

DAIRY TECHNOLOGY

STUDY MATERIAL

II SEMISTER SKILL DEVELOPMENT COURSE

Offered by

DEPARTMENT OF ZOOLOGY
P.R. GOVERNMENT DEGREE COLLEGE (A)
KAKINADA

DAIRY TECHNOLOGY - STUDY MATERIAL

MODULE I

Section I (Introduction and Establishment of a Dairy Farm): 05 Hrs
 1.1 Dairy development in India – Dairy Cooperatives (NDRI, NDDDB, TCMPF) (1hr)
 1.2 Constraints of Present Dairy Farming and Future Scope of Dairy Farmer. (1 hr)
 1.3 Selection of site for dairy farm; Systems of housing – Loose housing system, Conventional Dairy Farm; Records to be maintained in a dairy farm. (3 hrs)

1.1 Dairy development in India

Animal husbandry is the science of farming of animal livestock. It includes caring, breeding and management of livestock. Animal husbandry includes cattle, poultry, apiculture etc. Dairying is part of animal husbandry.

Dairying is the management of animals like cows, buffalos goats sheep for milk and its products for human consumption. The products like milk, yogurt (curd), cheese, butter, Ghee etc. constitute dairy industry.

India ranks first among the world's milk producing Nations since 1998 and has the largest bovine population in the World. Milk production in India during the period 1950-51 to 2017-18, has increased from 17 million tonnes to 176.4 million tonnes

When the world milk production in 2008 is around 700 million tones, India has produced 121.7 million tones. This was achieved due to the bovine population of 304 million (199.1 million cattle and 105.3 million buffaloes).

Today the dairying industry contribution to the GDP of india is around 4.2%.. It is a primary source of income for about 7 crore rural families.

In India most of the Milk is produced in rural areas by the farmers having 2 to 5 cattle at their homes. To improve the efficacy of the dairy industry all these farmers are to be united to achieve best yielding. Government of India established many Institutions to strengthen the dairy industry as follows.

NDDDB (National Dairy Development Board)

NDDDB was set up under the Societies Registration Act in 1965. The main objectives were as follows:

1. To monitor over the various development programmes by Indian Dairy Corporation set up in 13 Jan., 1970.
2. To promote the Co-operate dairy development programmes.
3. To success the operation flood programmes.
4. To increase research and extension work in the field of dairy

The Operation Flood programme (OFP) was conceived by the NDDDB and endorsed by the government. Operation Flood, launched in 1970 is a project of the National Dairy Development Board (NDDDB), which wasq the world's biggest dairy development program that made India a milk-sufficient nation and the largest milk producer in the world.The objectives of this programme were as follows

Operation Flood Programme Phase I ((1970-81)

1. Organizing the dairy co-operatives at the village level
2. Providing the physical and institutional infrastructure for milk procurement, processing, marketing

Achievements: Establishment of 13,000 Dairy Co-operative Societies (DCS) at Village level with membership of 18 lakh farmers.

Operation Flood Programme Phase II (1981-85)

Achievements: 1. The numbers of village level Co-operatives reached to 34,500 covering 36 lakh farmers. 2. The peak milk procurement increased to a level of 79 lakh litres per day.

Operation Flood Programme Phase-III (1985-94)

Achievements: 1. The no. of Dairy Co-operative Societies increased to 70,000 with 93.14 lakh farmer memberships. 2. Average milk production per day reached to 115 lakh litres per day

Operation Flood Programme: Phase-IV (1996-2006)

Achievements: 1. Strengthening the Co-operatives by providing funds 2. Impart education, personal training, marketing support, product development for the farmers.

In India National Milk Day is celebrated on November 26 which is the birthday of Dr. Verghese Kurien - the father of White Revolution (which includes operation Flood) in India.

NDRI (National Dairy Research Institute)

To develop any field requires good research facilities. Dairy educational activities in the country commenced with the establishment of the 'imperial Institute of Animal Husbandry and Dairying' in 1923 in Bangalore. This institute is renamed as National Dairy Research Institute and moved to Karnal Haryana in 1955 B.Sc. Dairying courses were started at NDRI in 1957.

Regular Post-graduate programmes were started in 1968

National Dairy Research Institute (NDRI) has contributed a lot in the growth of dairy industry and played a crucial role in India's development in milk production with its continuous research.

TCMPF (Tamilnadu Cooperative Milk Producers Federation Limited)

TCMPF is an organization of Dairy Co-operative of Tamilnadu. It was established in1981 and took over all the commercial activities such as milk procurement, processing, packing and marketing of milk and milk products from the Tamil Nadu. The Headquarters of the TCMPF is located at Chennai .

The Federation collects milk from various Districts markets the milk in Chennai Metro fulfilling the demand of milk consumers.

The Federation provides necessary technical support to the Unions, including marketing assistance.

1.2 Constraints of Present Dairy Farming and Future Scope of Dairy Farmer

Constraints of Present dairy farming

Indias's share in world milk production stands at 17% with 66 million tonnes. But there are many constrains to increase this level as follows.

1. Poor management.
2. Majority of stock of poor genetic quality.
3. Poor credit facilities.

4. Lack of veterinary extension services.
5. In-sufficient nutrients and green fodders.
6. Poor quality semen.
7. Lack of vaccination facilities.
8. Competition from private sector.
9. Adverse environment.

Future Scope of Dairying

India is endowed with the largest livestock population in the world. It accounts for about 57.3 per cent of the world's buffalo population and 14.7 per cent of the cattle population. Thus, there is a tremendous scope/potential for increasing the milk production through profitable dairy farming. The following are some of the reasons for the prospective future of the dairy industry

1. The demand for milk is constantly increasing in cities as well as small towns and rural areas because of nutritional awareness of the milk and increase in the health consciousness in the consumers.
2. Dairy farming in India has evolved from just an agrarian way of life to a professionally managed industry due to the profits involved in it and scientific approach
3. 65% of the milk produced is consumed in raw. The remaining is converted into processed foods like butter, cheese, Ghee etc. There is ample scope for subsidiary milk processing units.
4. cow dung and urine are gaining a slow market keeping in mind the cultural aspects.
5. There scope for Veterinary medical products, Veterinary farm products, and other allied industries
6. There will be very big employment for veterinary doctors, assistants, farm labour.

1.3 Selection of site for dairy farm; Systems of housing – Loose housing system, Conventional Dairy Farm; Records to be maintained in a dairy farm.

Selection of site for dairy Farm

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

- 1. Topography:** 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.
- 2. Soil Type:** The soil 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 placed so that direct sunlight can reach the platforms, in the shed. It should protect the cattle from strong wind currents whether hot or cold.
- 4. Accessibility:** Situation of a cattle shed by the side of the main road preferably a distance of about 100 meters for easy transport of cattle, feed or milk
- 5. Durability:** Durability of the structure is obviously an important criterion in building a dairy farm.
- 6. Water Supply:** Abundant supply of fresh, clean and soft water should be available at a cheap rate.

7. Surrounding: Areas with wild animal should be avoided. Narrow gates, smooth finished floor in the areas where the cows move should be eliminated.

8. Labour: Honest, economic and regular supply of labour should be available.

9. Marketing: Dairy buildings should only be in those areas from where the owner can sell his products profitably and regularly.

10. Electricity: Electricity is the most important sanitary method of lighting a dairy. Since a modern dairy always handles electric equipments

11. Facilities for Improved labour Efficiency: 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 utilisation of labour and land

Systems of housing – Loose housing system, Conventional Dairy Farm

The most widely prevalent practice in this country is to tie the cows with rope on a katcha floor. The animals will be exposed to extreme weather conditions leading to bad health and lower production. Dairy cattle may be successfully housed a wide variety of condition, ranging from close confinement to little restrictions except at milking time.

The housing systems of cattle are of two types. The loose housing and The conventional barn.

I. Loose Housing System

Loose housing may be defined as a system where animals are kept loose except at the time of milking and at the time of treatment. The system is most economical. Some features of loose housing system are as follows.

- In loose housing dairy animals are keeping loose in an open paddock except at milking time.
- The open paddock is provided shelter along one side and enclosed with half walls / wire fences / GI pipes.
- Common watering tank and manger (Feeding trough) is provided.
- Separate milking parlor is constructed for milking purpose.

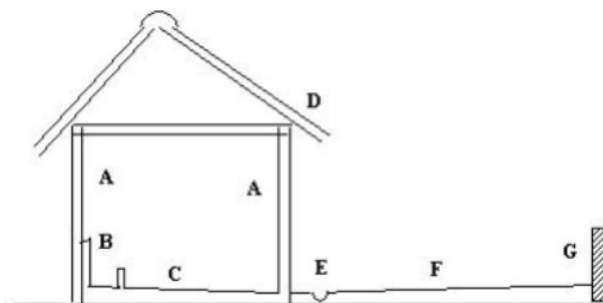


Fig. 4.1 Loose Housing System

Section of loose house showing internal details

- A. Roof supporting structures B. Manger C. Covered Area D. Roof
E. Gutter F. Open area and G. Compound Wall

Space requirements for different classes of animals in loose housing is given in the table.

Space requirements for different classes of animals in loose housing system (BSI)

Type of Animal	Space Requirement	
	Covered area (m ²)	Open area (m ²)
Cattle	3.5	7.0
Buffalo	4.0	8.0
Breeding bull	12.0	120.0
Advanced Pregnant	12.0	12.0
Young calves	1.0	2.0
Heifers	2.0	4.0

Advantages of loose housing system:

- Cost of construction is significantly lower than conventional type.
- It is possible to make further expansion without much change
- Facilitate easy detection of animal in heat.
- Animals get optimum exercise which is extremely



important for better health and production.

II. Conventional Dairy Barn

Animals are confined on a platform and secured at neck by neck chains.

The barns are completely roofed and the walls are also complete with windows / ventilators located at suitable places.

Animals are fed and milked in the same place.

There shall be individual standings in one or two rows.

The floor should have a gentle slope and a central drain one in 40 from centre towards the drain.

The Conventional Barn housing contains;

- Feeding passage
- Manger (Feeding trough)
- Standing space
- Gutter or drainage channel
- Milking passage



Gutter or Drainage
 Standing Space
 Manger
 Feeding Passage

Single row system: In single row system, 12-16 numbers of animals can be kept.

Double row system In double row system up to 50 animals can be maintained in a single shed.

Advantages

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

RECORDS TO BE MAINTAINED IN THE DAIRY FARM

Maintenance of farm records is important for

- Effective monitoring of animal performance right from birth.
- Evaluation of management and feeding systems.
- Individual animal comparisons to assist in breeding, culling and other decisions.
- Milk recording of individual animals.

The following records are necessary

1. Daily income and expenditure statement: This is very important record which records the daily income and expenditures of the farm.

Daily Income expenditure statement in dairy farms

Date	Description of the item	Income	Total income	Expenditure	Total expenditure	Balance
01.01.2011	Milk	20,000	45,000			+35,000
01.01.2011	Culled cows	25,000				
01.01.2011	Feed			8,000	10,000	
01.01.2011	Medicines			2,000		

2. Individual animal record

This register records the Individual details of the animals at the farm along with their identification number, date of birth, its sex, date of calving, date of purchase, date of sale/auction/death.

2. Individual Animal record

Animal number				
Lactation order	I	II	III	IV
Date of service				
1 st				
2 nd				
3 rd				
Date of calving				
Sex of the calf				
Days in milk				
Milk yield				
Days dry				
Remarks				

3. Individual Mother register/Calving register

This register maintains the records of calving that take place in the farm. calf number, sex and its date of birth and any other remarks like type of calving (normal/abnormal).

3. Calving register

Animal Number	Due date of calving	Date of Calving	Calf Number	Sex of the Calf	Birth weight of Calf

4. Calf Register (Sire=Bull, Dam= Mother)

This register maintains the records of calving that take place in the farm. It maintains dam and sire number of the calf, calf number, sex and its date of birth and any other remarks like type of calving (normal/abnormal).

4. Calf Register

Calf Number	Date of birth	Sex of the calf	Sire Number	Dam Number	Dispos-able

5. Growth record of the young calf: this record maintains the weight of the young stocks at different intervals.

5. Growth record of the young Stock

Calf Number	Birth weight	Fort nightly weight	Weight of 1st service	Weight of 1st calving	Remarks

6. Dially Feeding Register: This register records the amount concentrate, dry fodder, green fodder and other feeds given to the animals daily.

7. Daily Feeding Register

Date	No. of Animals	Concentrate			Green Folder	others
		Received	issued	Balance	R I B	R I B

7. Dially milk Record: This register records the daily milk yield performance of the cows

8. Daily milk record

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

8. Individual Health Register: It records the health status of individuals and their diseases.

9. Health Register

Animal Number	History and Symptoms	Diagnosis	Treatment	Remarks

9. Deworming and Vaccination register: It records the vaccination and dewarming schedules of the farm animals.

Deworming and Vaccination Register

Animal Number	Deworm- ing date	Next due date	Vaccination for	Date of Vaccina- tion	Next due date

10. Dially total animal count in the cattle farm : This register records the number of the animals at the farm along with their identification number, date of purchase, date of sale/auction/death.

(Heifer = Cow that has not given birth to calf yet)

. Daily Livestock Register

Date	Cows		Heifers	Breeding bulls
	Males	F		

The above records are to be maintained in cattle farm for proper management of farming

Record keeping is a necessary element of good livestock business management. Records provides basis for evaluation of animals. Helps in preparing pedigree and history record of animals. Helps in fixing proper prices of animal meant for purchase and sale.

Cattle breeds

Indigenous Cattle breeds

1. MILCH BREEDS /MILK BREEDS
 - I.Sahiwal
 - II. Red Sindhi
 - III.Gir
 - IV.Deoni

2. DUAL PURPOSE BREEDS

- I.Tharparkar
- II. Ongole
- III.Hariana

3. DRAUGHT BREEDS

- I.Malvi
- II. Kankrej
- I.Hallikar
- IV.Amrit Mahal

Exotic Dairy Breeds

1. Holstein Friesian
2. Jersey

Indian Buffalo Breeds

1. Murrah
2. Nagpuri

MODULE II

Livestock Identification and Management

13 Hrs

2.1 Breeds of Dairy Cattle and Buffaloes – Identification of Indian cattle and buffalo breeds and Exotic breeds; Methods of selection of Dairy animals. (5 hrs)

2.2 Systems of inbreeding and crossbreeding. (2 hrs)

2.3 Weaning of calf, Castration, Dehorning, Deworming and Vaccination programme (3 hrs)

2.4 Care and management of calf, heifer, milk animal, dry and pregnant animal, bulls and bullocks. (3 hrs)

2.1 BREEDS OF DAIRY CATTLE AND BUFFALOES

A breed is a group of animals having similar characters like general appearance, size, features and configuration etc. Often, breeds resemble each other with slight morphological differences, because of constant inbreeding in one locality.

There are total 231 breeds of cattle in the world out of which 26 are in India.

Indian cattle breeds are classified in to three types

A. MILCH BREEDS:

The cows of these breeds are high milk yielders and the male animals are slow or poor workers. The milk production of milk breeds is on the average more than 1600 kg. per lactation. The examples of Indian milch breeds are Sahiwal, Red Sindhi, Gir and Deoni.

B. DUAL PURPOSE BREEDS:

The cows in these breeds are average milk yielder and male animals are very useful for work. Their milk production per lactation is 500 kg to 1500 kg. The example of this group are Ongole, Hariana, Kankrej, Deoni, Rathi, Mewathi, Dangi and Nimari.

C. DRAUGHT BREEDS:

The male animals are good for work and cows are poor milk yielders and their milk yield on an average is less than 500 kg per lactation. They are usually white in colour. The example of this group is Hallikar, Amritmahal, Khillari, Bargur, Nagori, Bachaur, Malvi, Kenkatha, Kherigarh, Kangayam, Ponwar, Siri, Gaolao, Krishna Valley

Cattle breeds are also classified based on the place of their origin as indigenous and exotic. Indigenous cattle breeds are native to India where as exotic species are imported from other countries.

Indigenous Cattle breeds

1 MILCH BREEDS /MILK BREEDS

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I. Sahiwal

- The original tract of this breed is Montgomery district in Pakistan, but animals of this breed are found in Punjab and Haryana.
- It is the highest milk yielding cattle breed in Indian sub continent.
- It is a medium sized breed, having symmetrical body, broad fore head, thick short horns and fine loose skin.
- Chest is broad and deep. Legs proportionate to size

with good feet. In the male the sheath is pendulous.

- The tails is long with a black switch. Udder is large, broad and fine. Teats are good, uniform in size . Milk veins are large and prominent.



Fig. 2.1 Sahiwal Cow

- Milk yield – 1400-2500 kgs
- Age at first calving -37-48 months; Calving interval is 430-580 days

II. Red Sindhi

- This breed is from Sindh in Pakistan and found in Orissa, Tamil Nadu, Karnataka
- The colour of the breed is deep dark red. The bulls are much darker than cows. A white marking on the forehead is common.



Fig.2.2 Red Sindhi Cow

- The animals are medium sized, compact and symmetrical. The head is of moderate size, forehead is broad and poll is prominent in between horns.
- Eyes are fairly large, and clear. Ears are medium sized, fine and alert. The horns are short and thick.
- Dewlap is abundant in both males and females and hangs in folds, chest is broad and deep. Legs are medium in size.
- Tail is slender with black switch.
- The udder is large size with medium sized teats and well developed milk veins.
- Average weight of the male is 420 kg and the average weight of the female is 341 kg. The milk yield of selected village animal is 1.100 kg in a lactation period (300 days)

III. Gir

- The native tract of this breed is Gir forest of Gujarat state. Animals of this breed are found in Punjab and Haryana.
- The popular colour is white with dark red or chocolate brown patches distributed over the body.
- The animals are medium sized with proportionate body. The head is moderately long, and massive and the forehead bulging. The face is narrow and clean. The muzzle is square and black.
- The eyes are placed higher up in line with root of ears. Ears are large and pendulous.
- The horns are black, medium sized, shapely round, well set apart, and peculiarly curved.



Fig. 2..3. Gir Cow

- Dewlap is thin and hanging, not pendulous. Chest is deep, full and well developed. Legs are well proportionate and muscular. The hump is medium sized and markedly developed.
- The barrel is deep, long and proportionate.
- The back is long, strong and wide. The tail is long touching the ground.
- The udder is of medium size. Average weight of the male is 545 kg. and that of the female is 386 kg.
- The average milk yield is 1590 kg. • The bullocks are heavy and good for work

IV. Deoni

- The home of this breed is Marathwada now in Maharashtra state.



Fig. 2.4 Deoni Bull

- This breed is considered as a strain of Gir.
- The colour of the animal is white and black patches or red and white patches. The animals resemble Gir breed to some extent.
- The forehead is less prominent.
- The ears are long and pendulous.
- The chest is heavy and deep, the dewlap is well developed and in the males the sheath is pendulous.
- The head is medium sized, prominent forehead, the horns curving outwards and backwards. A wedge shaped barrel and well placed.
 - Deoni animals are fairly good milk producers and the average being 700 kg in 300 days, and in well breed herds, the average milk yield is 1000 kgs.
- The bullocks are large sized and good for heavy work

2. DUAL PURPOSE BREEDS

The cows in these breeds are average milk yielders and male animals are good work animals. Their milk production per lactation is 500 kg to 1500 kg. The example of this group are Tharparker, Ongole, Hariana, Kankrej, Rathi and Gaoalo and Mewathi.

I. Tharparkar

- Originated from Sind of Pakistan. Herds are found in Jodhpur, Jaisalmer of Rajasthan. Average animals of the Tharparkar breed are deep, strongly built, medium-sized, with straight limbs and good feet.



Fig. 2.5 .Tharparkarcow

- The usual color of the cattle is white or gray. In males, the gray color may deepen, particularly on the fore and hind quarters. All along the backbone there is a light gray stripe..
- The head is of medium size, the forehead broad and flat or slightly convex above eyes: the front of the horns and face are practically on one plane.
- Horns are set well apart curving gradually upwards and outwards
- The dewlap is of medium size and the skin is fine and mellow.
- The sheath in the males is of moderate length, and is semi-pendulous.

- The colour of the skin is black, except on the udder, under the belly, on the lower part of the dewlap and inside the ears where it is rich yellow.
- Tharparkar cows average 138 cm in height and an average weight of 408 kg. When left on arid pasture the milk production is approximately 1135 kg per lactation, while those animals maintained in the villages average 1980kg

II. Ongole

- The home of this breed is Ongole tract comprising of Ongole, Guntur, and Nellore districts of Andhra Pradesh.
- The cows are good for milk production and the males are for good for work.
- The colour of the animal is white.
- The bullocks are very powerful and good for heavy plough and cart work India.



- The forehead is broad and prominent between eyes; Black Kazal marking around the eyes is common.
- Face is moderately long, with wide nostril and black nuzzle. Ears are moderately long
- The horns are short and stumpy. Loose horns are common in this breed.
- Hump is well developed and erect, dewlap is well developed and folds extending to navel flap.
- Chest is deep and barrel is deep and long
- The tail is long with black switch reaching below the hocks.
- The udder is broad, extends well forwards and high up with moderate even sized quarters and teats are average size.
- The bullocks are very powerful and good for heavy work.
- Ongole is one of the heaviest breeds in India. The weight of the male is on the average of 545 kg to 682 kg. and that of the female is 432 to 455 kg. The average milk yield is 1600 kg in lactation

III. Haryana

- The home of this breed is Haryana state of India and distributed in Pubjab, Rajasthan and Uttarpradesh.
- The colour of the breed is white or light grey.
- The head is light and the face is long and narrow, flat forehead.

- This eyes are large and bright expressive but not prominent in mature bulls.
- The horns are short and fine or moderately long, and they are generally 4 to 9 inches long
- Dewlap is small without flashy folds and large in males.
- The chest well developed. Hump is large in males and medium sized in females.



Fig. 2.7 Haryana Bull and Cow

- Legs are moderately long and lean and feet are small, hard and well shaped.
- In the males the sheath is short and tight and in the 682 kg and of the female is 409 to 455 kg. The average milk yield is 1333 kg. in a lactation. The male are active, strong and good both for plough and cart

3. DRAUGHT BREEDS

The male animals are good for work and cows are poor milk yielders. Their milk yield on an average is less than 500 kg per lactation. They are usually white/grey in colour. A pair of bullocks can pull 1000 kg. with a walking speed of 5 to 7 km per hour and cover a distance of 30 to 40 km per day.

I. Malvi

- The breed is found in Malwa tract in Madhya Pradesh and Rajasthan. The bullocks are known for their draft qualities and the cows are poor milkers.
- In Females the navel flap is not prominent. Tail is short and thin • Udder' is large with milk veins. Teats are medium sized and proportionate.
- The average weight of males is 371 to 490 kgs and that of the females is 265 kg.
- The average milk yield of cows is 909 to 1364 kg. The bullocks are good for ploughing and road transport



Fig 2.9 Malvi bull

II. Kankrej

- The home of this breed is Gujarat and distributed in Ahmedabad, Bombay and kutch. The colour of the female is silver grey or black.
- The males are darker than the females.
- It is one of the heaviest breed in India.
- The forehead is broad slightly dished in the centre.
- The horns are thick, strong and curved and slightly symmetrical.
- The body is powerful, with broad chest. Straight back, well developed hump, pendulous sheath in males and the tail is of moderate length with black switch extending below the hock.



Fig. 2.8 Kankrej bull

- In cow the udder is well shaped and slightly developed. The average weight of the male is 455 To 500 kg.
- The colour of the animals is white to light grey, with black markings on neck, shoulders,
- The head is small and the face dished.
- The body is deep, short and compact with short legs and the tail.
- Ears are short and alert.
- The sheath in the male and navel flap in the female are short.
- The horns are massively built, black, upright and pointed at tips.
- Cows are poor milkers but bullocks are good work animals

III. Hallikar

- The home tract of this breed is Mysore, and Tumkur districts of Karnataka State



Fig. 2.10 Hallikar Cow

- The colour of the animal is dark or light grey with white patches round the face and dewlap. The bullocks are good for work and the cows are poor milkers and the bullocks are suitable for both for road and field work.
- The head is long with bulging forehead furrowed in the middle.
- Horns are close together and sprung perpendicularly from the head. The body is long and compact with long and slender legs. The novel flap is tucked up and tail is thin

IV. Amrit Mahal

- The home of this breed is Karnataka state.
- The colour of the animal is White and Grey.
- This is the best breed in India for drought purpose.



Fig. 2.11 Amritmahal bull

- The bullocks are suited for quick transport and the cows poor milkers.
- The animals are active and fine in temperament.
- The head is well shaped, narrow, and the forehead is deeply furrowed.
- The eyes are bright.
- The legs are well proportioned and medium in length.
- The hooves are hard, black with narrow clefts. The tail is fine and moderate in length. The udder is small, compact with small hard teats.

Exotic Dairy Breeds

The European breeds of dairy cattle belong to the species of *Bos Taurus*. They are hump less, generally large, short ears, without a pendulous dewlap. They are less heat tolerant and less disease resistant when compared to Indian cattle, but are superior in milk production.

The important European breeds of dairy cattle are Holstein Friesian, Brown Swiss, Jersey, Guernsey and Ayrshire. Out of the above breeds there is greater demand and use of Holstein Friesian and Jersey

I. Holstein Friesian

- This is the world's highest milk yielding breed through the fat percentage of milk is very low. The home of this breed is Holland

- Animals of this breed are the largest among the European breeds.
- This breed of animals is imported by many countries in the world.
- The colour of the animal is with black and white markings
- The animals are with the largest udders
- The head is long and narrow.
- The cows are docile.
- The ideal body weight of a cow is 682 kg and that of bull is 1000 kg.
- The cows are heavy milkers and the average lactation yield is 4295 kg

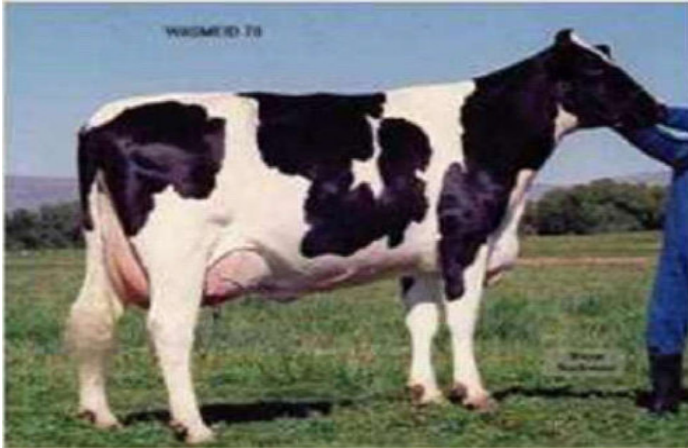


Fig. 2.14 Holstein Friesian

- Individual animals touched 19,995 kg of milk in a lactation period of 365 days.
- The milk of these animals are used for cheese making as the fat percentage is low.

II. Jersey

- The home of this breed is England
- This breed is popular and widely distributed all over the world.
- The colour of the animals is brown with variation of brown to black and vary from white spotted to solid in marking.



Fig. 2.16 Jersey Cow

- Jersey milk is yellow in colour due to high carotene and is good for butter making.
- Jersey animals are extensively used for cross breeding

programme in India.

- The average milk yield of the cow is 2727 kg in lactation. Individual yielded 13,296 kg in 365 days.

INDIAN BUFFALO BREEDS

There are 14 buffalo breeds present in India. But the most important breeds are Murrah, Jaffrabadi, Nili, Ravi, Mehsana.

I. Murrah

- The home tract of this breed is Hariyana State, Punjab and Delhi. This breed is distributed throughout India.



- The colour of the animal is jet black with white switch of the tail which is long and reaching the fetlock. The skin is soft and smooth.
- The she buffalo had a deep massive frame with a comparatively light neck and head.
- The horns are short and tightly curled. The forehead is broad • Face is fine without white markings and eyes prominent and bright in females.
- The udder is well developed with prominent milk veins and good sized teats.
- Average weight of the buffalo is from 490 kg to 500 kg and that of a buffalo bull is 545 kg to 682 kg.
- The average milk yield is 1364 kg to 1820 kg for a lactation period of 300 days. The milk fat per cent is about 7-9 %

II. Nagpuri

- This breed is of lighter type and comes from Central India. The head is long with a broad forehead, and the horns-are long, curved back on each side of neck behind the shoulders.
- Barrel is long and deep with light limbs
- The bull is comparatively short.
- The males are largely used for draft purpose and the females are fair milkers and the daily average milk yield is 5 to 8 kg



Fig. 2.24 Nagapuri Bull and Buffalo

METHODS OF SELECTION OF DAIRY ANIMALS

Breeding is defined as the crossing of the male and the female parents to get the off spring for the characters desired. The best organisms are for breeding so that best offspring will be produced.

Criteria for the Selection of Dairy Animals

For the success of a dairy farm good, healthy, strong, productive individuals are to be selected. The following criteria is to be followed to the selection of Dairy Animals.

Young animals

Those that have not given birth for more than 3-times, should be selected. They have a longer productive life. Old animals are poor breeders and low producers. Production and breeding efficiency decline with age.

Level of performance

Animals with highest production level selected. Performance best indicated by records. Good performance of animal indicated by; High milk, wool and egg production, Good mothering ability. The animals with poor performance should be culled. (Avoided)

Physical Fitness

Animals selected should be free from any physical defect e.g. mono-eyed, limping, irregular number of teats, defective and weak backline etc.

Health

Sick animals do not breed well and are expensive to keep. They should not be selected. Animals that are resistant to diseases pass that resistance to their offspring's

Body Conformation

Animals for breeding to be selected according to proper body conformation. A dairy cow should be with a large udder, thin legs, long neck.

Temperament or Behaviour

Animals with bad behaviors should be culled. e.g aggressiveness, kicking

Quality of products

Select animals that give products of high quality such as meat, milk.

Mothering Ability

Animals selected should have a good mothering ability. That is animals with good natural instinct towards their young ones. This will enable them to rear the young ones up to weaning.

Adaptability

Animals selected should be well adapted to the climatic condition in the area e.g Arid or draught areas

SELECTION METHODS

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

Individual Selection

Selection is based on the individuals own milk yield and physical characters. This method is not a good method because the characters of the parents may not

come to the offspring.

Family Selection

Whole families are selected for breeding. This means the siblings are allowed to mate themselves so that the good characters may be retained in to the next generation.

Progeny Testing

The criterion of selection is the mean value of an individual's progeny which comes closest to the breeding value. The value of an individual is judged by the mean value of its progeny

Production Records

In advanced countries large numbers of breeds are tested in dairy herd improvement programmes. During 1972 more than 2,66,001 lactation records were reported by supervisors of cattle houses. These records are analyzed and best breeders are selected.

Culling of animals

Culling is elimination of undesirable animals from the herd, for reasons of uneconomic, poor production, or very poor reproductive ability, with sterility problems and breeding irregularities, very poor body conditions, stunted growth, suffering from incurable illness, or disease.

2.2 SYSTEMS OF INBREEDING AND CROSS BREEDING

Process of mating selected males and females to produce offspring with the desired characteristics is called Breeding.

Terms Used in Breeding

Inheritance: Genetic transmission of characteristics from parents to off springs.

Hybrid and Hybrid Vigour: Hybrid vigour or heterosis is increased vigour and performance resulting from crossing two superior breeds. When two superior breeds e.g Pedigree friesian and Jersey breeds are mate the resultant offsprings have both the character of high milk yield and high butterfat content.

BREEDING SYSTEMS

They are categorized into two namely; Inbreeding and Outbreeding (Cross Breeding)

1. Inbreeding

Inbreeding is the mating of closely related individuals. Inbreeding is again divided into two types as Close Breeding: mating between very closely related animals, for example sib-mating and parents sib-mating.

Line Breeding: mating of distantly related animals that had a common ancestor for example cousins, halfbrothers/sisters, grand daughters and grand sires.

Advantages

- To increase genetic uniformity in a herd. To increase phenotypic uniformity.
- It brings about the uniformity of the required type.

Limitations

- It can bring about loss of hybrid vigour. It may lead to decline in fertility.
- It may lead to high rate of pre-natal mortality.

2. Outbreeding

Mating unrelated animals is known as outbreeding. It is divided into 5 types as Line Crossing, Out Crossing, Cross Breeding, Grading up, Species Hybridisation

1. Line Crossing: In this method of breeding, inbred lines of male and females were developed by intensive inbreeding for more than 5 generations. The unrelated inbred lines of male and female is mated and the offspring born out of such mating becomes a hybrid which exhibits hybrid vigour and are superior to either of the parents

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

3. Cross Breeding: It is the mating of animals belongs to different breeds. Cross breeding is an important tool for breeding animals for high milk and meat production.

In India Cross-breeding of cow is done by using the exotic bulls and the progeny inherit the desirable characters of the parent like high milk yield, early maturity, higher birth weight of calves, better growth rates, better reproductive efficiency and indigenous parents characters like heat tolerance, disease resistance, ability to thrive on scanty feeding and coarse fodder etc. For example Indian zebu breeds of cows are crossed with exotic breeds like Holstein Friesian or Jersey bulls produced high milk yielding offspring.

4. Grading Up: Grading up is the practice of breeding in which the superior breeds are mated with the normal individuals for several generations. After five or six generations of grading up, the normal individual population gets improved and resemble the superior breed.

Advantages: After 5 to 6 generations, grades resembling pure bred animals in matter of physical appearance and milk production.

Grading up avoids the expenditure of purchasing the high producing pure animals

5. Species Hybridization: When cross is done between two different species, it is called inter-specific hybridization or Species Hybridization. Mule is produced by mating of a male donkey with a female horse.

Artificial insemination

Introduction of semen into the female reproductive tract by artificial means is called artificial insemination.

Advantages

- There is economical use of semen. It reduces the expenses of keeping a male animal.
- Semen can be stored for long. It helps to control inbreeding.

Disadvantages

- It requires skilled labour. Low chance of conception due to death of semen during storage. It is laborious.

2.3 WEANING OF CALF, CASTRATION, DEHORNING, DEWORMING AND VACCINATION PROGRAMME

Weaning of Calf or Management of Calf

Good feeding and management are essential for the calves during their growth, so that they attain mature body weight earliest and will be useful as replacement stock. The feeding and care of the calf begins before its birth.

Early Management

- Immediately after birth remove any mucous or phlegm from those nose and mouth.
- Normally the cow licks the calf immediately after birth. This helps in dry off the calf and also stimulates breathing and circulation.
- The naval should be tied about 2-4 cms away from the body and cut 1 cm below the ligature and apply Tr. Iodine or boric acid or any antibiotic.
- The weight of the calf should be recorded.
- Wash the cow's udder and teats preferably with chlorine solution and dry off with a clean cloth. Allow the calf to suckle the first milk of the mother i.e. Colostrum.

Feeding of Calves

- Feed colostrum i.e. the first milk of the cow for the first 3 days. The colostrum is thick and viscous. It contains higher proportions of Vit A and proteins. The colostrum which gives protection against many diseases.
- Whole milk should be given after 3 days. It is better to teach the calf to drink milk from the pail or bucket.
- The limit of liquid milk feeding is 10 % of its body weight
- Give calf starter after one month of age.
- Provide good quality green fodder and hay from one month afterwards for the early development of the rumen.
- Feeding of antibiotics to calves improves its immunity and makes it resistant to diseases.

Other management practices for Calf

- Identity the calf by tattooing on inside of the ear after birth and tagging after one year.
- Deworm the calf regularly to eliminate internal parasites
- Fresh water should be given from 2nd week onwards.
- House the calves in individual calf pens up to 3 months and afterwards in groups. After six months males and females calves should be housed separately.
- Mortality in calves is more during first month due to worms (Ascariasis), Diarrhea (calf scours) and pneumonia.
- Extra teats beyond 4 should be removed at 1-2 months of age in the female calves.
- At 8-9 weeks of age all the surplus male calves should be castrated.
- Keep the body of the calves clean and dry to avoid fungal infection.
- Mineral-block licks should be provided to the calves to prevent mineral deficiency.

Castration

To castrate a male animal means that the functioning of the testicles is stopped so that the animal is unable to reproduce. Castration may be accomplished by physical, chemical or hormonal techniques. Physical methods are most common. Testicles may be removed surgically or killed by obstructing the blood supply. Young calves may be castrated with rubber rings, or by surgery. Surgical castration may be more appropriate

Reasons for castration

- Stop the production of male hormones and semen in unwanted bulls
- Helps in taming the oxen for draught purposes
- Produce docile cattle that are easier to handle compared to bulls
- Decrease aggressiveness, mounting activity, injuries
- Enhance on-farm safety for animals, producers and employees

Time of castration

Castration can be done at any age up to 12 months. It is, however, better to do it when the animals are very young (before 2 months of age).

Methods of castration

Burdizzo method of castration: It is the Common method of castration in cattle. In this technique the spermatic cord is crushed in one month and older calf.

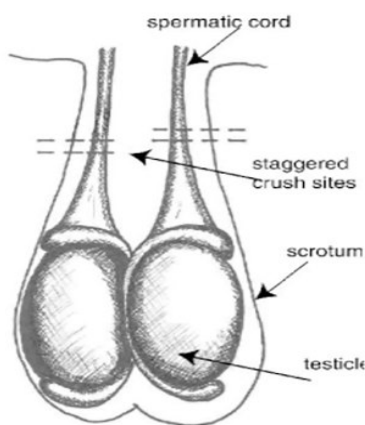


Fig. 6.49 Burdizzo Castration Site

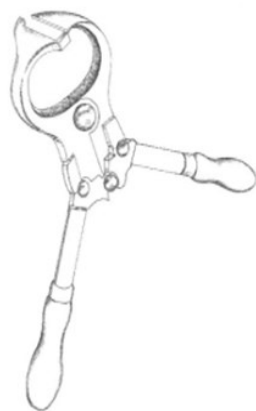


Fig. 6.48 Burdizzo castrator

Technique:

- Find the spermatic cord on one side of the scrotum. The spermatic cord runs from the testicle into the calf's body. It is about the size of a pencil.
- Pinch the cord to the outside edge of the scrotum between your thumb and forefinger. With the help of Burdizzo crush the spermatic cord.
- Release the Burdizzo, move it to a new site 1 cm below your first site, and repeat steps four and five times.
- Repeat the procedure on the opposite side.
- The testicles swell initially and then degenerate and shrink in size gradually

Elastrator Method: Elastic band castration cuts off blood supply to the testicles. A lack of blood supply kills the testicles. An elastic band is put on the neck of the scrotum.

The elastic band obstructs blood flow to the testicles and the scrotum. In time, the scrotum and testicles fall from the body. The elastrator band method is most reliable for calves

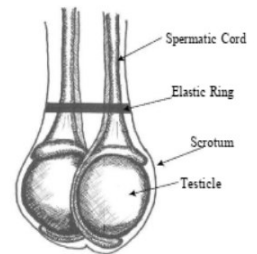


Fig. 6.51 Elastic Band at Top of Testicles

Dehorning

Dehorning is the process of removal of the horns of calf or the process of preventing their growth.

Methods of dehorning

There are two methods. 1. Chemical method 2. Electrical method

Chemical Dehorning: Caustic chemicals will prevent the growth of horns when properly applied to the horn buds of new-born (less than 10 days age) calves. The chemical destroys the horn-producing cells around the horn bud. The chemicals are available as sticks or pastes



Fig. 6.54 Horn bud in young Calf

Hot Iron Dehorning/Electrical method: Hot iron dehorning is available in versions heated by a furnace or fire, 12-volt battery, 120-volt electricity, power packs.

The head of the iron is a hollow circle and it fits over the horn bud. Proper application of the hot iron will destroy the horn-producing skin at the base of the horn.

This technique works well for calves up to 12 weeks old. There are several sizes of dehorning irons.

Electronic Hot Iron Dehorner

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

Deworming

Elimination of internal parasites is called deworming. The following is the deworming schedule in calves. Various medicines used in deworming are given in the table.

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

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

Advantages of deworming

- Improves feed efficiency and body weight in calves

- Prevents death in calves due to Ascariasis
- Improves resistance in calves for other infectious diseases

- Prevents anaemia in calves

Precautions During Deworming

- Dose should be appropriate
- Deworming should not be carried out in sick calves

Vaccination Schedules for Cattle

Vaccination is very important aspect of disease prevention. Many of the diseases are fatal.

Fortunately, vaccines are available for most of the diseases. The following diseases that can be easily prevented by timely and regular vaccination

1. Foot and Mouth Disease (FMD)
2. Haemorrhagic Septicaemia (HS)
3. Black Quarter (BQ)
4. Brucellosis
5. Theileriosis
6. Anthrax
7. IBR Infectious Bovine Rhinotracheitis
8. Rabies (Post bite therapy only)

S N o	Name of Disease	Age at first dose	Booster dose	Subsequent dose
1	Foot and Mouth Disease (FMD)	4 months and above	1 month after first dose	Six monthly
2	Haemorrhagic Septicaemia (HS)	6 months and above	-	Annually in endemic areas.
3	Black Quarter (BQ)	6 months and above	-	Annually in endemic areas.
4	Brucellosis	4-8 months of age (Only female calves)	-	Once in a lifetime
5	Theileriosis	3 months of age and above	-	Once in a lifetime. Only required for crossbred and exotic cattle.
6	Anthrax	4 months and above	-	Annually in endemic areas.
7	IBR Infectious Bovine Rhinotracheitis	3 months and above	1 month after first dose	Six monthly (vaccine presently not produced in India)
8	Rabies (Post bite therapy only)	Immediately after suspected bite.	4th day	7,14,28 and 90 (optional) days after first dose.

Important points to be noted during vaccination

1. Animals should be in good health at the time of vaccination.
2. Vaccines should be stored at prescribed temperatures.
3. A minimum vaccination coverage of 80% of population is required for proper control of the disease.
4. It is beneficial to deworm the animals 2-3 weeks before vaccination is carried out for better immune response.
5. Vaccination of animals in advanced pregnancy may be avoided

2.4. CARE AND MANAGEMENT OF CALF, HEIFER, MILK ANIMAL, DRY AND PREGNANT ANIMAL, BULLS AND BULLOCKS.

I. Care and management of calf

(See Previous notes under Weaning of Calf)

II. Care and management of Heifer

Cow that has not given birth to calf yet is called Heifer.

1. Feed the heifer sufficiently to produce normal growth. The heifers should be provided with a dry shelter
3. heifer should be bred at 24-30 months of age. Small heifers donot give proper milk yield.
4. Heifers should be vaccinated dewormed properly for proper growth and health.
5. Feed 2 - 3 kgs of concentrate daily for good growth and calving.
6. Poorly growing heifers should be removed from the herd.

III. Care and management of milk animal

1. Milch animal should be Provided with green succulent forage together with leguminous hay or straw for high milk yield.
2. Individual attention to feed each animal according to its production is a must.
3. Concentrate mix is fed before or during milking.
4. Milking thrice is better than twice
5. Cows should be trained to let down milk without calf suckling.
6. Provide at least 60 - 90 days dry period between calvings. If the dry period is not sufficient, the milk yield is subsequent lactation will be reduced.

IV. Care and management of pregnant animal

1. Extra concentrate mix of 1.25 to 1.75 kgs should be provided for pregnant animal as pregnancy allowance.
2. Feed good quality of leguminous fodder.
3. Allow moderate exercise, which helps in calving normally
4. Do not allow them to fight with other animals
5. Avoid slippery conditions, which causes abortion
6. one kg extra feed concentrate during last 8 weeks of gestation.

V. Care and management of Breeding Bulls and Bullocks

Breeding Bull

1. A breeding bull should housed separately known as "Bull Shed" with sufficient area of floor
2. A balanced rations should be fed containing adequate

energy, proteins, minerals, and vitamins

3. Most of the bulls are ferocious and so control them properly using nose rings etc

4. Moderate exercise should be provided to keep the breeding bull in active

Bullocks

1. Bullocks are normally used for agricultural operations and or transport purpose.

2. The working hours for bullocks are recommended from 6-8 hours

3. Sufficient roughages and 1-2 kgs of concentrates may be provided for feeding of bullocks

4. The bullocks are housed in separate sheds with sufficient space

MODULE III

(Feed Management, Dairy Management, Cleaning and Sanitation): 8 Hrs

3.1 Basic Principles of Feed, Important Feed Ingredients, Feed formulation and Feed Mixing(2 hrs)

3.2 Operation Flood –Definition of Milk and Nutritive value of milk and ICMR recommendation of nutrients –Per Capita Milk production and availability in India and Andhra Pradesh -Methods of Collection and Storage of Milk–Labelling and Storage of milk products (4 hrs)

3.3 Cleaning and sanitation of dairy farm – Safety precautions to prevent accidents in an industry.

3.1. BASIC PRINCIPLES OF FEED, IMPORTANT FEED INGREDIENTS, FEED FORMULATION AND FEED MIXING

Basic Principles of Feeding

- The feed given to the dairy animals should be ideal ration. The characters of **Ideal Ration** are...

It should contain all the essential nutrients like protein, fats, carbohydrates, minerals and vitamins in the right proportion as needed by the body

It should be well balanced and economical

It should contain enough amount of crude fibre in order to stimulate the wall of gastrointestinal tract for maximum secretion and excretion of digestive juices

It should be nontoxic

It should be easily available locally

It should be easily digestible and palatable to animals

- The feed material should contain greens roughages and concentrates so that the animal may get all the essential nutrients
- Avoid sudden change in diet because it upsets the whole GIT resulting in indigestion and reduction in milk yield
- The feed requirement of animal is calculated on dry matter basis. On average dairy animals consume 3 to 4 Kg dry matter per 100Kg body weight
- Of the total dry matter requirement of the animal, two thirds should be met by roughages.
- To avoid mineral deficiency in the body, the animal should be offered to 70 to 100g mineral mixture daily. A piece of common salt should also be placed in manger.
- The animal should be fed according to their body need. Feeding less or more are both detrimental to

animal health or production

- Feeding troughs should be cleaned regularly
- The animals should get clean fresh supply of drinking water
- For milk production the animal should be given at least 1Kg concentrate mixture per 2 litres milk yield

Important Feed Ingredients

Feed Ingredients of Ideal Ration fall into these categories.

1. Roughages

Roughages are bulky feeds that contain large amounts of fibre content and lesser Total Digestible Nutrients (TDNs) These are further divided into two categories.

a. Succulent roughages: Succulent Roughages contain 60-90% moisture content. Pastures (green grass), tree leaves, cultivated fodder crops like cow pea, legumes etc.,

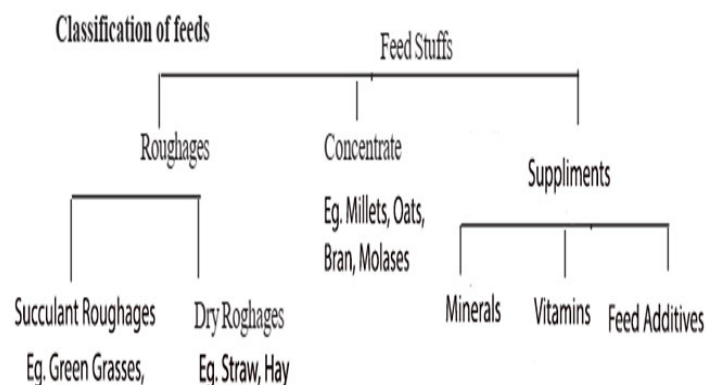
b. Dry roughages: Dry roughages contain 10-15% moisture content. The dried green parts of the plants like Hay, Straws come into this category. These are rich in Phosphorus, silica.

2. Concentrates

It is a feed mixture that contains primary nutrients (carbohydrates, Proteins and Fats) at higher levels and less fiber contents. The Feed Concentrates are classified as Energy rich Concentrates and Protein Rich Concentrates based on the amount of protein they contain. Energy rich Concentrates are prepared from maize, barley rice, ragi products as they contain more carbohydrates.

The protein rich concentrates are prepared from Oil

seed cakes like groundnut cake, mustard cake, soyabean cakes etc. The slaughter house wastes are powder dried and used as protein rich concentrates



Sources of Feed Ingredients for Concentrates

The Feed concentrates are prepared from various sources as follows.

General Grains: These include Maize, Bajra, Sorghum, Rice, Barley Wheat etc. General grains contain 80% carbohydrates, upto 10% proteins. and considerable amount of Fibre. These are used as Energy Concentrates.

Vegetable Protein: Oil cakes from ground nut, Soyabean, Sunflower, Cotton seeds, coconut etc are rich in protein. They contain upto 40% protein. These are used as Protein concentrates

Milling byproducts: These are the byproducts when the grains are milled. When rice grain is separated during processing it produces Rice bran. Similarly when rice is polished a fine powder is produced. I (thavudu in telugu).

The milling byproducts of rice or wheat are good sources for proteins, fats, vitamins and fibre.

Animal Fat: In slaughter houses the animal wastes are processed to produce some by products like Lard (pig fat) or Tallow (Cattle fat). These products are mixed with Cattle feed as they are very rich in Fat contents.

Sources of Feed ingredients



Commonly available feed ingredients for dairy animals			
Cereal grains	Vegetable protein	Milling by products	Animal fat
Maize	Groundnut oil cake	De oiled Rice bran	Lard
Bajra	Soybean meal	Wheat bran	Tallow
Sorghum	Sunflower oil cake	Rice Polish	
Broken Rice	Cotton seed meal	Molasses	
Oats	Coconut meal		
Barley	Linseed meal		
Wheat	Mustard cake		
	Sesame seed meal		

3. Feed Supplements

Various suppliments are added to the cattle feed for better growth and health of the individuals.

Minaral Suppliments: Common Salt, Calcium carbonate, Zinc sulphate, Copper sulphate are added to the feed for the wellbeing of the cattle.

Vitamin Suppliment: Vitamin A, D and B Complex are added to the feed for health and better milk production. Yeast and cod liver oil are good sources of vitamins.

Hormones Suppliments: Certain hormones like progesterone, thyroxine, androgens, estrogens are added to the feed to promote growth and better milk yield. Hormone suppliments have sideeffects on the health of the cattle.

Probiotics: Certain probiotics like Aspergillus oryzae, Lactobacillus are given to the cattle as feed suppliments. The probiotics increase milk yield by 5-7%.

Feed Additives: Commercially produced cattle feed contains certain chemical additives that help in increasing the feed intake and digestion. Eg. Xanthophils, Molasses, Ethoxyinin, agrozyme etc.

Feed formulation and Feed Mixing

The Feed requirements of cattle vary due to various conditions that change from time to time. **Various Feed Ingredients are mixed in different proportions to meet the needs of the stage of cattle.** It is of various types as follows

Daily maintenance requirement of Dairy stock

Body Wt. Kgs	Crude Protein (Grams)	TDN (Kg)	Energy (Kcal)	Mineral Mixture (Grams)
250	168	2.02	7.27	10
350	237	2.70	9.72	15
450	282	3.37	12.13	20
550	336	4.00	14.40	25

TDN = Total Digestible nutrients ie. Roughage and Concentrates together

Ration: Ration is the feed given for a given animal in a day.

Balanced Ration: Ration which provides the essential nutrients to an animal in required proportions so that they stay healthy and productive. It varies with the age and condition of the animal.

Maintanance Ration: This is the minimum amount of feed required to maintain the essential body process at their optimum rate without gain or loss in body weight. It usually should contain 68 to 72% Roughage and 20% protein.

For Dairy Cattle the maintenance Ration usually contains

- Straw 4-5 Kgs
- Concentrate mixture 1-2 Kgs

Production Ration: Ration given to an animal for certain production i.e. milk, work, meat or gestation (pregnency) is known as Production ration. **It is given in addition to the Maintenance ration.**

Gestation Ration

- Straw 3.5 Kgs
- Concentrate mixture 2 Kgs

Milch Cattle (Milk giving) Ration (1 kg extra feed for every 2 kg milk produced)

- Straw 6 Kgs
- Concentrate mixture 7 Kgs

3.2 OPERATION FLOOD

(See Module I Notes)

Definition of Milk and Nutritive value of milk

Definition of Milk

Milk may be defined as the whole, fresh, clean lacteal secretion obtained by milking of healthy milchy animals, excluding that obtained within 15 days before or 5 days after giving birth.

Major Constituents of Milk

The major constituents of milk are, water, fat, proteins, lactose, minerals and miscellaneous compounds.

Water:

It is the medium in which all the milk constituents are dispersed. It plays an important role in the physical properties exhibited by the milk. Water acts as a solvent in keeping the constituents in soluble, colloidal form

Fat:

Fat is the costliest component of milk. It is characterized by its presence as an emulsion. The unique feature of milk fat is its fatty acid composition. Milk fat is rich in saturated fatty acids and mono unsaturated fatty acids and also acts as a carrier for the fat soluble vitamins. Milk fat imparts the unique flavour to the milk and milk products.

Composition of cows milk.

Main constituent	Mean (%)
Water	87.0
Total solids	13.0
Fat	4.0
Proteins	3.4
Lactose	4.8
Minerals	0.8

Proteins:

Milk is rich in protein content and has a unique protein namely the casein. It constitutes about 80% of total proteins of milk. Casein exists only in milk. It is present in the form of colloidal dispersion in milk. It is easily digestible and supplies all the essential amino acids.

In addition to casein, milk also contains whey protein in the form of Lactalbumin and lactoglobulin. Immunoglobulins are present in Colostrum (first milk after giving birth) which gives immunity to the calf.

Lactose:

Lactose is called milk sugar. It is present only in milk. Milk contains approximately 4.6% carbohydrate that is predominately lactose. Lactose is a disaccharide of glucose and galactose. It is a good source of energy for the young ones. In addition to lactose, milk also contains several other carbohydrates in trace levels.

Minerals or ash

Minerals in milk are mainly inorganic salts. The Major salt constituents include potassium, sodium, magnesium, calcium, phosphate, chloride. Some inorganic matter is bound covalently such as calcium phosphate groups in casein. They are responsible for the ionic balance of milk.

Vitamins

Milk contains almost all the essential vitamins which include fat soluble and water soluble vitamins. It is a very good source for the most essential fat soluble vitamin namely the Vitamin A. Other vitamins like D, E, K, B complex, C are also found in milk.

Enzymes

Milk is a repository of a variety of enzymes. Over 20 enzymes have been isolated and characterized in cow milk.

Alkaline Phosphatase: The residual activity of this enzyme reduces the shelf life of processed milk.

Lactoperoxidase (LP): This enzyme is naturally present in milk. One of it acts as an antibacterial agent..

Lysozyme: It also acts as antibacterial agent as a natural defence of milk. .

Pigments: In cow milk, carotene is the major pigment and it gives cow milk a pale yellow appearance

Per Capita Milk production in India and Andhra Pradesh

In India the production of Milk in 1951 was 17 Million tonnes with percapita availability of 130 ml per day. It increased to 198 million tonnes during 2019-20 with percapita availability of 407 ml per day.

Indian Council of Medical Research (ICMR) recommends an average daily intake of 300 gm per day of milk to deliver the requisite nutrients.

Composition of Milk with reference to the Dialy requirement			
Nutrient	Recommended Daily requirement (1-3 Years child)	Quantity Present in 200 ml of milk	% of Requirement fulfilled
Protein (g)	16.7	6.6	40%
Fat	27	6.4	24%
Calcium (mg)	600	246	41%
Zinc (mg)	0.84	5	17%
Vitamin B ₁₂	1.0	1.08	100%
Vitamin A	32	200	16%

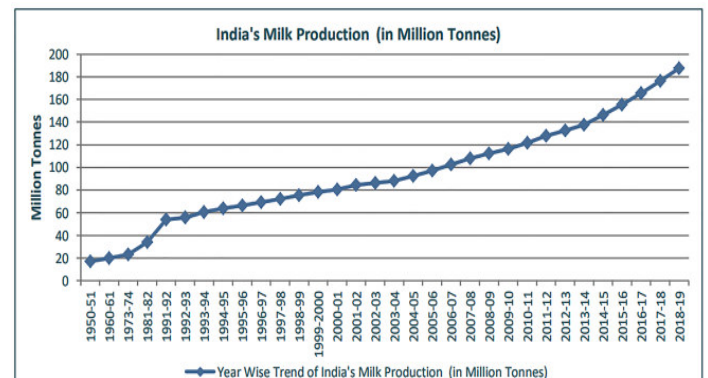
Total live stock population in India is 512 millions. Of these numbers cattle are 300 millions, sheep 65 millions, Goats 135 millions pigs and camel constitute remaining. The Total live stock population in India is 15% of world livestock.

World's top milk producing countries (2017)

Countries	Production (in million tonnes)	% of global production
India	176.27	21
United States	97.76	12
Pakistan	44.29	5
China	34.87	4
Brazil	33.74	4

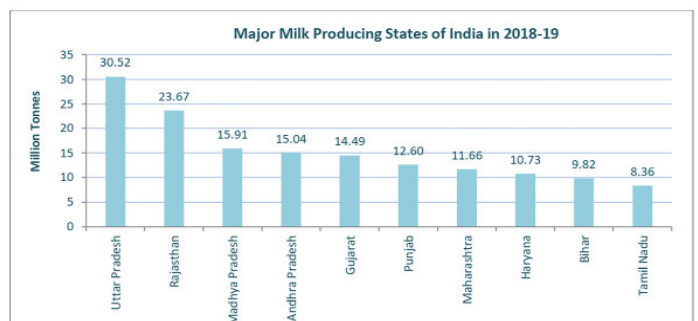
Percapita milk Production India:

At present India is the world's largest milk producer, with 22% of global production, followed by the United States of America, China. This phenomenal success is attributed to the head start given by programmes such as 'Operation Flood' during 1970–1996, which focused on dairy development activities. More than 70 million house holds in india depend on milk production for their daily income.

**Percapita milk Production Andhra Pradesh:**

Andhra Pradesh is one of the leading milk producing states in India. The percapita availability of milk in Andhra Pradesh is 522 ml per day which is 30% higher than the national average.

According to 2019 statistics Andhra Pradesh stands at 4th place in highest milk producing states in India with a production of 15 thousand tonnes of milk per year. First and second and third being Uttar Pradesh, Rajasthan and Madhya Pradesh. Andhra Pradesh produces 9% of the total milk production of India.



Government of India has initiated various dairy development programmes namely National Programme for dairy development (NPDD), Dairy Entrepreneurship

development scheme (DEDS) Dairy Processing and Infrastructure Development Fund (DIDF) etc. The budget of 2020-21 has planned to facilitate doubling of india's Annual Milk processing capacity from 53 million tonnes to 108 mt by year 2025.

Methods of Collection and Storage of Milk

A. Collection of Milk

Usually production of milk is confined to rural areas, while demand is mostly urban in nature. Hence, the milk has to be collected and transported from production points to processing centers and distributions points in cities.

In India Milk is produced by small farmers with 2 or 3 milch animals. As a result small quantities of milk are produced in a scattered manner. hence the task of milk collection becomes complex.

In India, four Methods of milk collection are popular namely Direct, Contractor, Agent and Co-operative systems. It has been estimated that about 48% milk is consumed at the producer level or sold locally in the rural area. The balance 52% of the milk is marketed for sale to processing industry. The organized dairies or milk Processing plants like Heritage, Amul, Reliance dairy, Horlicks factory etc collect milk through one or combination of the following systems:

1. Direct system: In this system, processing plant collects milk directly from the producers by establishing village procurement centers.

2. Contractor system: The milk is purchased by a contractor from the farmers and supplied to the processing unit.

3. Agent system: The processor appoints agents to procure milk in particular area. Payment for the milk is made directly to the producers while the agent gets the commission.

4. Co-operative system: This is the most important method of Collection of milk. Out of the total milk procured in India nearly 70% is collected through Cooperative method. Cooperative society method of Milk collection was first introduced by Amul an Indian dairy, based at Anand in Gujarat. Hence it is called *Anand Pattern*. **Dr. Verghese Kurien** was credited for the success of this type of Milk Procurement.

Cooperative method was has 3 tier levels.

a. Village Society:

At the village level, the farmers form a Village Dairy Co-operative Society (DCS) with a commitment of selling milk only to the society after becoming a member. The DCS establishes the milk collection centres in the village. The society collects milk twice a day where the milk is weighed, tested and the money paid to farmers.

The payment is



Village Milk Collection Centre of DCS

based on fat content or fat + SNF content in the milk. (Milk with 6% Fat and 9% SNF/Solids Not Fat is valued at maximum price). The milk collected by the Village societies is supplied/sold to the District co-operative dairy plant. It transports milk in cans by trucks

b. District Union

The Village DCS s form District milk producers union. District co-operative union establishes Processing plants. This union collects all the milk procured by the Village societies, Processes and markets it to the consumers. The District society also provides technical services such as the veterinary aid; supply cattle fodder seeds, artificial insemination etc. . They also give counselling to the society members to enhance milk production.

c. State Federation

This is the State level body of the Cooperative Milk Producers Union. It is responsible for marketing the liquid milk and products through a common brand name. (Like Amul of Gujarath, Nandini of Karnataka, Aavin of Tamilnadu etc). Some federations also manufacture feed and support farmers.

There are about 1,90,516 village-level Dairy Corporative Societies up to March 2019 with 16.93 million farmers as members in them. Among these 5 million members are women representing almost 30% of the total membership. These cooperative milk unions collectively procured an average of 507.69 lakh liters of milk per day in 2019.

Precautions to be taken at Collection centre:

Precautions to be taken at Collection centre:

1. The Collection point should be close to the road for easy transport
2. Clean containers and equipment should be used
3. Collected milk should be kept in shade
4. Collected milk should be transported as quickly as possible
5. Equipment used to test the milk are to be washed thoroughly and rinsed with disinfectants regularly
6. Milk collection records are to be maintained about the Name of the supplier, Date and time of supply, amount of milk supplied, Fat content of the milk etc

B. Methods of Storage of Milk

Milk is highly perishable item. The keeping quality of fresh milk is only 5-6 hours. The major cause for spoilage of milk is due to the action of micro organisms on lactose yielding lactic which in turn coagulates the milk

The principle involved in the preservation of milk is only to destroy the micro organisms or obstructing the microbial growth, so that acidity development is stopped or slowed down. The various methods of milk preservation are...

1. By Cooling the Milk : The most of the micro organisms present in milk are mesophilic i.e. they grow well at 20 – 40°C only. By cooling the milk to temperature i.e. 5 to 10°C, the multiplication of micro organisms can be restricted.

This table shows the bacterial growth

factor in milk at different temperatures.

Bacteria Growth factor is the count with which the bacteria multiplies. That is why milk should be cooled to 5°C to maintaining the quality.

2. *By Heating* : By heating the milk, the micro organisms will be killed. The various micro organisms are destroyed at different temperatures.

This Technique is called *Pasteurisation* where the milk is heated to to 71.7°C for at least 15 seconds then it is quickly cooled to 3°C. Pasteurization temperatures will kill 98 – 99% of spoilage micro organisms. Heating the milk will kill all the micro organisms, except spores.

3. *By addition of Chemicals* : Preservatives are the chemicals, which when added to milk at small concentrations will inhibit the microbial multiplication by interfering the metabolism path way of micro organisms or by neutralizing the acids produced.

The various preservatives used for storing the milk are - sodium carbonate, sodium bicarbonate, formaline / formaldehyde, Boric / Benzoic acids, salicylic acids etc.

Antibiotics will also inhibit microbial growth. Microbial antibiotics like nisin, acidophillin etc are used for inhibiting microbial growth.

Lactoperoxidase System : It is also known as cold sterilization. Lactoperoxidase is an enzyme, which is naturally present in fresh raw milk. It will prevent the growth of microorganisms in milk. But it will be in inactive state in natural conditions. Chemicals like Thiocyanate and hydrogenperoxides are added to raw milk at 30 : 70 ppm level will activate the lactoperoxidase system. Then Lactoperoxidase will act as anti microbial and extends the shelf life of the milk.

Labelling of milk products

Label means any tag or descriptive matter printed on the prepacked box, bottle or tin in which milk products are packed like a) Liquid Milk b) condensed milk or flavoured milk c) Ghee, butter, cream d) Dairy Whitener (Milk powder with sugar) e) Curd, yoghurt, butter milk, paneer, cheese.

Label of pre-packaged food should carry following information

1. *Name of food*: It is usually the Trade name of the product. Eg. Amul Milk powder, Heritage Ghee etc.

2. *List of ingredients*: These are the constituents of the product in ascending order according to quantity.

- Ingredients solely from milk: Class 'Milk solids'
- Ingredient of compound ingredient
- Added water

3. *Nutritional information*

Bacterial Growth in Milk at different Temperatures

Temp °C	Bacterial Growth Factor
0	1.00
5	1.05
10	1.80
15	10.00
20	200.00
25	1,20,000.00

Bulk Milk Chiller Faster Cooling 250 Liters



Milk Tanker Road Transport



- Energy in Kilo calories.
- Proteins, Carbs/Sugars, Saturated fats, Trans fats etc.
- Minerals or Vitamins

4. *Vegetarian and non-vegetarian symbol*

5. *Food additives*

- Specific name of the additive

- Colour or flavour

6. *Name and complete address of manufacturer and manufacturing unit*

7. *License number issued by the Government*

8. *Net quantity in Grams or Liters*

9. *Lot/batch identification number*

10. *Date of manufacture or packing*

11. *Best before and Use by date*

12. *Instructions for use like storage instructions or freezing temperatures)*

13. *Declaration by the manufacturer regarding presence or absence of certain components like artificial colours, flavours or Preservatives etc.*



3.3 Cleaning and sanitation of dairy farm – Safety precautions to prevent accidents in an industry

Cleaning and sanitation of dairy farm

The easy and quick method of cleaning animal house is with liberal use of tap water, proper lifting and disposal of dung and straw bedding, providing drainage to the animal house for complete removal of liquid waste and urine.

The daily removal of feed and fodder left over in the manger reduces the fly nuisance. Periodical cleaning of water trough eliminates the growth of algae, bacterial and viral contamination and thus keeps the animal healthy.

Sanitation in Dairy Farm

Sanitation is necessary in the dairy farm houses for eliminations of all micro organism that are capable of causing disease in the animals. Milk produced in an unclean environment is likely to transmit diseases which affect human health.

Dry floorings keeps the houses dry and protects from foot injury. Similarly, the presence of flies and other insects in the dairy farm area are not only disturbs the animals but also spreads deadly diseases to the animals

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

Sunlight is the most potent and powerful sanitizer which destroy most of the disease producing organisms.

Insecticides: Insecticides are the substances or

preparations used for killing insects. In order to control flies and disease transmitting ticks, insecticides are used in dairy farms.

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

Commonly used insecticides are BHC, DDT, Gamaxane wettable powders, Dairying malathion, sumithion etc.

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

Precautions in cleaning

- Remove dung and used bedding completely.
- Avoid the use of dirty water in cleaning the sheds.
- Never put the fresh fodder over the previous day's left over fodder in the manger.
- Prevent algae to grow in the water troughs
- Avoid the use of disinfectant solution at the milking time as milk absorbs these quickly.
- Scrape the floor with a brush and broom and wash with water.
- Remove the cobwebs periodically with the help of a wall brush.
- Whitewash the walls periodically by mixing insecticides in it to eliminate ticks and mites living in cracks and crevices.

Prevention of Accidents in Dairy Farm

The activities in dairy industry involves different hazards. There are various Departments like Production, Engineering, Packaging and Transport. Accidents can happen at any stage and safety measures are to be followed at each stage.

Falls, Electrocution, Exposure to chemicals, burns, Transport vehicle accidents, Short circuits may happen and cause fire accidents. workers lose limbs at the accidents with Packaging machinery .

Precautions:

- The floorings should be kept dry to prevent slips or falls.
- Chemicals must be handled using PPE kits.
- Damaged electrical fittings must be replaced immediately
- Proper parking facility should be provided to the vehicles carrying feed or Milk.
- For the operation of heavy electrical equipment Standard Operating procedures should be followed scrupulously
- Total work area should be monitored through CCTVs to find out the mistakes and rectify them immediately
- Regular inspections are to be made to the Equipment like Chillers, Boilers, Sterilizers etc.
- It is the moral responsibility of employer to Insure the Employees against accidents.

2. Animal Inbreeding
3. Sanitation of Dairy Farm
4. Dairy development in India
5. Feed Mixing
6. Deworming
7. Milk Storage Methods
8. Identification of characters of any Two Dairy cattle

SECTION B

(Answer any three questions. Each answer carries 10 marks)
3x10 = 30 Marks

1. Write an essay on Dairy development in India, its current position and future scenario.
2. List out different methods involved in selection of dairy animals and discuss briefly.
3. Give an account of feed ingredients and feed management required for dairy animals.
4. Explain different methods of collection of milk.
5. Explain two methods of systems of housing of dairy animals.

QUESTION BANK

MODULE I

5 marks Questions

1. Dairy development in India
2. Conventional Dairy Farm
3. NDDB
4. Selection of Site for Dairy farm
5. Explain Any 2 Records to be maintained in the dairy farm
6. Operation Flood Programme

10 Marks Questions

1. Write an essay on Dairy development in India, its current position and future scenario.
2. Explain two methods of systems of housing of dairy animals.

MODULE II

5 marks Questions

1. Animal Inbreeding
2. Identification of characters of any Two Indigenous cattle Breeds
3. Identification of Any two Exotic Cattle Breeds
4. Identification of Any two Buffalo Breeds
5. Vaccination Schedule for Cattle

10. Marks Questions

1. List out different methods involved in selection of dairy animals and discuss briefly.
2. Explain Castration, Dehorning and Deworming Practices in Dairy Farm
3. Write an essay on Care and Management of Calf, Heifer, Milk Animal, Pregnant animal and Bull.

MODULE III

5 marks Questions

1. Cleaning and Sanitation of Dairy Farm
2. Feed Mixing
3. Methods of Storage of Milk
4. Per capita Milk Production in India and Andhra Pradesh
5. Anand Pattern of Co-operative system

10 Marks Questions

1. Give an account of feed ingredients and feed management required for dairy animals.
2. Explain different methods of collection of milk.
3. Write an essay on the Milk and Its Nutritive value.

DAIRY TECHNOLOGY
Skill Development Course II Semester
MODEL QUESTION PAPER

Max. Marks: 50 Time: 1 1/2 hrs (90 Minutes)

SECTION A

(Answer any four questions. Each answer carries 5 marks)
4x5=20 Marks

1. Conventional Dairy Farm

