an average speed of 10 km per hour. E.g. Jaisalmeri camels can cover up to 200 km in a night without stopping for food or water.

**Depending Upon the Origin/Hump, Camels can be Classified into Two Groups:**

(1) **Dromedary Camel (Camelus dromedarius):** These are from the Middle East and North Africa. Single hump. Head and body length: 9.6-11 feet. Shoulder height: 5.8-7.5 feet. Weight: 700-1500 pounds. Their color ranges from white, brown, tan, red, black and spotted. With their longer legs they can easily out run the bactrian camel.

(2) **Bactrian Camel (Camelus bactrians):** These are Asian camels, which come from the deserts of China and Mongolia. They have two-humps, shorter legs, are usually a beige color with hair that ranges from short to long depending on the season. Head and body length: 10-12 feet. Shoulder height: 6-7.6 feet. Weight: 1300-2100 pounds. Height of humps: up to 9 feet.
CHAPTER 6
INTRODUCTION TO COMMON FEEDS AND FODDERS, THEIR CLASSIFICATION AND UTILITY

Livestock feeds are generally classified according to the amount of a specific nutrient they furnish in the ration. They are divided into two general classes – roughages and concentrates. Roughages are bulky feeds containing relatively large amount of less digestible material, i.e. crude fibre more than 18 per cent and low (about 60 per cent) in T.D.N on air dry basis. Concentrates are feeds which contain relatively smaller amount (less than 18 per cent) of crude fibre and have a comparatively high digestibility and as a result higher nutritive value having more than 60 per cent T.D.N.

The number of substances used as feeding stuff to different species of livestock may exceed over 2000 items. All that is being attempted in this section is to indicate the outlines of classification of the conventional feeds into broad categories and to give typical examples of different groups under this classification.

Roughages:

Roughages are sub-divided into two major groups- succulent and dry, based upon their moisture content. Succulent feeds usually contain moisture from 60-90 per cent, whereas dry roughages contain only 10-15 per cent moisture. For the sake of convenience, succulent feeds are again classified into various types such as pasture, cultivated fodder crops, tree leaves, silage and root crops. Dry roughages have been further classified as hay and straw based on the nutritive values and methods of preparation.

Succulent Feeds:

1. Pasture: Of the succulent feeds, pasture is the most convenient and economic for maintaining larger livestock. Young rapidly growing grasses are rich in protein and highly palatable.
2. Cultivated fodder crops: In the absence of sufficient grazing ground of good quality for maintaining cattle, sheep, goat on pasture all the year round, the importance of growing fodder crops to provide feed economically for production of milk for draught animals, need no special emphasis. For the sake of convenience, these are classified into two groups- leguminous and non-leguminous. Among leguminous fodders, cowpea (Vigna catjang), cluster bean (Guar – cyamopsis psoraloides) are the most common kharif leguminous crops. They contain from 2-3 per cent D.C.P. and about 10 per cent T.D.N. on fresh basis and yield about 100 quintal of forage per acre. Berseem (Trifolium alexandrium) and lucerne (Medicago sativa) are two other commonly cultivated...
leguminous fodder in India. The former is an annual crop grown during the rabi season; the later is a perennial one having maximum growth in winter and spring but the growth is retarded during the monsoon season. Both these crops can yield over 300 quintals per acre in 5-6 cuttings. The disadvantage is that, both the foders are liable to produce “bloat” if given in large quantities and thus it is advisable that they should always be given along with some dry fodder. Lucerne and berseem contain on an average 2.5 to 3 per cent D.C.P. and 12 per cent T.D.N. on fresh basis. The phosphorus content of these two forages are poor and thus have wide calcium to phosphorus ratio. It is advisable to supplement a ration containing a large amount of leguminous fodder with a limited quantity of wheat or rice bran.

Among non-leguminous fodder jowar (Sorghum vulgare), maize (Zea mays) and sudan grass (Sorghum sudanens) are most common kharif fodder. Yield ranges from 100-200 quintals per acre. Most of the foders belonging to this group (Non-legume kharif) are having 0.5 per cent D.C.P. and 11-15 per cent T.D.N. except maize, which is the nutritious of all, having 1 per cent D.C.P. and 17 per cent T.D.N. on fresh basis. An improved variety of bajra named as I.C. 2291, has been evolved by I.C.A.R., which has protein content of 2.5 per cent on fresh basis and the yield is about 65 tonnes per acre in 4 cuts. Among the rabi non-leguminous fodder crops, oat is by far excellent for milch cattle. It has 2 per cent D.C.P. and 17 per cent T.D.N. on fresh basis. Non-leguminous perennial fodder crops consists of napier grass (Pennisetum purpureum), para grass (Bracharia mutica) and guinea grass.

All these grasses flourish vigorously during summer and rainy seasons. About 4-6 cuttings can be taken under north Indian conditions, so that an annual yield of 30-40 tonnes per acre is the yield.

**Important Forage Crops:**

**I. Cultivated fodder - Legumes**
- Berseem, Lucerne, Senji, Cowpea, Guar, and Rice bean.

**II. Cultivated fodder – Cereals**
- Oats, Sorghum, Bajara, Maize, Teosinte, Barley etc.

**III. Cultivated fodder – Other than cereals and legumes**
- Brassica spp.

**IV. Cultivated fodder – Perennial grasses**
- Napier, Bajara hybrid, Guinea grass.

**V. Cultivated fodder – Annual grasses**
- Deenanath grass

**VI. Perennial Range Grasses**
- Setaria, Anjan grass, Dhaman grass, Marval grass etc.
Feeding Stuffs

Concentrates

Proteinous Feeds

Oil cakes

Proteinous Feeds

Dry

Energy Feeds

Roughages

Animal by products (blood meal, other meat scraps and offal from slaughtered animals)

Roughages

Roots (Tapioca tubers, turnip, potatoes)

Mill by products (Arhar chuni, wheat bran, rice bran, grain chaff)

Grain and seeds (Maize, barley, sorghum etc.)

Proteinous Feeds

Roughages

Dry

Non-legume

Hay

Legume

Vegetarian (Sorghum, maize, doob etc.)

Legume (Hays of Lucerne, cowpea etc.)

Non-legume (Sorghum, maize, doob etc.)

Dry

Root crops

Succulent

Tree leaves

Green fodder

Pasture

Succulent
CHAPTER 7
PRESERVATION AND STORAGE OF FORAGES AS SILAGE AND HAY

Forages can be preserved either in the green form as Silage or in the dry form as Hay or Straw.

(A) **Silage Making**

Silage is the product resulting from storage and fermentation of succulent forage under anaerobic conditions in a silo.

**Advantages of Silage Making**

1. It furnishes high quality succulent feed for any season of the year and can be stored for number of years.
2. Nutrients are better preserved in silage than in hay, and it has high carotene content.
3. The animals eat fermented coarse stems of jowar and maize practically without waste.
4. It requires less storage space than the hay.
5. There is no hazard of fire as it contains 65% moisture.
6. Weedy crops/plants can be utilized in silage making.
7. It is slightly laxative and easy to digest by the animal.
8. Silage making is possible during monsoon, but not the hay.

**Limitations of Silage Making**

1. Transport of the fodder from distant places to the silo is difficult and costly especially during rainy season.
2. If not ensiled (filled and sealed) properly, wastage is high.
3. Small farmers can not afford to make silage, since silage once opened need to be utilized and silo can not be reclosed.
4. Vit-D content is less in silage than the hay.

**Crops Suitable for Silage Making**

All cereal crops rich in carbohydrates are suitable for silage making. Green maize has higher soluble carbohydrates and hence on anaerobic fermentation produces more organic acids (lactic and propionic acids), which preserve the silage well. This is the reason why green maize and jowar make excellent silage. The leguminous crops like green Lucerne, berseem not only have lower carbohydrates, but also have higher crude protein, which is broken down into butyric acid and ammonia, which make the silage unpalatable. If the carbohydrate content of silage material/crop is low, one may add molasses, vinegar or ground grains.
Types of Silo

<table>
<thead>
<tr>
<th>Vertical or Upright Silo</th>
<th>Horizontal Silo</th>
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<tbody>
<tr>
<td>Pit</td>
<td>Trench cum Bunker Silo</td>
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<tr>
<td>Tower</td>
<td>Trench</td>
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<tr>
<td>Tower cum pit</td>
<td>Bunker</td>
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<td>Silo</td>
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Silos, viz. tower silos and to some extent tower cum pit and trench cum bunker silos are more suitable where water table in the soil is very high.

**Advantages of Vertical/Upright Silo**
1. The gravitational force of the material is an advantage in self-packing of the silage.
2. The surface area exposed to air is less in such silo, and hence
3. Even with less skill, the material can be packed well in upright silo.

Because of these benefits upright/vertical silos are more popular in India.

**Limitations/Disadvantages of Vertical Silo**
1. It requires more labour in filling and emptying of silage material.
2. It does not facilitate mechanical filling, pressing and self-feeding.

Hence they are getting out-dated in European countries and are replaced by horizontal type of silos as they facilitate above aspects and therefore save labour.

The wall of a silo should be air tight, without any cracks and crevices. If walls are smooth plastered, it facilitates well settling and packing of material.

On an average one cubic meter space in silo can store 600 kg silage (i.e. 15-17 kg per cubic feet space). Silage is much more compact and heavier as the depth from surface increases.

**Ensiling (Filling the Silo Pit)** includes following steps:
1. Harvest the crop (jowar, maize) at 50% flowering /dent stage, when it contains maximum nutrients.
2. Dry/wilt the harvested crop for 1-2 hrs so that its moisture content is reduced to 70% or so. If moisture content is more, silage will be slimy / lumpy, and with lower moisture, there will be mould growth.
3. Chaff the green fodder into small pieces (1-2.5 inch) by electric chaff cutter. Set the chaff cutter in such a way that the chaffed fodder is thrown directly into the silo pit.
4. Spread the chaffed green fodder evenly into the silo and press it to the maximum extent for expulsion (removal) of air trapped in. Occasionally, trampling should also be done.

5. Do even spread of common salt @ 0.5-0.7% i.e. 10-15 kg per 2 tons of chaffed materials. Because all the fodders are deficient in sodium and chloride. Salt improves the test and acts as preservative. If the crop is poor in sugar and/or protein content like legumes and/or Napier hybrid/natural grasses, respectively one can add molasses @ 0.8% and urea @ 1 % in the silage material.

6. Fill up the silo layer by layer using chaffed fodder (1-2 feet) and silage additives (salt, molasses) in as much compact manner as possible, over a week time.

7. Cover the top of the silage material with poor quality dry roughages like wheat or paddy straw (about 1 feet layer).

8. Lastly, close the silo pit with a plastic sheet and pack it with minimum of 3 feet layer of earth/soil on the top for complete pressing of silage material.

9. Finally, seal or plaster the top of earth layer with a mixture of cow-dung and mud to create anaerobic condition in the silo. Check after 3-4 days for the presence of any cracks and if found, seal it again.

10. Maintain this air-tight condition for 2.5 to 3 months for complete fermentation of green forage into the silage.

**Silage Additives**

For making good quality silage, the fodder crop should contain sufficient amount of moisture and sugar. Napier hybrid, Guinea grass, Para grass, pasture grasses etc. contain less sugar and need addition of molasses @ 0.8% (8 kg/ton). Some time urea is also added @ 1% (10 kg/ton) to increase the protein content of the silage. Salt is added @ 0.5% (5 kg/ton) to increase palatability and preservability. Ground grains and grain byproducts are also added to absorb excess moisture and to increase the nutrient content of silage. Various organic acids are also used to increase the acidity, which helps in preservation of silage.
Figure – Process of silage making

How Ensiling Preserves the Green Fodder (Chemical Reaction in Silage)

When the green forage is placed in a compact mass in a silo, for some time the living plant cells continue to respire/breathe rapidly using the O₂ of the air trapped within the mass and give out CO₂. Within few hours practically all O₂ disappears and CO₂ level built-ups, which prevents development of mould. Initially heat is generated. This favours the growth of desirable anaerobic microbes mainly *Streptococcus lactis* and *Lactobacillus bulgaricus*. These microbes multiply vigorously in absence of O₂ and break the sugars of green forage, and produce various organic acids, viz. Lactic acid, Acetic acid and others. When enough lactic acid is produced in the silage, pH goes down to 3.8 to 4.0. In this condition silage is preserved for a long time. There is also production of other volatile fatty acids namely formic acid and butyric acid. When there is exchange of air inside the silo, the butyric acid producing bacteria multiply and break down the protein into butyric acid and ammonia leading to spoilage of silage. The moulds and fungi also grow/multiply under such aerobic conditions.

If silage is prepared and preserved well the losses are less. Loss of nutrients due to bleaching and shattering of leaves observed in hay making are not occurring in silage. However, if silage is not prepared skillfully, the losses are greater due to total spoilage. As compared to silage, hay making requires less skill and facilities. Moreover, there is shortage of green fodder, hence Indian farmers prefer hay making rather than silage making.
Qualities of Good Silage
1. It should have yellowish green colour (Khaki colour).
2. It should have fine aroma of lactic and acetic acids.
3. There should not be any mould or fungus growth.
4. It should have soft texture without coarse stems.

(B) Haylage
It is between hay and silage. It is low moisture silage. It is a product of legumes and/or grasses, which are wilted to about 50% moisture before ensiling in upright silo. The lower moisture content of haylage makes it difficult to pack sufficiently to exclude air from the mass, which results in greater spoilage.

Advantages of Haylage
1. Where the climate is not conducive/favourable (heavy continuous rain) for hay making, haylage can be prepared.
2. Animals also consume more dry matter in the form of haylage than the silage.
3. Feeding value of the forages when fed as hay or haylage is about the same, when proper procedures for both are followed.

(C) Hay Making
Forages, which are harvested before seed formation i.e. at flowering/bloom/dent stage and dried to near 85-90% dry matter, form hay. Indian hay just like straw consists of dry grass on which seeds have been ripened and leaves usually has been shed. For hay making, forages are dried (cured) either under the sunrays or inside the barn or in the machine, i.e. Sun curing, barn curing or machine curing is used to prepare hay.

Harvesting and Field Curing of Hay
The best time for cutting the crop for hay making is when it is 1/3rd to ½ in bloom. The crop cut early is higher in protein, lower in crude fibre and contains more vitamins i.e. more nutritive. Such hay is more palatable and will shatter less. It is best to let the crop lie in the field for few hours until it is well wilted or about 1/3rd to 1/4th dried cured. It should be raked in to small loose bundles called “windrows”. It is necessary to handle the hay only early in the morning to avoid loss of leaves.
Requisites/Characteristics of Good Quality Hay

1. It should be leafy. Leaves are rich in protein, vitamins and minerals.
2. Colour of hay should be green parrot like, which indicates the amount of carotene – a precursor of vitamin-A present in it.
3. It should be soft and pliable in texture.
4. It should be free from dirt, dust and fungus/mould growth.
5. It should have smell or aroma characteristic of the crop from which it is prepared.
6. It should be free from weeds and stubbles.

Losses of Nutrients in Hay Making

1. Losses of leaves by shattering. Gentle handling in early morning prevents shattering.
2. Losses of vitamins due to bleaching by sun and fermentation by bacterial action. Avoid bacterial action by complete drying/curing of material.
3. Losses of carbohydrate due to fermentation, starch is oxidized into CO$_2$ and water
4. Losses of soluble nutrients by leaching in heavy rain.
5. When hay is not properly dried, more heat will be produced by fermentation in staked hay and have a chance of spontaneous combustion.

Kinds of Hay

1. **Leguminous hay**: It has got more of digestible protein and other nutrients, viz. carotene, vit-D & E as it is prepared from leguminous crops like lucerne, berseem etc.
2. **Non-leguminous hay**: It contains less protein, minerals and vitamins and is less palatable as it is prepared from non-leguminous crops like jowar, grasses etc.

3. **Grain crop hay**: It is made from crops like barley, oat, harvested at dent stage.

4. **Mixed hay**: prepared from mixed legume and non-legume crops, has balanced nutrients.

**Physical Forms of Hay (Treatment of Dry Roughage)**

1. **Long hay**: Forages that are cut dried and then stored as such in the barn.

2. **Chopped hay**: Dry hay cut into small pieces of 2.0 - 2.5” in size and then stored.

3. **Baled hay**: Hay is tied in the form of bales of about 1m x 1m x 1m size. It requires less storage space than the chopped or long hay.

4. **Pelleting**: Grinding and pelleting of hay results in a product, which is easy to handle and store than the previous three forms. Pelleted hay is consumed in greater amount than the other forms, resulting in faster body weight gain. The processing cost is however little higher under Indian condition.

5. **Wafering or Cubs**: Hay is packed in form of 2-3” long x 1.25” wide x 1.25” high blocks/cubes. It requires less space for storage (25 lbs/cubit feet), because of small size and compactness. It also requires less labourers for transport, storage and feeding.
CHAPTER 8
REPRODUCTION IN FARM ANIMALS

Efficient reproduction (i.e. regular calving at 12-14 months interval) is a key for profitable dairy farming. The knowledge regarding anatomy and physiology of reproduction is very essential to maximize fertility and minimize reproductive disorders.

**Male Reproductive System**

The male reproductive system has been shown in figure below. The primary organs of reproduction in male are two testes, which are located outside the body in a sac like structure called scrotum. Scrotum maintains the temperature of testes about 4-5°C below body temperature. The cooler temperature is required for the normal spermatogenesis (process of formation of sperms in testes). The temperature is maintained by contraction and relaxation of muscles of scrotal wall. During cold atmosphere testes are retracted towards body whereas in warm weather they are relaxed.

**The male reproductive tract consists of two parts** –

1. **Testicles (primary sex organ) including**
   - Seminiferous Tubules made of Leydig Cells and Sertoli Cells
2. **Secondary sex organs, including...**
   - Epididymis
   - Vas Deferens
   - Urethra and Penis
   - Seminal Vesicle
   - Prostate Gland and
   - Cowper’s Gland

**Testes:**

Two in numbers suspended vertically within sac known as scrotum, ovoid in shape. Length is 10 - 16 cm and 8 cm width. Each testes composed of several crypts enclosed in serous layer called tunica vaginalis. Each crypt has several numbers of seminiferous tubules. The wall of seminiferous tubules consists of basement membrane & multilayered sperm producing epithelium having two types of cells i.e.

(i) Germ cells - Spermatozoa produced here.
(ii) Sertoli Cells - Sperms get matured. The space between seminiferous tubules occupied by interstitial cells (Leydig's cells) produces male hormone.
Epididymis:
Is considered in three parts i.e.
   (i) Caput (head),
   (ii) Corpus (body),
   (iii) Cauda (tail).
It arises from efferent ducts testes. Throughout of its length epididymal tube is lined with secretory cells. Spermatozoa produced in testis accumulate and mature during their journey through epididymis which is 30-35 meters in bull.

Transport:
Sperms transported from rete testes to efferent duct by the fluid pressure of testis and by active beating of cilia. It takes 7-9 days for any sperm to travel from germinal epithelium to caudal epithelium.

Concentration:
Dilute sperm concentration originated in testes- water absorbed into epithelial cell of epididymis mainly in caput & highly concentrated sperm left in cauda (tail).

Maturation:
In the course of migration of sperm cells get matured as; it result of secretion from epididymal cells.

Storage:
Cauda (tail) is store depot for sperms where they remain viable up to 60 days.

Vas deferens:
It is slender tube with thick cord like wall originating from tail of epididymis ending into urethra. It is paired and is with spermatic arteries, veins,
nerves. It passes through the inguinal ring and pelvic cavity. It is abundantly supplied with nerves & by voluntary contractions of musculature/it is involved in ejaculation.

**Urethra:**

It is common passage way for product of testes, accessory glands and for excretion of urine. It extends through penis to the glands penis.

**Penis:**

It is male organ of copulation arid composed of erectile tissue attached and held by sigmoid flexure. It has function of ejaculation and excretion of urine.

**Seminal Vesicles:**

Two in number located on either side of ampulla which secrete a fluid high in sugars (fructose) to nourish the spermatozoa – feels like a bag of grapes (palpation). The secretion contains mainly fructose and citric acid contributes to seminal plasma which is rich in carbohydrates, salt of citric acid, proteins, amino acids, enzymes, vitamins. This fluid also dilutes sperm at ejaculation and serves to activate motility – the bulk of fluid production occurs here. Secretes prostaglandins, causing uterine contractions.

**Prostate Glands:**

Consist two joined parts. It is surrounded by urethral muscles. Secretion is high in mineral content.

**Cowper's gland:**

Are paired, round - compact of walnut size, located above urethra. Secretion is viscid & mucus like.

**Female Reproductive System**

It consists of organs, namely

1. **Ovaries** : Reproductive glands
2. **Fallopian Tubes**: Coveys ova from ovary to uterus.
3. **Uterus**: In which fertilized ovum develops.
4. **Vagina**: Dilatable passage from uterus to Vulva.
5. **Vulva** : Terminal segment of system

**Ovaries:**

Two in number laying in the abdominal cavity sizes are 0.5 to 1.5 Inch diameter and 0.5 to 1.5 inch width & thickness. Dual purpose - production of eggs or ova and production of female hormone i.e. estrogen.
Oviduct (Fallopian Tube):

Are slender, zigzag tubes attached to ligament 20-25 cm in length, close to ovaries in such a way that eggs / ova released by ovary area cached through funnel shape wide end called as "Infundibulum". The epithelial lining of oviduct is ciliated of which ciliary motion helps to conduct ova from ovaries to uterus. The fertilization occurs in the ampullary region.

Uterus:

It consists of short medium body, pair of spirally twisted internally cavity connecting two horns known as body of uterus. The uterus has three layers i.e. outer servosa, middle muscular and inner is mucosa. In non-pregnancy period uterus lies in the pelvic cavity which descends into abdomen during pregnancy. Fertilized ovum/embryo develops into uterus until the time of birth. It nourishes the developing foetus through cotyledons of inner layer.

Cervix:

It is thick walled portion which lies between uterus and vagina having muscle layers forming longitudinal folds forming spiral passage way through it. It is 4 inch long and 1 inch or more thick. It is tightly closed during pregnancy and anoestrus period and reopens during estrus and parturition.

Vagina:

It is between cervix to vulva in cow. It is 8-10 inch long highly elastic organ. Responsible for secretion of mucus, serves as birth canal dung parturition & admits male organ during copulation.

Vulva:

It is external vertical opening of genital tract just below anus. Diameter is
larger than that of vagina. Vulva walls supplied with glands which are active
during excitement.

**Oestrus Cycle**

**Definition:**

1. The interval from the first signs of sexual receptivity at Oestrus (heat) to
   the next estrus is called estrus cycle.

2. The chain of physiological events that begins at one Oestrus period and
   ends at next is called as Oestrus cycle.

The cycle is of 20 + 2 days in cows for normal female in quite regular cycles.
This cycle may be studied in four distinct phases as designated by Marshall i.e.
Proestrum, Estrum, Metestrum and Diestrum.

**Proestrum: (Pre-estrus)**

This phase is indication of animal coming in heat. The ovary is
surrounded by follicular fluid containing high level of estradiol. The Graffian
follicle within ovary grows. The increased level of estradiol is absorbed into
blood making effect to oviduct causing growth of cells lining the tube &
increasing in the number of cilia which are shortly helpful to transport ova to
uterus. Also, epithelial wall of vagina increases in thickness to accommodate
smooth coitus this period is of 8 hrs to 2 days.

**Estrum: (Estrus)**

This is period of sexual desire. The Graffian follicles are mature or ripe in
this stage. This phase period comes to close by rupture of follicle of ovulation
i.e. release of Ovum. This period lasts for 12-24 hours in cow while 1-2 days in
ewe. The symptoms exhibited during this period by cow are it bellows
frequently, mounts other animals, excited, licking to other animals and stands to
be ridden by other animals. This period is called period of standing heat. The
proper period to breed is 8 to 15 hrs, for getting high fertility rate.

**Metestrum: (Met-estrus)**

Period during which reproductive organs return to normal condition. The
phase is of 1-5 days in which the cavity of the Graffian follicle from which
ovum had been expelled becomes reorganized and forms new structure known
as corpus luteum (C.L.) which secretes progesterone hormone having following
functions:

1. Prevents maturation of further Graffian follicles which prevent
   occurrence of further estrus period for a time.

2. It is essential for implementation of fertilized eggs.

3. It initiates the development of mammary gland.
**Diestrus: (Di-estrus)**

This is the longest phase of cycle. The corpus luteum is fully grown, making its effect on uterine wall to accommodate the embryo. The muscles of uterus develop. The uterine milk is produced to nourish embryo. If pregnancy succeeds, this stage is prolonged throughout gestation remaining C.L. intact for the period. In absence of fertilized eggs, the C.L. undergoes retrogressive changes the cell becomes vacuolated in the lipid droplets. Since the C.L. got reabsorbed, the level of progesterone is declined and the level of estradiol increases, bring the animal in heat and the cycle is repeated in case of failure of fertilization.

**Pregnancy**

The period from the date of conception to the day of parturition is called "gestation period" and the condition of the female of carrying the foetus during this period is called "Pregnancy".

OR

"The period of pregnancy is the duration of time which elapses between conception and parturition".

**Importance of Pregnancy Diagnosis:**

Whether animal is pregnant or not is directly related to economy of dairy management Pseudo-pregnancy may lead to loss of valuable time period in the life of animal. Pregnant animals need to change their feeding schedule as well as the management from early stage. An early detection of pregnancy becomes an indispensable job for herd owner.

**Methods of Pregnancy Diagnosis:**

1. Signs of Pregnancy - exhibited and and detected externally.
2. Symptoms of Pregnancy - per rectum / vaginal examination.
3. Laboratory Tests - Presence of certain hormones tested in laboratory.

**Signs of Pregnancy:**

1. Cessation of Oestrus cycle.
2. Sluggish temperament
3. Tendency to fatten.
5. Gradual increase in weight
6. Increase in size of udder.
7. Waxy - appearance of teats in last month of pregnancy
CHAPTER 9
HOUSING PRINCIPLES, SPACE REQUIREMENTS FOR DIFFERENT SPECIES OF LIVESTOCK

Housing of Dairy Cattle

Objectives
1. To protect the animals from extreme/harsh climatic conditions.
2. To protect them from the predators.
3. To increase the efficiency in the herd management in terms of feeding, cleaning, watering, health control, handling etc.
4. To increase the efficiency of labour utilization in carrying out the farm work.

Points to be considered while deciding the 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 soil 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 criteria 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 manager curbs, and 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 a 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, 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 areas contribute not only to greater milk yield of cows and make the work of the operator easier but 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 below:

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

**Types of Housing:** Two systems

1. **Conventional Housing or Stanchion Barn**

   In this system, the animals are tied throughout the day and night in a completely enclosed structure or barn. Feeding, watering, milking, treatment etc is carried out at the same place. This system is followed in countries having cold climate such as European countries. Facilities for heating or cooling the internal air are also provided in the barn through heaters or coolers and used according to the season. Management is also mostly through automation.
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.

Figure: Cattle shed

Advantages of Tail to tail system:

1. Under the average conditions, 125 to 150 man hours of labor are required per cow per year. In cleaning and milking the cows, the wide middle alley is of great advantage.
2. Lesser danger of spread of diseases from animal to animal.
3. Cows can always get more fresh air from outside.
4. 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 head gowala.
5. Any sort of minor disease or any change in the hind quarters of the animals can be detected quickly and even automatically.

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.
2. Loose Housing System

Here the animals are kept loose all the while, except a temporary tying at the time of milking and treatment. Facilities of suitable manger under the shed and water-trough in paddock under the tree-shade are provided to the animals for free access to feed, water and rest. This system is widely practiced in hot tropical countries including India due to its many advantages over conventional system.

Advantages of Loose Housing

1. Animals move freely and are most comfortable to get feed, water, sunlight, exercise etc at their will.
2. The construction cost is less because of its simplicity in design.
3. Expansion of buildings/sheds is easy, if required in future.
4. The sheds have flexible utility. A cow shed can be utilized for heifers and vice-a-versa.
5. It is labour saving – less labourers required for feeding, watering, cleaning etc.
6. Detection of heat, sickness and such problems is easy since the animals can manifest them through their behaviour.

Limitations of Loose Housing System

1. Separate milking parlour is required to be constructed.
2. More labour is required in catching and handling of animals.
3. Chances of spread of contagious disease are more as the animals move freely and are in intimate contact to each other, and there is common feeding and watering.
4. It is difficult to disinfect the animal shed regularly and completely.
5. Powerful or bossy animals do not allow sufficient space for feeding, watering, rest etc to the mild or weak animals.

Floor Space Requirement per Animal as per BIS (Bureau of Indian Standard)

<table>
<thead>
<tr>
<th>Sr. No.</th>
<th>Category of animals</th>
<th>Floor space required (sq.m.)</th>
<th>Maximum No. of animals/shed</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Under shed</td>
<td>In paddock</td>
</tr>
<tr>
<td>1.</td>
<td>Cows</td>
<td>3.5</td>
<td>7.0</td>
</tr>
<tr>
<td>2.</td>
<td>Buffaloes</td>
<td>4.0</td>
<td>8.0</td>
</tr>
<tr>
<td>3.</td>
<td>Down calvers (Advanced pregnant cows/heifers)</td>
<td>12.0</td>
<td>12.0</td>
</tr>
<tr>
<td>4.</td>
<td>Breeding Bulls</td>
<td>12.0</td>
<td>120.0</td>
</tr>
<tr>
<td>5.</td>
<td>Young calves</td>
<td>2.0</td>
<td>4.0</td>
</tr>
<tr>
<td>6.</td>
<td>Older calves</td>
<td>1.0</td>
<td>2.0</td>
</tr>
</tbody>
</table>
Minimum height of shed at eaves should be 175 cm (6 feet) in the medium to heavy rainfall areas, and 220 cm (7.5 feet) in semi-arid areas.

**Feeding and Watering Space Requirements**

<table>
<thead>
<tr>
<th>Sr. No.</th>
<th>Category of animals</th>
<th>Feeding space/animal (cm)</th>
<th>Watering space/animal (cm)</th>
<th>Width of manger/water-trough (cm)</th>
<th>Depth of manger/water-trough (cm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Adult C/B Calves</td>
<td>60-75</td>
<td>6.0-7.5</td>
<td>60</td>
<td>40</td>
</tr>
<tr>
<td>2.</td>
<td></td>
<td>40-50</td>
<td>4.0-4.5</td>
<td>40</td>
<td>15</td>
</tr>
</tbody>
</table>

These requirements are to be provided under loose housing system when feed and water are available *ad libitum*.

**Approximate Storage Space requirement per quintal (m³)**

1. Hay (loose): 1.60  
2. Hay (baled): 0.70  
3. Hay (Chopped): 0.60  
4. Straw (loose): 3.00  
5. Concentrates: 0.17  
6. Silage: 0.50

**Structures on a Dairy Farm**

1. **Primary structures** – meant for housing the animals, like Cow sheds, Calving boxes, Calf pens, Heifer sheds, Bull pens, Bullock shed, Isolation boxes, Milking Parlour etc.
2. **Secondary or Ancillary structures** - other than animal sheds, like Dutch barn, Silos, Chaff cutter shed, Milk room, Office, Stores and Labour Quarters.
3. Pump house and Fodder farm.

**PRECAUTIONS:**

It should never be taken for granted that the bull, howsoever mild and well-behaved, will not go vicious. While handling the bulls, i.e. tying, untying, leading, taking for a walk etc., one should always be cautious and at the same time confident.

The bulls have enormous physical strength. Hence very strong and thick ropes, chains, walls, fences etc., should be used for bull management. Halter, nose strings and nose rings should be changed before they get worn out and give way. This will not provide any opportunity to the bulls to learn about their enormous strength and capability.
CHAPTER 10
MANAGEMENT OF CALVES, GROWING HEIFERS, DRY AND PREGNANT ANIMALS AND MILCH ANIMALS

(A) Importance of Calf Raising (as replacement stock)
In dairy herd, adult cows or buffaloes produce milk. Milk is the main source of income to the dairyman. Every year some of these cows or buffaloes are to be sold/culled because of the following causes/reasons.

a) Old age/senility,
b) Not breeding properly –repeat breeding,
c) Loss of teat/s & udder- mastitis,
d) Low production –uneconomic
e) Vices – self suckling, suckling others, bossism
f) Chronic contagious diseases – TB, JD, Brucellosis etc.

The proportion of such animals may be 20 to 30 per cent of the total cows. As these uneconomic animals are removed from the herd, equal number of new animals should be added every year to maintain the herd strength and the milk production. This new addition (or herd replacement) can be done by two ways.

(i) By purchasing cows or buffaloes and
(ii) By raising the farm-bred heifers.

Replacing the uneconomic cows through purchases has following disadvantages.

a) Only unwanted animals are sold. So in most cases we purchase animals having low production or some defects/vices.
b) Diseases are introduced in the herd along with purchased animals.
c) Consistent increase in level of production of the herd, every year or every generation, cannot be done.

In view of the above disadvantages, raising heifers on the farm is advisable.

(B) Systems of Calf Raising: Calves can be raised by two methods. They are;

(i) Natural methods, and
(ii) Artificial method or weaning.

In natural method the calf is allowed to suckle the dam at the time of milking, morning and evening. In ‘weaning’ or ‘artificial’ method the calf is not allowed to take milk directly from the teats of the dam, but it is fed known quantity of whole milk or other substitute by the man in bowl/pail.
The advantages of weaning are as follows:

a) In natural method the calf suckles large quantity of milk; say 25-30% of the milk received in the pail. This comes to 450-500 liters per lactation. In weaning method the quantity of whole milk feeding can be very much reduced. So the calf can be raised more economically.

b) We can know the real milk producing ability of cows.

c) In case of death of the calf, the milk yield of the dam is not lost. If dam dies, calf can survive on milk of other cows.

d) Male calves and defective female calves can be sold at early age.

e) The cows become regular breeder. They come in heat earlier and conceive earlier than the cows, suckling their calves.

The only disadvantage of weaning method is that if proper care is not taken and proper sanitation is not observed, there is higher rate of mortality (death rate) among calves due to pneumonia, enteritis, calf scour, septicemia etc.

(C) Care of the Calf right at Birth:

Care of the calf starts well before it is born. The dam should be housed in a clean well-bedded calving pen. As soon as the cow shows signs of labour pain, one man should constantly and quietly watch her. Uneasiness, kicking the floor, frequent getting up and sitting down, lying down and straining, are the signs of initiation of parturition. Within two to three hours after starting of labour pain, usually, the water bag appears at the vulva. This ruptures and the hooves of the two fore legs appear. At each contraction/straining by the cow the feet of the calf are pushed out gradually. The head is presented- pressed on the knees, as the feet are out. This is the normal presentation. If the calf is not in this position at the time of birth, it leads to "Dystokia"- difficult birth. When there is dystokia, expert help should be called immediately. If the position is normal, the calf may be pulled out, gently, when the cow is straining. The cow generally does not need assistance for birth of the calf, if the presentation is normal.

As soon as the calf is out, we should see that the respiration is started. Clean the mouth and the nostrils off the obstruction if any. If the respiration is not established a light jolt may be given to the calf.

(D) Care of the Calf after the Birth:

a) Natural system: The newly born calf, if it is to be raised by natural method, should be placed before the dam. The cow will immediately begin to lick and dry the calf. This will stimulate respiration, improve the circulation and dry the calf. A vigorous calf will attempt to get up in about 15 minutes. When
the calf is dried and can stand on its legs, it may be weighed. It may be noted that male calves are slightly heavier than the female calves. The naval chord may be cut to about 3 to 6 cm size by sterilized scissors and disinfected with 30% solution of tincture of iodine or with solution of savlon.

b) **Weaning system**: The calf to be raised by weaning should be removed to the next room, soon after it is born. It should be cleaned dry with a clean soft towel or cloth. The drying should be done quickly to prevent the calf from chilling especially in winter. After drying the calf, it may be weighed and the naval chord cut and disinfected as stated above. Soon after this, ear marking with tattooing fork or ear tagging should be done for definite identification of the calf. Earlier application of identification marks is very important for calves to be raised in groups by weaning.

**Feeding Colostrums**:

The first milk that a cow gives after dropping a calf is known as colostrum. It is thick, sticky and yellow in colour. The colostrum from the dam is to be fed to the calves to be reared by natural as well as weaning method for first 3-4 days.

**The importance (advantages) of colostrum feeding is as follows.**

a. Colostrum contains 3 to 5 times more protein than normal milk. It is also richer in minerals (copper, iron, magnesium, manganese), carotene, vitamin A and other vitamins of B complex group, than normal milk. These nutrients are very essential for a good start of the growth of the calf.

b. The laxative property of colostrum helps to clean away the “muconium” - a solid metabolic waste product collected in the intestines of the young one. This is sticky, foul smelling and black in colour – first faeces passed out by calf.

c. The globulin fraction of the protein of colostrum carries antibodies. They enable the calf to protect itself from many infections.

**The colostrum from the mother should be fed to the calf preferably within 30 minutes and not later than 90 minutes of birth.** This is because with passage of time the permeability of intestinal wall to globulin (antibodies) decreases. If the colostrum from the mother is not available, that from any other cow may be fed. If no colostrum is available, the calf may be given the normal milk supplemented with 20 ml of cod liver oil, 60 ml of castor oil and one egg yolk.
Teaching the Calf to Nurse/Suckle:

- **Natural method:**
  By instinct the calf looks for the food at and above the level of its head, and tries to suck anything it goes into touch with. Under natural conditions most of the calves will find out the teats, within ½ to 1 hour after their birth, and begin to nurse themselves. However, there may be calves, which need assistance in suckling for a period from one to several days. The calves have difficulty in nursing because of tight, turgid, thick teats full of milk, so they should be allowed to suckle after some milk is drawn from the udder.

- **Weaning method:**
  In case of weaning system it is very necessary to teach the calf to drink milk. The calf has the instinct to look for food at and above the level of its head. This comes in the way of making the calf to understand that the food comes from below that level. Again, the calf knows “suckling” instinctively, but not “drinking”. Therefore, the fingers should first be dipped into colostrum and be given to the calf for suckling from above. As the calf sucks, the fingers should be inverted and lowered down and dipped into the vessel containing colostrum. The mouth of the calf will follow the fingers to the surface of the colostrum. As its mouth comes in contact with the surface of the colostrum it will be induced to drink. By repeating the above action the calf should be taught to drink milk. This operation requires a great deal of patience. For convenience, the calf may be taken to one corner of the pen and the milk pan should be kept at suitable height near the mouth of calf. Milk feeding pails with nipples attached are also available. The vessel and hand of operator should be thoroughly washed and disinfected prior to milk feeding, otherwise the calf may get infection leading to scour.

**Feeding the Calves:**

(a) **Natural Method:**

In this method, the calf is kept with the dam day and night for first 3-4 days. Then it is transferred to the calf pen. The calves in the same pen should be of about the same age. The calf should be taken for suckling twice to the dam. Ordinarily the calf should be allowed to suckle 1 kg of milk per 10 kg of its body (i.e. 10% of its body weight) per day for first 6 to 8 weeks of age. This may then be gradually decreased. The calf should be given a handful of concentrate mixture, moistened with milk after 1 week of age. This may gradually be increased to 0.5 kg daily. Similarly the calf should be given excellent quality roughage – preferably green - after it is about 2 weeks old. As
the calf learns to eat the fodder, the quantity may be increased and fed *ad-libitum*.

(b) **Weaning Method:**

Under weaning system, the calf may be reared by feeding.

1. Skim milk or butter milk or whey (Milk replacer/substitute).
2. Calf starter (Conc. mixture containing 22-24% CP & one animal origin ingredient)
3. Milk replacer and calf starter combined.

**Feeding schedule for method-1 (milk replacer)** is given in Table below

<table>
<thead>
<tr>
<th>Age of calf</th>
<th>Rate of feeding per day (kg)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Whole milk</td>
</tr>
<tr>
<td>1 to 3 days</td>
<td>colostrum</td>
</tr>
<tr>
<td>4 to 14 days</td>
<td>3 to 5</td>
</tr>
<tr>
<td>2 to 3 weeks</td>
<td>5 to 6</td>
</tr>
<tr>
<td>3 to 4 weeks</td>
<td>-</td>
</tr>
<tr>
<td>4 to 5 weeks</td>
<td>-</td>
</tr>
<tr>
<td>5 to 6 weeks</td>
<td>-</td>
</tr>
<tr>
<td>6 to 8 weeks</td>
<td>-</td>
</tr>
<tr>
<td>8 to 12 weeks</td>
<td>-</td>
</tr>
<tr>
<td>12 to 16 weeks</td>
<td>-</td>
</tr>
<tr>
<td>16 to 24 weeks</td>
<td>-</td>
</tr>
</tbody>
</table>

It is thus estimated that the following *amount of feeds* will be required for raising the calf *up to six months of age* by this method.

Whole milk: 45 to 75 liters.  
Grain: 175 kg  
Skim milk: 500 to 700 liters.  
Hay: 300 kg

When skim milk, butter milk or whey are not available for feeding, method 2 or 3 may be employed.

**Precautions in Feeding Weaned Calves:**

1. Care should be taken in maintaining sanitation and disinfection of milk feeding vessels, calf pen etc. The mouth of calf is cleaned after milk feeding & common salt be applied.
2. The temperature of milk or milk substitute should be nearer to the body temperature.
3. Routine timing of feeding should be followed.
4. The calves are kept tied individually at and after milk feeding to avoid suckling body parts of each other.

The calves should be taught to eat feed as early as possible. This will hasten rumen development, so that they can digest and eat more of their natural,
economical feeds, viz. roughages and concentrates. Little milk may be sprinkled on concentrates initially when these are offered first time at the age of 1 to 2 weeks. The calves like clean, green and leafy legume or mixed fodders. The calves should have access to clean, fresh drinking water at all times.

**Housing:**
1. The calves should be kept in dry, clean and well-ventilated pens.
2. They may be provided clean bedding in winters.
3. They are kept individually until one month of age.
4. Then they are housed in groups according to age.
5. After 3 month of age, male & female calves are kept separately in similar age group.
6. The calf pen should have attached open yard for sufficient exercise.

**Dehorning /Disbudding:**

*Advantages:* Dehorned animals are safe to handle and require lesser floor and feeding space. There is no danger of horn cancer or injury afterwards.

*Methods and age:* The dehorning is done by physical method using electric dehorner / hot iron rod or by chemical method using KOH /AgNO₃ crystals at 10 – 14 days of age.

**Deworming:**

The calves, especially buffalo calves, are prone to numerous roundworm infestations. So regular deworming of calves is important to maintain their normal growth rate. They are drenched with various broad spectrum anthelmentics periodically, such as Piperazine adipate, Heltac, Mebendazole, Parbendazole, Vermax etc. Coccidiostats like DOT, Sulpha drugs and Amprosol are also given to control coccidiosis.

**Vaccination:**

Calves are vaccinated for foot and mouth disease at 2 month of age and again booster dose is given at 6 months of age.

**Growth pattern (Test of efficient calf management)**

1. At birth weight of Kankrej, Jersey X Kankrej crossbred, Holstein Friesian X Kankrej crossbred and Mehsani buffaloes are 21 –22 kg, 22-24 kg, 25-26 kg and 24-26 kg, respectively.
2. Indigenous, crossbred and buffaloes calves should grow at the rate of 300, 450 and 400 gm daily.
3. Calf mortality should be within 10 %. Buffalo calves have little higher mortality rate (<15%) than this.
MANAGEMENT OF DAIRY HEIFERS

(A) Management of Growing Heifers:

From the management point of view, growing female bovines after the milk feeding or suckling stage (4 months of age) till first calving are called heifers. These are actively growing, yet unproductive animals. Therefore, there is a general tendency to neglect these animals. They should be managed as cheaply as possible, at the same time taking care that they grow at the normal rate and start breeding at an early age.

(a) Early Post-Weaning Period:

For the period of about 4 to 6 months after milk feedings or suckling stage (i.e. from 4 to 8-10 months of age) the dairy heifers should be fed 1-2 kg concentrates of good quality. The mixture, if possible, may contain some protein from animal origin. Concentrates mixture should contain nearly 14-16% protein, if legume roughage is fed, and if not, the protein percent in the ration should be about 16-18%. Mineral mixture and common salt each should be fed daily @ 20 to 25 g to each heifer. Since the rumen is not fully functional in the early post-weaning period, good quality roughage should be fed to dairy heifers. Mixed (legume /non-legume) succulent roughage is very good. If all roughage is only non-leguminous it is necessary to feed about 25 g of steam-sterilized bone meal or any other calcium supplement to the heifers daily.

(b) Late Post-Weaning Period:

By about 4-6 months after weaning, i.e. after 8-10 months of age, heifers adjust themselves to high roughage-low concentrates ration. The rumen is also fully developed and functional by this age. In view of this, the heifers may not be fed concentrates mixture if good quality leguminous or mixed roughage is available for feeding. If the roughage is all cereals and is not of good quality, it is necessary to feed concentrates @ 1 to 2 kg. Mineral mixture and common salt each be fed @ 25 to 35 g daily.

Measures to Economize Feeding of Dairy Heifers:

One can economize ration for growing heifers by feeding

1. Some unconventional concentrates: Babul pods, cassia torra, mango seed kernel etc.
2. Urea treated poor quality roughage: Urea @ 4% breaks lingo-cellulose complex.
3. Molumin (urea + molasses + mineral) blocks.

The growing heifers are more comfortable under loose housing system. Buffalo heifers eat more and grow at faster rate when water is
sprinkled/splashed on their body or are allowed to wallow in pond during noon hours in summer. This also helps in reducing the problem of anoestrus, silent estrus etc (summer sterility) by improving signs of estrus manifestation. They should be protected from external and internal parasites for efficient growth. They are vaccinated for HS, BQ, RP and FMD every year.

(B) Management of Breedable Heifers (Reproduction management):

The heifers should be fed, cared and managed in such a way that they attain optimum body size at their breeding age. For onset of puberty, body growth and development are more important than the age. They should not suffer in growth. Otherwise, (1) there will be delay in age at first calving and (2) loss in lifetime milk production. Optimum age and body weight at puberty, first breeding/maturity and calving for heifers are given below. There are species and breed differences in these characters.

<table>
<thead>
<tr>
<th>Reproductive trait</th>
<th>Exotic</th>
<th>Crossbred</th>
<th>Zebu</th>
<th>Buffalo</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Age at first heat/puberty (month)</td>
<td>8-9</td>
<td>12-15</td>
<td>20-24</td>
<td>18-24</td>
</tr>
<tr>
<td>2. Age at first breeding/maturity(mths)</td>
<td>13-15</td>
<td>15-20</td>
<td>24-30</td>
<td>20-27</td>
</tr>
<tr>
<td>3. Weight at first breeding (kg)</td>
<td>240-260</td>
<td>240-260</td>
<td>260</td>
<td>230-240</td>
</tr>
<tr>
<td>4. Age at first calving (months)</td>
<td>24-28</td>
<td>28-30</td>
<td>36-40</td>
<td>36-40</td>
</tr>
<tr>
<td>5. Weight at first calving (kg)</td>
<td>340-360</td>
<td>300-320</td>
<td>300-320</td>
<td>340-380</td>
</tr>
</tbody>
</table>

Pubertal/Mature heifers should be checked for heat at least two times daily, i.e. morning and evening, so that animals in heat are not missed. If the herd size is large, a teaser (vasectomised bull) is used for heat detection. Anoestrous heifers of breedable age and having proper growth should be routinely examined every month and necessary action be taken.

The heifer should be got bred depending on her breed/genetic group and the breeding policy to be followed. In case of crossbred heifers the breed and exotic inheritance of the sire to be used should be decided well in advance to carry on breeding according to a planned program. It is desirable to maintain the exotic inheritance between 50 and 62.5% for better heat & disease tolerance. Breeding heifers to bulls, known to produce small calves, helps reducing trauma/dystocia at calving and subsequent reproductive problems. Purebred exotic heifers and indigenous heifers of dairy breeds should preferably be bred with progeny tested pure breed sires, and not for crossbreeding. Pregnancy diagnosis of the heifers should be a routine on the farm.

Those heifers which are pregnant should be well looked after and cared for and be fed slightly liberally. They may be accustomed to getting tied and be groomed.
(C) Management of Advanced Pregnant Heifers:
Gestation period:

Average gestation period of indigenous cows is about 280 to 285 days and that of buffaloes 310 days. Average gestation period of exotic dairy cattle is about 283 days. But this varies with breed from 278 to 288 days. Ordinarily, heifers have 1 to 2 days shorter gestation period as compared to that of the cows. Similarly on average male calves are carried 1 to 3 days longer than the female calves.

Management:

Up to about 7 ½ months of pregnancy, no much extra feeding or care is necessary to be given to the heifers. They are housed, fed and managed along with other heifers. Then on completion of about 7 to 7 ½ months, the heifers should be transferred to the milking herd. They should be housed and fed along with milch cows. They should be brought to milking byre/parlour, tied and fed concentrates along with milking cows. While feeding concentrates they should be groomed. Their hind legs be tied, and udder and teats be manipulated as if milking is done.

Feeding:

Advance pregnant heifers are growing animals. Not only is this, in their body the foetus also actively growing. Hence they need especially extra energy, proteins and minerals in their ration. Such heifers should be fed daily, about 1½ to 2 kg of concentrate mixture in addition to their usual ration fed till now. In the concentrates mixture, they should be fed 25 to 30 g of mineral mixture or steam sterilized bone meal.

Housing:

About a fortnight before the expected date of calving, the advance pregnant animals should be housed in maternity pen/calving box at night time. The pen should thoroughly be cleaned and disinfected and sufficiently bedded before the animals are housed in them. With approaching parturition, they may be housed in the pen all day and night, and should be looked for calving, every 2 to 3 hours during the day and night. They should be given laxative ration.

(D) Care of Pregnant Heifers at Calving:

When the animal is observed to kick the floor, it is to be presumed that the labour pain has already started and that parturition is expected within 2-4 hours. Arrangement should be made to observe silently the progress of the process of parturition and readily assist the cow in the process in case of need/dystocia. During this process of watching, we should ascertain whether the
A calf is in normal position or not. If the presentation is normal, generally no assistance is necessary. Yet, we may pull the calf out gently after the head and legs up to knees are out. In case of abnormal presentation (Dystocia - difficult birth) expert aid should be called for to assist the birth.

**CARE & MANAGEMENT OF FRESHLY CALVED ANIMALS**

The cow should be fed palatable feeds (calving mixture) like wheat bran 1 kg mixed with high energy feeds like Jaggery 500 gm, Common oil 200 gm, cooked Bajra/Jowar 1 kg plus Suva, Ashalio, Methi each 100 gm, after the birth of the calf. It is customary to feed to parturient animals the calving mixture after cooking for a period of 10 to 15 days after calving.

This will provide to the cow readily available energy. It is also believed to induce the milk flow and to aid cleansing the reproductive tract. It is not necessary to feed special calving mixture, if the heifers were fed well during gestation.

After feeding calving mixture/concentrates, the cow should be given lukewarm drinking water. This may be warmed up if it is very cool. Good quality dry roughage should then given to the animal. The animal then be allowed to take rest and watched silently for passing out of the placenta or fetal membranes. The placenta is expelled out normally within 6 to 8 hrs of calving. It weighs between 2.5 to 3.0 kg. If placenta is not expelled out, there will be decomposition in uterus and may impair general health and subsequent reproduction of the cow. If the placenta does not get expelled within 24 hrs, arrangement should be made to remove the same manually. The placenta, on expulsion, should be immediately removed away from the animal and be buried. As the animal have a very strong urge of eating these membranes and hence constant attendance is necessary to prevent the animal from eating the same and dispose it away. It is believed; if the animals eat these membranes their milk production is decreased and may develop troubles in digestion.

After the expelling of the fetal membranes the hind region of the cow should be washed with warm water and dried with cloth. The soiled and wet bedding then be removed and replaced by fresh dry bedding material. Freshly calved cow should be milked as early as possible to remove colostrum. The colostrum is to be fed to the calf. For first few days, the cow may not be milked completely to avoid problem of milk fever.

Freshly calved cow may be housed in the maternity pen for about 4 days. She should be fed good quality roughage ad-libitum and calving mixture or concentrates mixture. The quantity of concentrates mixture fed should be
gradually increased and in the calving mixture normal concentrates should be mixed in increasing proportion and finally cow to be taken to only the normal milch ration.

For a period of about 10-15 days after calving, the cow should be protected from stormy cold winds, rain or direct sun as the case may be. The cow also needs protection from dogs, foxes, wolves, crows etc., during and just after calving.

CARE AND MANAGEMENT OF MILKING ANIMALS

Milking animals are the earning members of the dairy herd. These animals produce milk, sale of which forms more than 80-85% of the income from the dairy farm. Any lapse in the management of these animals is immediately reflected in lowered milk production and hence the reduced income. That is why it is necessary to look after the milking animals very carefully. Different body systems of the milking animals have to work very hard for producing high quantity of milk. As a result of this, the milking animals are under a sort of stress. Hence, even the slightest deviation from the normal routine makes them upset resulting into low milk production.

The salient 10 features of the management of the milking animals are as follows:

(1) Regularity of routine operations:

Dairy animals are the creatures of habits. Repeating any action at appointed time in a given sequence forms habit. Performing various daily operations in a sequential manner at a particular time on a farm makes a routine. Hence, on a dairy farm any convenient sequence of daily operations should be followed at conveniently fixed timings. However, having fixed the routine according to our convenience, it should not be lightly changed; but be followed regularly. Milking animals get very nervous to any change in the routine and react very badly by producing less milk.

(2) Gentle and kind handling and behaviour:

Animals of all the categories of the herd should be treated with kindness. This is more so with the milking animals. Ill-treating the animals, shouting very loudly, beating etc., should be avoided with milking animals, as they are readily frightened and become nervous. This leads to reduction in feed intake and milk yield. Milking animals should be called with gentle voice and affection, and should be patted and groomed gently.
(3) Feeding:
(a) Concentrates:

From a very long-standing experience of keeping and feeding very large number of animals, dairymen have evolved certain guidelines for feeding concentrates to animals. They are known as thumb rules. In this method concentrates is fed for maintenance and for milk production.

(i) Maintenance Allowance:

Ordinarily, mixed roughage of good quality fed to the milking animals, supply fully their nutrients requirement for maintenance. In other words it is not necessary to feed any concentrates to the milking animals for supplying nutrients for maintenance, if the roughage is mixed and is of good quality. But if the milking animals are getting all cereal roughage, i.e. not mixed, it is necessary to feed concentrates to them. This may be fed @1-2 kg daily/head according to the roughage quality and condition of the animals.

(ii) Milk Production Allowance:

The concentrates for milk production are to be fed in addition to what is fed for maintenance. The amount of concentrates to be fed for milk production depends principally on the fat content of milk, i.e. whether the animal is cow or buffalo, and to some extent on type of roughage fed.

With good quality mixed roughage feeding and if the fat content of milk is not exceeding 5.0 %, i.e. for cow, the concentrates may be fed at the rate of 33% of milk production. If roughage is all cereals and/or its quality is not good, the concentrates may be fed @ 40 % of milk production. If the fat content of milk is 6.5 - 7.0 % or more, i.e. in case of buffaloes, with good quality mixed roughage, the concentrates may be fed @ 40% of milk production. With all cereal roughage or medium to poor quality roughage, the rate of concentrates feeding should be 45 - 50% of milk production.

<table>
<thead>
<tr>
<th>(A) Production allowance for Fat % in milk</th>
<th>Concentrate to be fed (as % of milk production), if fed during Good quality mix roughage</th>
<th>All cereal roughage</th>
</tr>
</thead>
<tbody>
<tr>
<td>(i) 4-5 % fat (cow)</td>
<td>33 % of milk</td>
<td>40 % of milk</td>
</tr>
<tr>
<td>(ii) 6-7 % fat (buffalo)</td>
<td>40 % of milk</td>
<td>45-50 % of milk</td>
</tr>
<tr>
<td>(B) Maintenance allowance</td>
<td>nil</td>
<td>1-2 kg</td>
</tr>
</tbody>
</table>

(b) Feeding Minerals:

Ordinarily, except for the calcium, phosphorus, sodium and chloride all the other minerals required by the milking animals are present in conventional feeds to meet with their normal requirements. Hence they need not be supplemented. But there may be certain areas where soil is deficient in one or more of the micro-minerals. In that case, the forages grown on such soils are
also deficient. Under normal conditions milking animals should be fed about 30 g of common salt daily. This may be fed mixed with concentrates or in form of bricks or blocks of salt as licks, or loose in saltboxes, or loose in mangers. If the animals do not get about 50% of roughage as legumes, they should be fed daily about 25 to 30 g of calcium supplement or steam sterilized bone meal. It is advisable to feed minerals supplement to the high yielding animals even if they are fed mixed roughage.

(4) Milking:

After parturition, the dairy animals are milked. The milk produced for first 3 to 5 days may not be taken for sale or use as fluid milk as it is ‘colostrum’. It is very high in protein and coagulates on heating.

After parturition, the dairy or weekly milk yield of the animal increase very rapidly up to 5 to 9 weeks and reaches the maximum level. This highest level reached, is called the peak yield. In Kankrej animals, this peak is reached in the sixth week after calving. The peak production then declines at the rate of 1.7 to 2.0 per cent per week. Persistency of high milk production is important for getting higher lactation yield.

The lactation milk yield of the dairy animals is lowest in the first lactation. It then increases up to 3rd to 4th lactation; after which it gradually decreases showing the effect of advancing age.

The dairy animals are mostly milked two times daily. It is well known that milk secretion is a continuous process and also that the rate of milk secretion is inversely proportional to the intra-mammary pressure, hence cow should be milked at regular interval of 12 hrs. In view of these facts, soon after milking, secretion rate is at its maximum and soon before milking secretion is at its lowest. Therefore if animals are milked three times instead of twice there will be an increase in production of milk by about 15 to 20%. The animals yielding 10 liters or more milk daily can be milked thrice. Very high yielding animals may be milked even four times daily.

Measures/Tips for Clean Milk Production:

It is desirable to milk the animals in a clean milking byre. Milking should be done in clean sterilized utensils by healthy milkers, dressed in clean cloths. Udders and teats of these animals should be washed with warm potassium permanganate solution and dried with a clean piece of cloth. Strip cups should be routinely used to detect mastitis in early stage.
Precautions at milking time:
After the letdown of milk by action of hormone oxytocin released, the milking operation should be swift, yet comfortable to the cows. At the time of milking the surrounding should be clean, quiet and peaceful. Barking of dogs, shouting, beating the animals, presence of peculiarly dressed strangers, visitors in large number should be avoided, since these results in release of fright hormone adrenalin and withholding of milk/reduction in milk production.

(5) Breeding:
After parturition, animals may come in heat within about a month’s time. However, it takes about 2 months for complete uterine involution. Hence animals coming in heat within two months of parturition may not be bred.

Exotic cows have a calving interval of about 13 to 14 months; crossbred cows about 14 to 16 months, indigenous cows about 17 to 19 months and buffaloes about 16 to 20 months. The calving interval longer than 15 months leads to uneconomic production. Hence the milking animals should be successfully bred between 3 to 5 months after calving. All the relevant measures of heat detection, pregnancy diagnosis etc., as described under ‘to maintain the reproductive efficiency’ under the managerial function on a dairy farm, should be taken for maintaining optimum calving interval.

(6) Housing: (objectives of providing house)
Milking animals should be housed in such a way that-
(i) They are protected from extremes of climatic elements, wild life and ecto-parasites.
(ii) They are comfortable under sufficient ventilation and sanitation.
(iii) There is convenience in feeding and management of the cows.

(7) Drying:
It is necessary that dairy animals have adequately long (60 days) dry period. Because during this period (i) the nutrients reserve that is lost during lactation is replenished in the body, (ii) the mammary system makes good wear and tear of different tissues and gets ready for the next lactation and (iii) the nutrients are diverted to the actively growing foetus. Dry period of about 60 days in believed to be adequate for exotic/crossbred animals. With high yielding indigenous animals the period of about 100 days is considered adequate. The dry advance pregnant animals should be given extra allowance of nutrients called “steaming up” to meet the above needs of the body.
Methods of Drying:
The animals which have had a lactation period of about 10 months and which carry the foetus of 6 to 7 months may be dried. The animals to be dried should not be allowed to come in contact with their calves. Their concentrate feeding is discontinued. They should not be fed any succulent roughage. Even dry fodder fed should be of poor quality and that to only 50-60% of normal quantity. Water intake should also be reduced. These steps help in reducing the milk secretion materially and hence drying the animal quickly. The animals can be dried by any one of the following three ways/methods.

(i) Partial milking method:
In this method of drying, all the milk the cow gives is not removed, but some amount is allowed to remain in the udder. Thus, the intra-mammary pressure in the udder is not completely relieved. This results in reduced secretion of milk day by day, since milk secretion is inversely proportional to intra-ma pressure. When the milk yield is considerably reduced, milking first on alternative days, then once in three days etc, dries the animals.

(ii) Intermittent milking method:
In this method animals are milked once daily, then once in 2 days, once in 3 days etc., thus gradually extending the period between milking and then stopping the milking.

(iii) Abrupt stoppage of milking:
This is the most effective method of drying. Animals yielding even up to 10 litres of milk can be dried by this method without any trouble. As the milking is not done the intra-mammary pressure is built up in the udder, hence milk secretion comes to stand still. As the formation of fresh milk is stopped the milk already filled in the udder gets re-absorbed into the blood streams and the cow gets dried up.

(8) Providing water:
Milking animals perform very hard work in secretion of milk. In addition, they lose quite a lot of water from the body in form of milk. As a result of these, they need more water than that needed by animals of any other category of the dairy herd.

The amount of water required by the milking animals is governed by the following factors, viz. (i) Ambient temperature/season (ii) Moisture content of the feeds, (iii) Milk yield (iv) Temperature of water and (v) The degree of cleanliness of the water.
Milking animals, in addition to 30-35 litres of water for maintenance, need 2 to 3 litres of water for every one litre of milk production (total 55-60 lit). In summer, the water requirement of milking animals increases by 100% over that in winter. In addition to drinking water needs, about 40 to 70 litres of water per cow daily is also required for cleaning and washing of animal/shed etc.

Milking animals should have free access to clean drinking water, all the time. If this is not possible, they should be given water at least four times daily. In regions, where winters are very chilly the drinking water for milking may be slightly warmed up. Providing water to the milking animals through automatic drinking bowls is the most satisfactory way.

(9) Health Care Measures:
Sanitation, isolation of sick animals and timely treatment are important. Regular CMT testing for mastitis helps control of disease. All the animals of the dairy farm, viz, calves, heifers, cows, breeding bulls, bullocks etc should be kept free from infectious/contagious diseases. Therefore, as routine the herd should be got regularly tested annually once for Tuberculosis, John’s disease & Brucellosis, and reactors/doubtful animals be removed/slaughtered.

Timely vaccination for prevention of disease like Foot and Mouth disease, Rinderpest, Hemorrhagic Septicemia, Black Quarter etc., should invariably be done. Regularly, as a routine for control of endo-parasites, deworming of the dairy herd should be done at least once before the onset of monsoon and once after the monsoon is over. This must scrupulously be observed in case of crossbred and exotic animals as they are very badly affected by worm infestation. The whole dairy herd should also be protected from ecto-parasites like the ticks, mites, lice, grubs etc by periodical dipping.

A health calendar should be prepared, indicating the approximate dates and months of the year and the prophylactic measures to be taken against diseases, worms, ecto-parasites etc., and this should be rigidly followed.

(10) Daily Routine Inspection:
It is very necessary that daily some responsible person should observe each milking animal individually very closely. At the time of the observation the following points/objectives be kept in mind and be noted, viz. (i) general health and condition of the animal, whether there is loss in condition or improvement, (2) whether the animal is cycling, is in heat, or has passed the heat or has been bred and is pregnant etc., (3) whether there are ecto-parasites like ticks on the body, especially underneath the root of the tail etc., (4) whether there is any injury to the teat or udder, (5) the level of current milk production
of the animal, whether increasing or decreasing etc. The actions necessary to be taken as a result of the inspection should be decided and promptly executed. The additional advantage of this routine inspection is that the responsible man will know all the milking animals individually. The animals also feel familiar with the person and do not get frightened or nervous when he moves in the herd or approaches very closely to any of them.

**CARE OF THE DRY COWS**

In an efficiently managed dairy herd the dry cows are always pregnant, carrying the foetus at least of five months or more, (mainly because of proper calving hygiene, timely post-partum breeding, and sound care & management throughout lactation). As the foetii are growing actively in the wombs of advanced pregnant animals, they require liberal supply of energy, protein and minerals in their ration (steaming up). They have also to replenish the reserve storage of nutrients already depleted during the lactation period through milk secretion, and to have improved yield in ensuing lactation.

Therefore, after about 7 1/2 months of pregnancy, the dry cow should be fed 1.5 to 2.0 kg of concentrate as pregnancy allowance, over and above the maintenance need. If leguminous roughage is lacking, daily about 25 to 35 gm of steam-sterilized bone meal or any other suitable mineral supplement be fed. The other management of the dry pregnant cows should be similar to that described for advance pregnant heifers.
CHAPTER 11
PREVENTION AND CONTROL OF IMPORTANT DISEASES OF LIVESTOCK

The herd health calendar includes schedules in the form of charts, tables, pamphlets etc of various operations like vaccination (immunization), annual/periodical testing, de-worming and dipping or spraying etc to be performed on animals to preserve their normal health. It gives information about the content, dose, route and mode of administration of vaccines or drugs, and also the time of its application and the name of disease against which it is to be used.

Livestock Health

Herd health programme that emphasize prevention of disease, rather than treatment play a central role in any attempt to increase production efficiency. Treatment will always be important in terms of survival of the individual sick animal. However in terms of survival of the total production unit (profit versus loss) prevention is the more desirable method of disease control. Health denotes physical, physiological and mental wellbeing of an individual. Disease means any deviation from normal state of health.

Classification of Diseases:
A. According to Mode of Origin
   1. Hereditary diseases: Transmitted from parents to the offspring.

B. According to Specific Causes:
   a) Specific diseases: Produced by a specific pathogen or factor. They are subdivided into
      i) Infectious diseases: Caused by pathogenic organisms like
         Viral diseases: Rinderpest (RP) and Foot & Mouth disease (FMD).
         Bacterial diseases: Black quarter (BQ) and Hemorrhagic septicemia (HS) and
         Protozoan diseases: Surra and Theileriosis.
      ii) Non-infectious diseases: Caused by physical or chemical or poisonous agents, nutritional deficiency or disturbed metabolism.
         E.g.
         1. Deficiency diseases - Rickets
         2. Metabolic diseases - Milk fever
         3. Poisoning - Pesticide poisoning
   b) Non-specific disease: Those diseases whose causes are indefinite or multiple e.g. Pneumonia.
C. According to mode of spread:
1. **Contagious disease:** Spread by means of direct or indirect contact, e.g. FMD and HS. All infectious diseases may or may not be contagious but all contagious diseases are infectious.
2. **Non-contagious diseases:** Do not spread by means of direct or indirect contact. E.g. Rickets.

D According to clinical signs:
1. **Per acute disease** is characterized by very short course (few hours to 48 hours) and very sever symptoms e.g. Anthrax.
2. **Acute disease** is characterized by a sudden onset, short course (3-14 days) and severe symptoms e.g. FMD, RP.
3. **Sub acute disease:** Whose course is 1-4 weeks and severity is less than acute one. E.g. Sub acute mastitis.
4. **Chronic disease:** Whose course is more than 4 weeks and signs are not severe in character e.g. Tuberculosis.

E. According to intensity and spread of diseases:
1. **Sporadic disease:** Occurring occasionally, singly, or in scattered instances and shows little or no tendency to spread within the herd e.g. Johne's disease.
2. **Enzootic/Endemic disease:** Outbreak of disease among animals in a definite area or particular district. E.g. Anthrax, H.S.
3. **Epizootic/Epidemic disease:** Which affects a large population of animals in large area at the same time and spread with rapidity e.g. FMP, RP.
4. **Panzootic /Pandemic disease:** Widespread epidemic disease usually of worldwide distribution e.g. Influenza.
5. **Zoonotic disease:** A disease which can be transmitted from animal to man and vice versa e.g. Anthrax, Brucellosis.

**General Measures for Prevention of Contagious Diseases**
1. Identification and isolation of infected animals.
2. Treatment of affected animals.
3. Slaughter of animals suffering from incurable diseases.
4. Disposal of dead animals either burning or deep burial.
5. Destroy contaminant fodder by burning.
6. Proper disposal of contaminated water.
7. Regular cleaning and disinfection of cattle shed and its premises.
8. Don’t allow animals to come from affected to clean area.
9. Restrict the movement of animals from affected to clean area.
10. Don’t allow animals to drink water from ponds, rivers etc. during outbreak of disease.
11. Close animal markets, cattle shows etc. during outbreak of disease.
12. Regular spraying of insecticides to control external parasites.
13. Regular de-worming to control internal parasites.
15. Provide adequate ventilation and sufficient space.

**Normal clinical values in animals:**

<table>
<thead>
<tr>
<th>Species</th>
<th>Temperature °F</th>
<th>Pulse rate/minute</th>
<th>Respiration rate/minute</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cattle &amp; buffalo</td>
<td>101.6</td>
<td>42 – 60</td>
<td>16 – 24</td>
</tr>
<tr>
<td>Sheep &amp; Goat</td>
<td>102.6</td>
<td>70 – 80</td>
<td>18 – 30</td>
</tr>
<tr>
<td>Poultry</td>
<td>107.0</td>
<td>130 – 160</td>
<td>15 – 30</td>
</tr>
</tbody>
</table>

(I) **Vaccination or Immunization Schedule:**

`Vaccine is a Proteinous preparation of any living attenuated or killed micro-organisms, which is used to evoke immune response of host specific to the antigen when injected, and thereby protecting animals from that disease.

However, the young animals below 2 months of age should never be vaccinated as it would neutralize the passive antibodies/immunity received in the form of maternal or colostral immunoglobulin, and thus, would make the animal more susceptible to infection rather than creating resistance/immunity against that disease. Normally first dose of vaccine is administered to young growing animals at the age of 4-6 months, except for FMD which can be given earliest at 2 months of age.

No vaccine has so far been developed for fungal and parasitic diseases, except Theileriosis.

(II) **Annual/Periodical Testing:**

Farm animals are generally tested annually once (in the month of June-July) for the possibilities of certain chronic, zoonotic or contagious diseases like TB, JD & Brucellosis, and periodically (monthly/fortnightly) for detection of sub-clinical mastitis for immediate treatment/action.

1. **Tuberculosis (TB) and John’s Disease (JD)** — Intra-dermal Tuberculin and Johnin tests are done in the skin fold of neck region by injecting 0.1 ml of antigen by a tuberculin syringe and then measuring the circumference of the bead with the help of Venire Caliper immediately and after 48-72 hr. In positive
reactors, the site appears swollen, hot, painful and hard within 72 hrs. Therefore, the difference in the reading above 4 mm is considered positive and such animals are retested 3 months later and if again found positive, are culled/slaughtered.

2. Brucellosis - Milk ring test is done as a herd test on pooled milk sample of the entire herd using coloured *Brucella abortus* antigen in a test tube and if it is found positive (coloured ring formation in tube on incubation at 56°C for 1 hr) then blood or serum of individual animal is checked by plate agglutination or tube agglutination test respectively. A serum titer above 1:40 is taken positive and such animals are culled immediately from the herd.

3. Sub-clinical mastitis: California Mastitis Test (CMT) is carried out periodically on milk samples of all four quarters of each lactating animal in a *strip-cup* using coloured California reagent. The change in colour and consistency of milk (greenish-sticky) indicates infection in that quarter of the udder, and intra-mammary treatment should be given soon to prevent development of clinical form of mastitis in that case, as it is economically very harmful to the farmer.

(III) Control of Internal (Endo-) Parasites (by Deworming):
As a routine, deworming is usually done twice a year i.e. before (June-July) and after (Oct-Nov) monsoon. In young growing animals, it should be done at 10 days and then at 1, 3, 6, 9 & 12 months of age and then every year before & after monsoon. Important deworming agents used are albendazole, mebendazole, permethazole, fenbendazole, fasciolax, flukin, distodin, oxyclozanide, banminth, heltac, piperazine, vermax etc.

(IV) Control of External (Ecto-) Parasites (by Dipping or Spraying):
Dipping means immersing the animals in insecticide solution or spraying of some safe insecticides on the animal body to eradicate ecto-parasites like ticks, fleas, lice, mange, mites etc present in the skin or hair coat. For the purpose, DDT, BHC, Malathion, Butox (safe), Pestoban, Arsenic- sulphur dip, Tobacco leaves extract etc can be used. Dipping or spraying should be done at least twice at 14 days interval to kill adult as well as egg/larval stages of parasites from the body coat.
### Vaccination Schedule for Farm Animals

<table>
<thead>
<tr>
<th>Sr. No.</th>
<th>Vaccine/Disease</th>
<th>Content of vaccine</th>
<th>Animals to be vaccinated</th>
<th>Dose and route</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>A. Bacterial vaccines</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1.</td>
<td>HS — vaccine for hemorrhagic Septicemia</td>
<td>Oil adjuvant, formalized or alum precipitated killed <em>Pasteurella multocida</em> bacteria</td>
<td>Cattle/Buffalo/Calves/Sheep/Goat</td>
<td>3.0ml S/C</td>
<td>Vaccinate 3 wks before onset of rainy season (pre-monsoon vaccination) i.e. in the month of May or June.</td>
</tr>
<tr>
<td>2</td>
<td>BQ vaccine for black Quarter</td>
<td>Killed/activated suspension of <em>Clostridium chauvoei</em> bacteria</td>
<td>As above</td>
<td>3.0ml S/C</td>
<td>As above</td>
</tr>
<tr>
<td>3</td>
<td>Anthrax spore vaccine for anthrax</td>
<td>Live attenuated spores of <em>Bacillus anthracis</em> bacteria</td>
<td>As above</td>
<td>1.0ml S/C</td>
<td>Avoid self-inoculation - Practice only in endemic areas in June.</td>
</tr>
<tr>
<td>4.</td>
<td>Brucella vaccine for Brucellosis</td>
<td>a) Live attenuated <em>Brucella abortus</em> strain-C 19 vaccine</td>
<td>Calves 4-8 M old only (Calfhood vaccine)</td>
<td>1.0ml S/C</td>
<td>Avoid self-inoculation- Practice only in young stock, not in adults.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>b) Killed/inactivated suspension of Br. <em>abortus</em> strain 45/20</td>
<td>Adult cattle and buffaloes</td>
<td>5.0ml S/C</td>
<td>Used in adults during actual outbreak of disease.</td>
</tr>
</tbody>
</table>
### B. Viral Vaccines

<table>
<thead>
<tr>
<th>No.</th>
<th>Vaccine Type</th>
<th>Description</th>
<th>Age Group</th>
<th>Dose</th>
<th>Route</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>FMD polyvalent vaccine for Foot &amp; Mouth Disease</td>
<td>Killed/inactivated suspension of FMD (Aptho) virus serotypes O, A, C, Asia1</td>
<td>All cloven footed farm animals, 1st dose at 2 months</td>
<td>5.0ml</td>
<td>S/C</td>
<td>Vaccinate twice a year i.e. Feb-March and again Sept-Oct (half yearly)</td>
</tr>
<tr>
<td>2</td>
<td>R.P. vaccine for Rinderpest</td>
<td>Live attenuated or killed tissue culture of RP (Myxo) virus</td>
<td>Calves at 6 &amp; 10 Months of age and then, annually</td>
<td>1.0ml</td>
<td>S/C</td>
<td>Vaccinate once a year in epidemic areas and every 3 yrs in other zone</td>
</tr>
<tr>
<td>3</td>
<td>Rabisin or Raksha-rab vaccine for rabies</td>
<td>Inactivated suspension of Rabies (Rhabdo) virus</td>
<td>All pet and farm animals, 1st dose at 4-6 months of age.</td>
<td>1.0ml</td>
<td>S/C</td>
<td>Post-bite immunization: 1 dose on day of bite in vaccinated animals, and 7 dose each of 1 ml on 0,3,7,14,30,60 &amp; 90days of bite in non-activated animals</td>
</tr>
</tbody>
</table>

### C. Protozoan Vaccine

<table>
<thead>
<tr>
<th>Vaccine Type</th>
<th>Description</th>
<th>Age Group</th>
<th>Dose</th>
<th>Route</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Raksha-T vaccine for Theileriosis</td>
<td>Killed suspension of Theileria annulata blood protozoa</td>
<td>Exotic and crossbred calves</td>
<td>1.0ml</td>
<td>S/C</td>
<td>Costly vaccine, used only in susceptible young cattle</td>
</tr>
</tbody>
</table>

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Enterotoxaemia
Inactivated toxin of Clostrid. Perfringi-D
All age groups of Sheep
3.0ml S/C
Follow Pre-monsoon vaccination i.e. in June.

Tetanus toxoid for tetanus
Inactivated toxin of Clostridium tetani
All age group, all species
0.5-5.0ml I/M
Whenever there is serious injury/accident or operation.