

Compendium for ASCI Trainees For **“Dairy Farmer / Entrepreneur”**



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Chapter - 1

Cattle and buffalo breeds of India

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Cattle and buffaloes constituting 299.6 million bovine population in India are the major domestic animal species. India ranks first in milk production in the world with total of 190.9 million cattle population and 108.7 million buffaloes. There are thirty well defined cattle breeds in our country and ranks second in cattle population. There are seven well defined breeds of buffaloes and India ranks first in buffalo population in the world. The buffaloes contribute maximise (52%) to total milk production, followed by cattle (45%) and goats (3%).

Cattle Breeds: Based on utility cattle breeds are categorised as Milch , draught and Dual purpose breeds.

A) Milch breeds : Red Sindhi, Sahiwal and Gir etc.

B) Draught Purpose :Hallikar, Khillari , Amrithmahal etc.

C) Dual purpose :Tharparkar, Hariyana , kankerj etc.

Milch Breeds :

A) Sahiwal : This is one of the best indigenous dairy breed originated in Montgomery region of undivided India. This breed otherwise known as Lola (loose skin), Lambi Bar, Montgomery, Multani, Teli. The Sahiwal cows are red and light brown in colour but some animals with white patches are also found. . Heavy breed with symmetrical body having loose skin. The average milk yield of this breed is between 1400 and 2500 kg per lactation.(in village conditions yield is 1350 lit in a lactation of 305 days. Average age at first calving is 36 months and the calving interval is 420 days. Average fat and SNF content of the milk is around 5 and 9.2% respectively.

B) Red Sindhi : This breed is otherwise called as Red Karachi and Sindhi and Mahi. Originated in Karachi and Hyderabad (Pakistan) regions of undivided India and also reared in certain organized farms in our country. Colour is red with shades varying from dark red to light, strips of white. Milk yield ranges from 1500 to 2200 kg in a lactation of 305 days. The average age of first calving is 42 months (32-50) and inter calving period from 425-540 days. Bullocks despite lethargic and slow can be used for road and field work.

C) Gir : This is one of the best indigenous dairy breed. This breed is otherwise known as Bhadawari, Desan, Gujarati, Kathiawari, Sorthi, and Surati. Most of the Gir Cattle are purely red in colour and some are with patches of red, black and red & black on white skin. Originated in Gir forests of South Kathiawar in Gujarat also found in Maharashtra and adjacent Rajasthan. Horns are peculiarly curved, giving a ‘half moon’ appearance. The Gir cattle have medium sized body with massive heads, extremely budding forehead and long pendulous and drooping ears with notches at the tip. Milk yield ranges from 1200-2000 kg per lactation. Certain outstanding cows with 26-27 kg peak milk yield in a day and lactation milk yield more than 4500 Kg indicate a high genetic potential for milk production. Age at first calving 40-60 months and inter calving period from 430 to 490 days. This is known for its hardiness and disease resistance.

Indigenous dual purpose cattle breeds

A) Tharparkar : Originated in Tharparkar district (Pakistan) of undivided India and also found in Rajasthan. Otherwise known as White Sindhi, Gray Sindhi and Thari. They are medium sized with compact body. Body colour is white or light grey. The bullocks are quite suitable for ploughing and carting and the cows yield 1800 to 2600 kg of milk per lactation. Age at first calving ranges from 38 to 42 months and inter calving period from 430 to 460 days. Lactation length is 285 days.

B) Haryana: This breed is originated from Rohtak, Hisar, Jind and Gurgaon districts of Haryana and also popular in Punjab, UP and parts of MP. Horns are small. The bullocks are powerful work animals. Haryana cows are fair milkers yielding 600 to 800 kg of milk in lactation. The age at first calving is 40 to 60 months and calving interval is 480 to 630 days.

C) Kankrej : It is one of the heaviest breeds of cattle in India. Originated from Southeast Rann of Kutch of Gujarat and adjoining Rajasthan (Barmer and Jodhpur district). The horns are large strong and curved upwards. Ears are large, pendulous and open. Colour of the animal varies from silver-grey to iron-grey or steel black. The gait of Kankrej is peculiar called as 1 ¼ paces (sawai chal). Kankrej is valued for fast, powerful, draught cattle. Useful in ploughing and carting. The cows are good milkers, yielding about 1750 kg per lactation. Average lactation length is 295 days.

D) Deoni: Very popular dual purpose breed of cattle of Marathwada region of Maharashtra and adjoining parts of Telangana and Karnataka. Body colour is usually spotted black and white. The ears are grey –white or complete white black pinna. The ears are dropping and the forehead is prominent and slightly bulged similar to that of Gir cattle. This breed is considered to have admixture of Gir, Dangi and local cattle. The animal is docile and calm. Age at first calving ranges from 30-51 months. Milk yield ranges from 636 to 1230 kg per lactation (average of 950 kg) with a average lactation of 300 days. Calving interval averages 450 days. Bullocks are suitable for heavy cultivation.

Exotic breeds of Cattle:

- A) Jersey:** It is developed in the Jersey Island, U.K. In India this breed has acclimatized well and is widely used in cross breeding with indigenous cows in hilly areas. Jersey is relatively a smaller dairy breed and hence is more suited for crossbreeding with zebu cattle. Mature jersey cows weigh around 450 kg. The typical colour of Jersey cattle is reddish fawn. Dished fore head and compact and angular body. These are economical producers of milk with 4.5 - 5% fat. Average milk yield is 4500 kg per lactation. Heifers grow rapidly and mature early and calve at the age of 25 to 30 months and calving interval is 13 to 14 months.
- B) Holstein Frisian (H.F):** This breed was developed in the northern parts of Netherlands, especially in the province of Friesland. This is the best dairy breed and is most widely distributed breed of dairy cattle in the world. They are heavily built and possess large udder. They are the largest dairy breed and mature cows weigh as much as 700kg. They have typical marking of black and white that make them easily distinguishable. The average production of cow is 8000 to 10000 kg per lactation. However, the fat content in their milk is rather low (3-3.5 per cent). Age at first calving is 29 to 30 months and calving interval is 13 to 14 months.
- C) Brown Swiss :** The mountainous region of Switzerland is the place of origin of Brown Swiss breed. It is famous in its home tract for its rugged nature and good milk production. Average milk yield is 5000 kg per lactation with 4% fat. The Karan Swiss is the excellent crossbred cattle obtained by crossing this breed with Sahiwal cattle at NDRI, Karnal. Age at first calving is 28 to 30 months and calving interval is 13 to 14 months.

Crossbred Cattle Strains :

For bringing rapid improvement , particularly in non descript zebu cattle, the crossbreeding of indigenous cattle using frozen semen of bulls of exotic dairy cattle breeds (H.f, Brown Swiss ,Jersey) resulted in developing various synthetic crossbred cattle strains. Karan Fries, Frieswal are some of the examples of the high producing synthetic crossbred cattle strains developed at organised farms and under village conditions .

- A) Karan Swiss :** Karan Swiss is crossbred cattle strain has been developed at NDRI Karnal by crossing Brown Swiss bulls with Sahiwal and Red Sindhi zebu cattle. The average age at first calving of Karan Swiss is 32-34months . Average lactation milk yield in 305 days of lactation is about 3350 kg The average service period , dry period and inter calving period are 117,85 and 404 days respectively. The average fat and SNF content in milk is 4.16% and 9.20% respectively.
- B) Karan Fries :** Karan Fries is crossbred cattle strain has been developed at NDRI Karnal by crossing Tharparkar cows with the frozen semen of superior Holstein Frisian bulls. The average age at first calving of Karan Swiss is 30-32months . Average lactation milk yield in 305 days of lactation is about 3400-3600 kg The average service period , dry period and inter calving period are 123,104 and 401 days respectively. The average fat and SNF content in milk is 4.1% and 8.92% respectively.

C)HF Crossbred : The HF crosses are more suitable for cooler climatic regions like hilly areas as they are less tolerant to heat (coastal and delta areas). Have less resistance to tropical diseases than Jersey crosses. Although the milk yield is higher in HF crosses the fat per cent is less. Crossbred H.F cow gives 10-15 litres milk per day.

D)Jersey Crossbred: Jersey crosses are produced by upgrading/ cross breeding the non descript / Indigenous breeds of cows with Jersey semen. Jersey crosses are suitable dairy animals for tropical plains of our country. They are medium sized, have better heat tolerance than other exotic crosses and well adapted to our climate. Depending on the milk production potential of our indigenous cows, the Jersey crosses may show 2 to 3 fold increase in milk yield in the first generation.

Buffalo Breeds :

India is considered as home tract for some of the best buffalo breeds. There are seven well defined breeds of buffaloes .Apart from providing milk , the buffaloes are also used for carting , ploughing and other agricultural operations. The characteristics of important buffalo breeds used as dairy animals have been discussed below.

A)Murrah : Synonyms : Delhi, Kundi, Kali . It is the most important breed of buffaloes whose home tract is Rohtak, Hisar and Jind of Haryana and Nabha and Patiala districts of Punjab. The colour is usually jet black with white markings on tail and face and extremities sometimes found. The tightly curved horn is an important character of this breed. The body size is massive, neck and head are comparatively long. Head of females is short, fine and clear cut. Hips are broad and fore and hind quarters are drooping. Average lactation yield is vary from 1500-2500 kg the average milk yield is 6.8 kg/day . While a few individual animals yield much as 19.1 kg/day. The milk fat and SNF content are 7 and 9.5% respectively. Age at first calving is 45-50 months and inter calving period is 450-500 days.

B) Nili Ravi : This breed is found in Sutlej valley in Ferozpur district of Punjab and in the Sahiwal district of Pakistan. (bred around Ravi river) Usually the colour is black with white marking on forehead, face, muzzle, legs and tail. The most desired character of the female is the possession of white markings. The head is elongate, bulging at top and depressed between eyes. The muzzle is fine. The frame is medium sized. The peculiarity of the breed is the wall eyes. The horns are small and coiled tightly. The neck is long, thin and fine. The milk yield is 1500-1850 kg per lactation and the inter calving period is 500-550 days. Age at first calving is 45-50 months.

C)Bhadavari : Home tract of this breed is Agra and Etawah district of Uttar Pradesh and Gwalior district of Madhya Pradesh. The body is medium size and wedge shaped. The head is comparatively small, the legs are short and stout, and the hooves are black. The hind quarters are uniform and higher than the forequarter. The body is usually light or copper coloured is a peculiarity of this breed. Eye lids are generally copper or light brown colour. Two white lines ‘Chevron’ are present at the lower side of the neck similar to that of Surti buffaloes. Horns are black, curling slightly outward, downward before running backward parallel and close to neck, and finally turning upward. The average milk yield is 800 to 1000 kg. The bullocks are good draught animal with high heat tolerance. The fat content varies from 6 to 12.5 per cent. This breed is an efficient converter of coarse feed into butterfat and is known for its high butter fat content .

D)Jaffarabadi : These are massive animals found in their pure form in Gir forests. The breeding tract of this breed is Kutch, and Jamnagar districts of Gujarat. The head and neck are massive. The forehead is very prominent, wide with a slight depression in the middle. The horns are heavy, inclined to droop at each side of the neck and then turning up at point, but less tightly curved than in Murrah (drooping horns). The colour is usually black. The average milk yield is 1400 to 2300 kg (1800Kg) . These animals are mostly maintained by traditional breeders called Maldharis, who are nomads. The bullocks are heavy and used for ploughing and carting. Age at first calving is 50-55 months and inter calving period is 450 days. The average milk fat is around 6.5- 7 % respectively.

E)Surti : The breeding tract of this breed is Kaira and Baroda district of Gujarat. Coat colour varies from rusty brown to silver-grey. Skin is black or brown. The body is well shaped and medium sized; the barrel is wedge shaped. The head is long with prominent eyes. The horns are sickle shaped, moderately long and flat. The colour is black or brown The peculiarity of the breed is two white bands, one round the jaw and the other at the brisket. The milk yield ranges from 900 to 1300 kg. The age at first calving is 40-50 months with a inter calving period of 400-500 days. The peculiarity of this breed is very high fat percentage in milk (7.5-8.5 per cent).

F) Mehsana : Mehsana is a dairy breed of buffalo found in Mehsana town in Gujarat and adjoining Maharashtra state. Body is mostly black; a few animals are black-brown in colour. The breed is supposed to have been evolved out of crossbreeding between the Surti and the Murrah. The body is longer than in Murrah and the limbs lighter. The head is longer and heavier. The horns usually are less curved at the end compared to Murrah breed but are longer and could be of irregular shape. The milk yield is 1400-1800 kg. The breed is supposed to have good persistency. The inter calving period ranges between 450-550 days.

G)Godavari : Godavari is a result of crossing of native buffaloes with Murrah bulls. The home tract is Godavari and Krishna deltaic area The animals are of medium stature with compact body. The colour is predominantly black with a sparse coat of coarse brown hair. Godavari buffaloes are reputed for high fat with daily average milk yield of 5-8 litres and lactation yield of 1200-1500 litres. The animals breed regularly and have a short calving interval compared to Murrah.

H)Pandharpuri : This buffaloes are found in Kolhapur, Solapur districts in south Maharashtra. Body colour varies from light black to deep black. It is medium sized animal having long narrow face, very prominent and straight nasal bone, comparatively narrow frontal bone and long compact body. The breed can be easily identified by its long, sword shaped, sometimes twisted horns, which measure from 45-50 cm up to 1-1.5 m of length. The majority of the breed are black with white markings found on the forehead , legs and switch of tail. The Pandharpuri are medium sized with average body weight of 450-470 kg. The long horns usually turned upwards or lateral. The udder is compact, trough shaped with cylindrical teats. The head is long, narrow with prominent nasal bone and the horizontal ears. The breed is famous for its high reproductive ability, producing a calf every 12 months. Under average management conditions and hot -dry climate these buffaloes yield 6-7 litres of milk per day; however under good management they are reported to yield up to 15 lit of milk per day.

Chapter - 2

Housing management of dairy cattle

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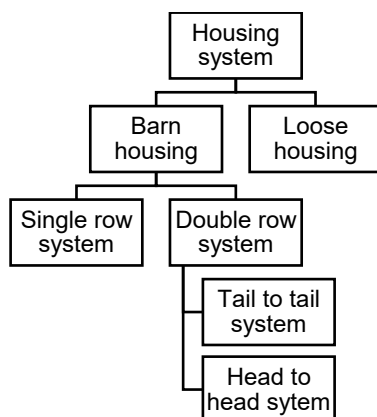
Objectives:

1. To protect animals from adverse environmental conditions (rain, cold and winds)
2. For proper and economic feeding of the animals
3. For ease of management of different class of animals (calves, heifers, milking, dry and pregnant cows)
4. To provide for comfort to animals
5. For removal and disposal of excreta, cleaning and disinfection of animal house

Site selection:

Following things should be considered while selecting site for dairy farm

1. The land should not be low lying, somewhat level, with no abrupt slopes
2. Soils should be fertile for production of fodder
3. Dairy farm should be near to market place and or a co-operative society for transportation of milk for quick transport and to reduce the transport cost.
4. Skilled labours should be available from nearby place
5. Uninterrupted power supply is essential
6. Continuous supply of clean and potable water should be available
7. The site if has trees around provides shade and prevent rough winds

Housing systems

Loose Housing system

As the name says in this system the animals are let loose. However there is also a covered area in which cows can feed, rest and take shelter during rain and hot sun. In this system there are separate sections like milking barn, calf shed, heifer shed, dry cow shed, milch animal shed etc.

The covered area is built with asbestos or GI or steel sheets with iron or concrete pillar support. The height at the centre is 4.6 meter above the ground level and at the sides it is 2.4 meter. The floor of the covered area can be built using concrete. The open area is fenced using GI Pipes.

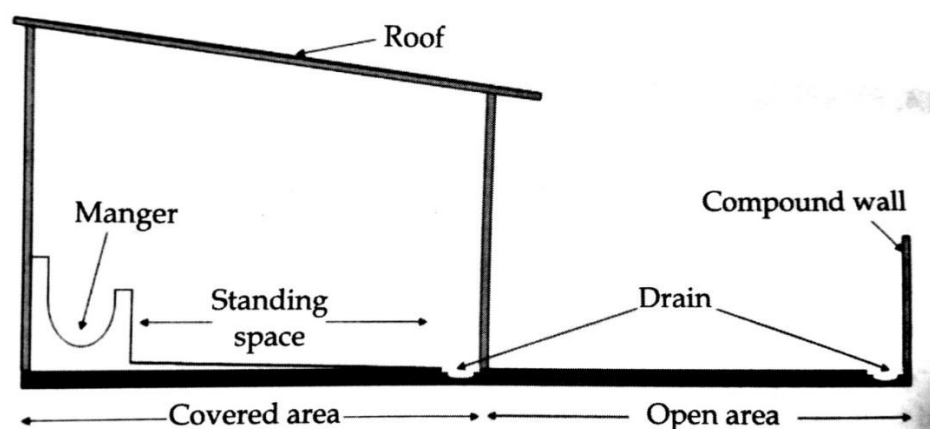


Fig. Layout of louse housing system

Barn housing system

In this system the cows will be usually tied inside a shed. In this system the movement of animals is restricted. Different activities like feeding, watering and milking are done inside the shed. There will be a roofed barn. The side walls could be either open or closed. If closed may be some times provided with windows or ventilators. The barn system may be of single or multiple rows; either head to head or tail to tail based housing.

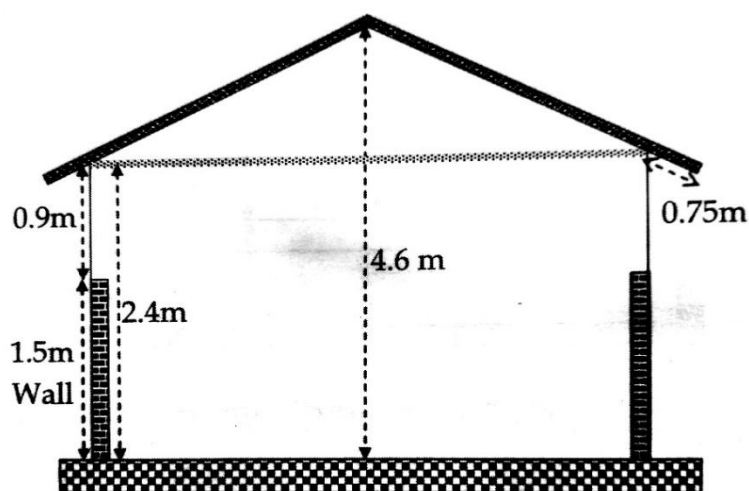


Fig. Layout of barn housing system

Table: Comparison of loose housing and bran housing systems

<i>Parameter</i>	<i>Loose Housing</i>	<i>Cow House Conventional Barns</i>
1. Labour saving	More	Less
2. Stabling costs	Less	More
3. (a) Comfort to cow	More	Less
(b) Health of animal	Better	Good
4. Heat detection in cows	Easier	Less Easy
5. Benefit of sunlight to cows	More	Less
6. Cows tend to remain cleaner	No	Yes
7. Benefits of exercise due to movements	Yes	No
8. Enlargement or expansion	Easy and Less Expensive	Difficult and More expensive
9. Efficiency and Profitability	More	Less
10. Quality of milk	Good	Better

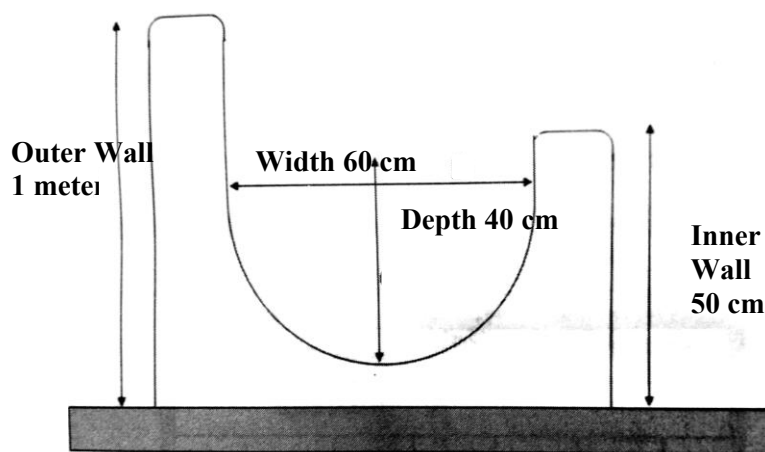
Different components in a barn housing system

Feeding passage:

This space of 1 meter width is required for movement of persons and feeding trolley for filling the mangers with feed

Manger (Feeding trough)

The manger is a space in which the feed is kept for animals. It can be made of either wooden planks, bricks and concrete. The manger should be constructed raised (10-15 cm) above the floor of the house to facilitate adequate drainage and cleaning of the manger.

**Fig. Dimensions of manger**

Standing space

This is the place where animals stand. Generally a width of 1.2 meter and length of 1.5-1.8 meter is sufficient for each cow. Between the animals dividers can be provided if required. The standing space should have a slope of 2.5-3 cm per meter towards the drain for cleaning.

Drain (gutter):

The gutter of 20 -30 cm wide and 10-15 cm deep should be constructed behind the standing space. A slope of 2.5 cm for every 3 m length is necessary.

Passage:

A passage of 1 meter width is required next to drainage for milking, movement of staff, cleaning of animals and removal of dung etc.

Floor space requirement of dairy cattle in loose housing system (BIS 1223-1987)

Type of animal	Floor space required (m ²)	
	Covered area	Open area
Young calves (< 8 weeks)	1.0	2.0
Older calves (> 8 wks)	2.0	4.0
Heifers	2.0	4.0-5.0
Adult cows	3.5	7.0
Adult buffaloes	4.0	8.0
Cows approaching calving	12.0	20.25
Bulls	12.0	120.0
Bullocks	3.5	7.0

Floor space requirement of cattle based on body weight (FAO 2011)

Animal category	Age (months)	Body weight (kg)	Area per animal (m ²)	
			Fully covered bedded shed	Shed with exercise yard
Young stock	1.5 - 3	70-100	1.5	1.4
	6	100-175	2.0	1.8
	6-12	175-250	2.5	2.1
	12-18	250-350	3.0	2.3
Bred Heifers and small milking cows		400-500	3.5	2.5
Milking cows		500-600	4.0	3.0
Large milking cows		> 600	5.0	3.5

Feeding manger and water trough requirements of dairy animals (BIS IS 11799:2005)

	Feeding manger length per animal (cm)	Water trough length per animal (cm)
Young calves (< 8 weeks)	40-50	10-15
Older calves (> 8 wks)	40-50	10-15
Heifers	45-60	30-45
Adult cows	60-75	45-60
Adult buffaloes	60-75	60-75
Cows approaching calving	60-75	60-75
Bulls	60-75	60-75
Bullocks	60-75	60-75

Dimensions of the mangers and water troughs

Type of animals	Dimensions of the mangers and water troughs (cm)		
	Width	Depth	Height of inner walls
Adult cows / buffaloes	60	40	50
Calves	40	15	20

Types of bran housing system

1. Single row system

Single row housing is suitable when the number of animals is less than 10. The long axis of the shed should be oriented east to west direction in coastal areas.

2. Double row system

Double row housing is suitable when the number of animals is more than 10 and up to 50. In double row system the animals can be housed either in tail to tail fashion or head to head fashion and both of them have their own advantages and disadvantages. In head to head system animals head will be facing each other and in tail to tail system the head will be facing outward. The long axis of the shed should be oriented east to west direction in coastal areas

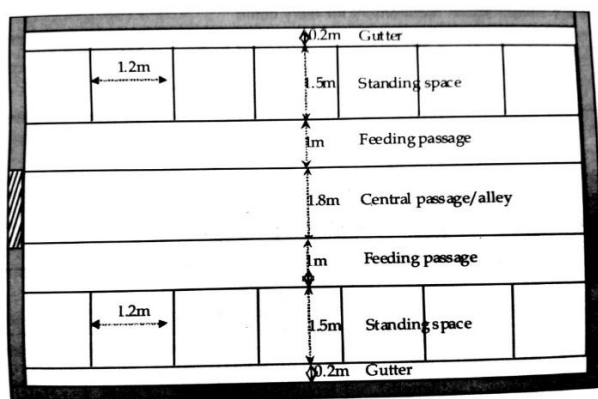


Fig. Top view of head to head system of housing

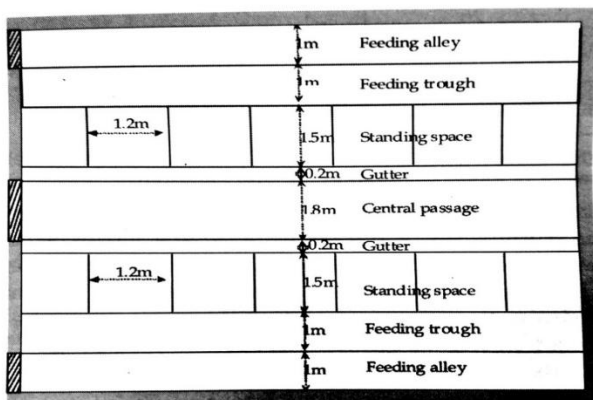


Fig. Top view of tail to tail system of housing

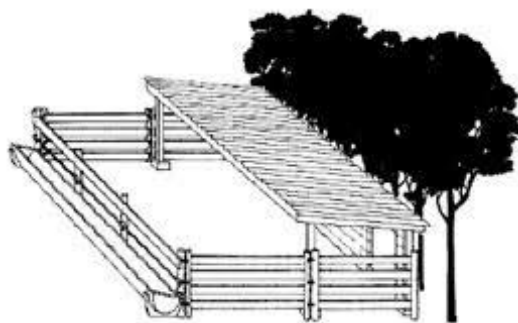


Fig. Loose housing system

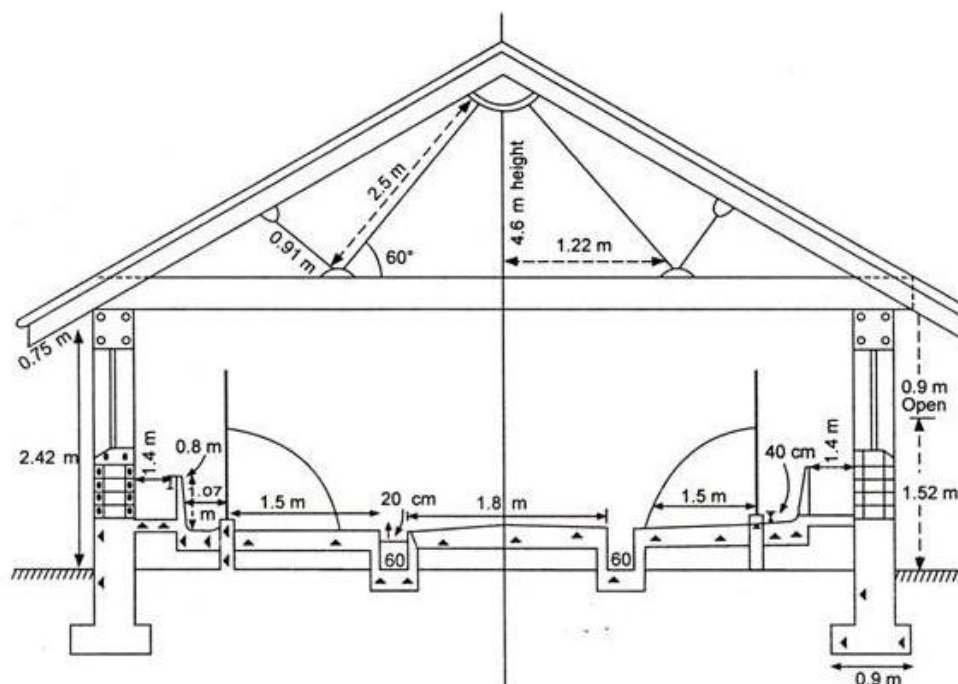


Fig. Sectional view of tail to tail housing system

Table: Comparison of tail to tail and head to head system of housing

Parameters for comparison	Double row system	
	Tail to tail	Head to Head
1. Feed distribution	Difficult	Easy
2. Cleaning gutters	Easy	Difficult
3. Supervision of milking	Easy	Difficult
4. Possibility of stealing milk at milking time	Difficult	Easy
5. Detection of injury on hind quarters	Easy	Difficult
6. Look of animals at a glance	Good	Better
7. Fresh air and direct sunlight		
To (A) Milker at milking	Less	More
(B) Animals	More	Less
8. Floor Space for barn	More	Less
9. Cost of construction	More	Less
10. Gutter exposed to sun rays and kept dry	Less	More
11. Easier for cows to get into stalls	No	Yes
12. Danger of spread of disease	Less	More
13. Walls are splashed and kept dirty with dung and urine		
14. Back tracking of feed trolley	Needed	Not required
15. Safer for health of cows	Yes	No

Different kinds of buildings in a dairy farm

1. Milking cow shed
2. Dry cow shed
3. Calving shed
4. Heifer shed
5. Bull shed
6. Calf shed – Keep male and female together up to 6 months. After that house them separately
7. Milking parlour and milk chilling room– in loose housing system
8. Chaff cutter room
9. Storehouse for concentrate feed, dry fodder, equipment
10. Pumphouse
11. Generator room
12. Wash rooms
13. Silo pits
14. Office

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Chapter - 3

Care and management of dairy animal

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Animal husbandry or livestock rearing is as old as human civilization. India has a tradition of intimating with animals or treating them as one of their family. With gradual change in societal structure, the conventional livestock system has transformed into a more commercial venture. Under domestication the animals are dependent on humans for their sustenance and performance. They need to be provided with appropriate levels of feeding, suitable housing, breeding, timely healthcare and management so as to obtain desired productivity. Their feeding, housing, healthcare and routine management based on scientific recommended practices is essential for obtaining higher profits from dairy farming. The care and management of a dairy farm starts with the birth of a healthy calf. The healthy female calves born have to be fed and cared well to grow at a faster rate and become a producing cow or buffalo at an early age. Once in production, the dairy animals are managed for breeding regularly and to produce milk at higher level so that their rearing becomes profitable to the dairy farmer.

1. CARE AND MANAGEMENT OF CALF:

We must give good feeding and management for the calves so that they develop well and, useful for replacement stock. The feeding and care of the calf begins before its birth. The dam should be dried 6-8 weeks before expected calving and should be fed well. Underfed animals will give weak and small calves.

A) Early Management:

- Immediately after birth remove any mucous or phlegm from nose and mouth.
- Normally the cow licks the calf immediately after the birth. This helps to dry off the calf and helps in stimulating breathing and circulation. When the cow does not lick or in cold climate, rub and dry the calf with a dry cloth or gunny bag. Provide artificial respiration by compression and relaxing the chest with hands.
- The naval should be tied about 2-3 cm away from the body and cut 1cm below the ligature and apply Tr. Iodine or boric acid or any antibiotic.
- Remove the wet bedding from the pen and keep the stall very clean and dry in condition.
- The weight of the calf should be recorded.
- Wash the cow's udder and teats preferably with chlorine solution and dry.
- Allow the calf to suckle the first milk of the mother i.e. Colostrums.
- The calf will be standing and attempts to nurse within one hour. Otherwise need help to nurse the weak calves.

B) Feeding of Calves:

- Feed colostrums i.e. the first milk of the cow for the first 3 days. The colostrum is thick and viscous. It contains higher proportions of energy, vitamins especially Vitamin A, minerals and proteins. The proteins are immunoglobulins which gives protection against many diseases. Colostrum contains anti-trypsin which avoids digestion of immunoglobulin in the stomach and is absorbed as it is. Also colostrum has laxative effect which helps to pass first faeces i.e. meconium in newborn calf.
- Whole milk should be given after 3 days and it is better to teach to drink the milk from the pail or bucket. Feed twice a day which should be warmed to body temperature. For weak calves feed thrice a day.
- The limit of liquid milk feeding is 10 % of its body weight with a maximum of 3-5 liters per day and continue liquid milk feeding for 8-10 weeks. Over feeding causes ‘Calf Scours’.
- The milk replacer can be given to replace whole milk. The most suitable milk replacers consist almost entirely of milk by-products. It should contain 22-25 per cent good quality protein. This is an excellent feed for calves. It can be substituted for whole milk when calves are two weeks old. The change can be made abruptly or gradually over 3 days. It can be continued to feed skim milk until the calves are 4 to 5 months old. For economic way of raising calves, the whole milk can be substituted with skim milk and calf starter.
- Give calf starter after one month of age. A calf starter should be highly palatable. It should be high energy (75% TDN) and contain 14-16 per cent digestible crude protein.
- Provide good quality green fodder and hay from 4th month afterwards.
- Feeding of antibiotics to calves improves appetite, increases growth rate and prevents calf scours. E.g. aureomycin, Terramycin etc

Table: Feeding schedule for calves up to 6 months

Age of calf	Approx. body weight (kg)	Quantity of milk (kg)	Quantity of calf starter (g)	Green grass (kg)
4 days to 4 weeks	25	2.5	Small qty.	Small qty.
4-6 weeks	30	3.0	50-100	Small qty.
6-8 weeks	35	2.5	100-250	Small qty.
8-10 weeks	40	2.0	250-350	Small qty.
10-12 weeks	45	1.5	350-500	1-0
12-16 weeks	55	-	500-750	1-2
16-20 weeks	65	-	750-1000	2-3
20-24 weeks	75	-	1000-1500	3-5

C) Management practices:

- Identity the calf by tattooing in the ear at birth and branding after one year.
- Dehorn the calf within 7-10 days after birth with red hot iron or caustic potash stick or electrical method.
- Deworm the calf after one week of birth and then regularly at 30 days interval upto 6 months to remove worms using deworming drugs.
- Fresh water should be given from 2 -3 week onwards.
- House the calves in individual calf pens for 3 month afterwards in groups. After six months males and females calves should be housed separately.
- Weigh the calves at weekly interval upto 6 months and at monthly interval afterwards to know the growth rate. Feed the calf as per requirement to maintain the body weight gain at the rate of 500-600 gm per day.
- Mortality in calves is more in first month due to pneumonia, diarrhea (calf scours) and worms.
- House them under warm, dry and clean condition to avoid above disease complications.
- Extra teats beyond 4 should be removed at 1-2 months of age.
- Keep the body clean and dry to avoid fungal infection.
- Mineral-blocks should be provided, so that the calves lick and no chances for mineral deficiency.
- Wean the calf from the mother and feed through pail feeding system.

2. CARE AND MANAGEMENT OF HEIFER:

Dairy replacements are the foundation of any dairy enterprise. Improvement of a herd is possible when culled cows are replaced by well fed, healthy, genetically superior, and properly managed 2-year-old heifers. An excellent way to improve herd production is to mate cows to the best bulls available, then feed and manage replacement heifers so they reach their true potential in an optimal time period. Better care and management of heifer will give high quality replacement stock to the dairy farm.

The following care and management practices are recommended for a heifer.

- Feed the heifer sufficiently to produce normal growth. During the early stage relatively more protein than energy is needed. Most heifers grow well if excellent hay is given as much they can eat. The amount of growth depends upon the quality of forage fed.
- The heifers should be provided with a dry shelter free from drafts. A loose housing system with a shelter open to one side is sufficient.
- The size rather than the age of a dairy heifer at breeding time is important. Breeding under sized animals is never profitable. They may be stunted or slow to reach maximum size. Small heifers are more likely to have difficulty in calving. Though the heifer that

is bred to calve at an older age yields higher milk yield in the first lactation, the total milk produced by such a cow will be less when compared to the heifers that freshens at an early age.

- The heifer should be growing and in good flesh at calving time. This is necessary so that she can produce milk at the most profitable level.
- Place the heifer in a separate shed about 6-8 weeks before she is due to calve.
- Feed 2 - 3 kg of concentrate daily and all the forage she eats.
- Before calving let the heifer become accustomed to handling and to the procedures used in the milking herd. Always handle her gently and with kindness.
- Maintenance of health among heifers is very important for proper growth. The health among the heifers is maintained by hygienic housing, watering, balanced feeding and taking necessary preventive steps against common diseases.
- Periodically the heifers in the herd should be checked for their proper growth and other progress. Animals lagging behind below the required standards should be removed from the herd.
- For the heifer the calving is first time and it may have difficulty in calving. So take extra care during calving.

3. CARE AND MANAGEMENT OF LACTATING ANIMAL:

To get high milk during any lactation, the milch animal should be properly fed and necessary care and managerial practices should be followed.

- The cow is fed for both maintenance and for production during early lactation. During mid lactation, the main target while feeding is to maintain the peak production. And during late lactation milk yield and feed intake become reduced. There is less protein and energy requirement during late lactation. So accordingly provide green succulent forage together with leguminous hay or straw to the extent of animal can consume, so that all its maintenance requirements are met with through forage only. Extra concentrate at the rate of 1 kg for every 2 to 2.5 liters of milk should be provided. Salt and mineral supplements should be given to maintain the lactation.
- Never frighten or excite the animals. Always treat them gently and with kindness.
- With proper feeding and care, a cow will come to heat with in 16 days of calving. Do not withhold service unnecessarily after the signs of heat are noticed in a cow. The shorter the interval between calving, the more efficient the animal is as a milk producer. By maintaining proper records of breeding and calving of the animals will ensure a steady flow of milk throughout the year.
- Individual attention to feed each animal according to its production is a must. For this purpose maintain individual production records.
- Keep up regularity of feeding. Concentrate mixture is fed before or during milking, then as roughages after milking. This practice will avoid dust in the shed.

- Water should be provided to drink at will or at frequent intervals. It is more beneficial, if the animal is maintained on paddy straw as sole roughage.
- Regularity in milking is essential. Increase of milk in the udder will reduce further secretion of milk. Milking thrice in high yielders is better than twice since 10 - 15 % more milk can be produced.
- Cows should be trained to let down milk without calf suckling. This will help to wean the calves early.
- Loose housing with shelter during hot part of the day should be provided. The animals will get maximum exercise in loose housing system.
- Grooming of the cows and washing of the buffaloes before milking help in clean milk production. Daily brushing will remove loose hair and dirt from the coat. Grooming will also keep the animal hide pliable and also helps to increase blood circulation in skin.
- Wallowing of buffaloes or water spraying on their bodies will keep the buffaloes comfortable especially in summer.
- Common ailments should be properly detected and treated.
- Common vices should be properly detected and care should be taken. Eg: Kicking, licking, suckling etc.
- Provide at least 60 - 90 days dry period between calving. If the dry period is not sufficient, the milk yield in subsequent lactation will be reduced.
- Vaccinate the cows- against important diseases i.e. FMD, HS, BQ etc and also guard against insects and pests.
- Every animal should be numbered and particulars pertaining to milk, fat %, feed taken, breeding, drying and calving dates should be recorded.
- Check for mastitis regularly.

4. CARE AND MANAGEMENT OF DRY AND PREGNANT ANIMAL:

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

- Extra concentrate mix of 1.25 to 1.75 kg should be provided for pregnant animal as pregnancy allowance. Feed good quality of leguminous fodder. The animal should not be ‘not - lean - not fat’ condition.
- Provide clean drinking water and protection from thermal stress.
- Do not allow them to mix with other animals that have aborted or that are suffering from or carriers of diseases like brucellosis.
- Allow moderate exercise, which helps in calving normally.
- Do not tire them by running or transporting long distances especially on uneven surfaces.
- Do not allow them to fight with other animals and take care that they are not chased by dogs and other animals.

- Avoid slippery conditions, which causes the animal to fall receiving fractures, dislocation etc.
- If accurate breeding records are available, calculate the expected date of calving. Separate it one or 2 weeks before and shifted to individual parturition or calving pens.
- These pens are thoroughly cleaned and fresh bedding may be provided.
- Feed one kg extra concentrates during last 8 weeks of gestation.
- Feed laxative about 3 - 5 days before and after calving (Wheat bran 3 kg + 0.5 gm of Groundnut cake + 100 gm of mineral mixture of salt).
- Symptoms of delivery may be observed i.e. swelling of external genitalia, swelling of udder; usually majority of animals will deliver without any help. If there is any difficulty, provide veterinary help.
- After parturition external genital, flank should be cleaned and protect the animal from chill and give warm water.
- Placenta will normally leave the cow within 2 - 4 hours after calving. If not take the help of a veterinarian. Take care of the animal before calving from milk fever.
- Give calcium supplement. Some times the udder will be swollen just before calving. Remove the milk partially. Take care, of the animal, if at all any abortion. Provide always free access to drinking water.

5. CARE AND MANAGEMENT OF BULL:

The maintenance of breeding bulls in good condition and suitable for breeding is highly essential requirement for the success of breeding programme. A rising condition is better for reproduction than a falling one. Fat males may produce semen of inferior quality or they may be slow or fail at service.

Breeding bull should receive plenty of exercise; will usually produce large ejaculation containing more sperms of higher activity. A breeding bull should housed separately known as “Bull Shed” with sufficient area of floor and proper covering. It is sound practice to provide cool conditions and adequate drinking water. A balanced ration should be fed containing adequate energy, proteins, minerals, and vitamins. Concentrate is provided to the bulls to the tune of 2.0 to 2.5 kg per bull during morning hours. Seasonal green fodder such as maize, cowpea, berseem, jowar etc. depending on their availability, along with mixture of maize and oat silage during lean period was fed *ad lib.* to the animals. Green fodder must be available both before and during breeding season.

Most of the bulls are ferocious and so control them properly using nose rings etc. It is of great importance that males should be fed regularly and not too much at one time, and too little at another. For bulls two mating a day has been found to be openings. Moderate exercise should be provided to keep the breeding bull in active and non fatty conditions. Regular grooming of the breeding bull be practiced. In buffalo bulls regular shaving may be practiced.

Chapter - 4

Feeds and feeding management of cattle and buffalo

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India ranks first in milk production in the world but average yield of Indian cattle is very low as compared to exotic milch breeds. There are various reasons which are responsible for low yield of our milking animals i.e. Lower genetic potential of our animals for milk production, feed shortage and lower nutritional quality of feeds.

Feed is the major input factor for milk production. Efficient management of limited feed resources is paramount importance in optimising milk production in the country. As farmers are spending 70% on feeds only. Hence dairy farmers have to know some basic principles of feeding in order to get maximum output in terms of milk with minimum expenses on feeding.

As per the Weende's method of feed analysis there are 6 proximate principles of feed which are as follows :

1. **Moisture:** water content of feedstuff and rest is dry matter percentage.
2. **Crude Protein(CP):** True proteins + NPN substances (urea, biuret, amides)
3. **Crude fibre (CF):** less digestible carbohydrates like pectin, cellulose, hemicellulose and non-carbohydrate like lignin
4. **Nitrogen free extract (NFE) :** more digestible carbohydrates like starch , sugars
5. **Ether extract (EE):** lipid portion of feedstuffs i.e. fats , fatty acids, pigments, waxes etc.
6. **Total Ash:** inorganic portion like minerals and silica

Animal Feeds:

Animal Feeds are broadly grouped into two categories as roughages and concentrates.

1. Roughages: These are main source of bulk and energy for animals which contains more than 18% crude fibre and less than 60% TDN. Roughages are low digestible than concentrates. Roughages are mainly classified as dry or green.

A) Dry roughages: This consists of Hay, Stover (kadbi) and straws (crop residues –paddy straw & Karad Grass) which contains 10-15 % moisture.

B) Green roughage: This consists of pastures, cultivated fodders, tree leaves, Root crops and silage contains 60-90% moisture.

Cultivated fodders are classified as follows:

- A) Leguminous fodders.** e.g lucern, berseem cowpea etc They fix atmospheric nitrogen due to presence of Rhizobium bacteria in their root nodule hence have higher nitrogen content. They are rich in protein and therefore forms good source of protein to farm animals . They are rich in calcium. They are rich in vitamins like Vit A , Vit.D .They are more palatable
- B) Non Leguminous fodders:** Includes cereal fodder crops like maize, sorghum etc. and cultivated grasses like paragrass,, Hybrid Napier etc.

Importance of Green fodder:

1. It keeps animal in good health and improves reproductive efficiency.
2. It is palatable and easy for digestion
3. It has cooling effect on the body
4. It is mild laxative , hence prevent constipation
5. It provides fresh nutrients in their natural form
6. It doesn't put any stress on the body or organ and leads to efficient utilisation of feed nutrients.
7. It is rich in carotene: precursor of vit . A thereby maintains normal vision , skin lustre and body resistance.
8. It is liked by animals hence feed wastage is minimum .
9. it satisfies the appetite
10. It supplies soluble sugars like glucose , fructose and sucrose
11. It provides amino acids like arginine and glutamic acids.
12. It contains unidentified growth factors that favours the growth of animal..
13. It gives long-life to animals and thereby longer production period
14. Feeding of green fodders alone can sustain about 10 li. of milk production per day with An average 20 % saving on feed cost.

Cultivation of hybrid Napier:

1. **Varieties:** Co -3, Co-4, Co-5 IGFR-7, DHN-6
2. **Sowing time :** February to August (except winter)
3. **Planting material required for 1 hectare :** 4000 (Once planted yield for 3 -4 years)
4. **Slips:** cutting with 2 nodes (stem cuttings) or rooted slips
5. **Method of plantation:** slanted position at one side of ridge with one node develops roots and shoots while the upper node shoots only.
6. **Manuring :** FYM 10 TON / Acre.
7. **Distance between plant to plant and row to row:** 50 – 75 cm
8. **Fertilisers required per Hecter:** NPK @ 8:10:5 kg / Acre as basal application
9. **Application of urea:** 30 kgs / acre after every harvest
10. **Water requirement:** every 8-10 days (summer), every 15-20 days (winter)
11. **First cutting of fodder:** 60-75 days after plantation
12. **Cuttings:** every 30 to 45 days or plants attain a height of 1-1.5 meter (6-8 cuttings / year)
13. **Fodder yield:** 200 -400 tons / hect.

Thumb rule of feeding to cattle and buffalo:

The average dry matter (DM) requirement of Deshi cow is 2 (dry) to 2.5 (lactating) kg/100 Kg body weight / day while it is 2.5 (dry) to 3 Kg (lactating) in crossbred cows and buffaloes. The roughage requirement is fulfilled through green and dry fodders. About 2/3 DM requirement is to be fulfilled through Dry fodder and remaining 1/3rd from green fodder.

The concentrate requirement of animal for maintenance, production and pregnancy is satisfied as follows:

1. The maintenance requirement of Deshi Cow and Crossbred cow /Buffalo is 1 and 1.5 Kg respectively.
2. Lactating animals should be given 1 kg of additional concentrate allowance for every 2.5 kg (buffaloes to 3 kg (cow) milk produced.
3. Pregnant cows / buffaloes should receive 1.5 kg / day extra concentrate allowance during advance pregnancy to meet extra need of nutrients for growth of foetus.
4. Breeding bulls in service should get 1kg /day extra concentrate allowance to maintain good health and sex libido.
5. Mineral mixture and common salt each @ 25-50 gm should be given to fulfil mineral requirements of animal.

Maintenance Ration :

1. It is minimum allowance of ration given to the animal for carrying out its essential body processes at optimum rate without gain or loss in body weight or change in body composition.
2. It is general given to dry non producing animals
3. It provides all essential nutrients required for normal functioning of the body
4. It roughly satisfies the nutrient requirement for maintenance
 - a) Deshi cow: 1 – 1.5 kg / day
 - b) Buffalo and crossbred cows : 1.5-5 kg / day

Gestation or pregnancy ration :

1. It is the allowance of ration given to the pregnant animal in addition to maintenance ration during the last quarter of pregnancy .
2. It is given to satisfy nutrient requirement of pregnant animals.
3. It is required for optimal growth of foetus.
4. It helps in proper development of udder for future lactation.
5. It also helps to produce more milk after calving.
6. During advance pregnancy an extra allowance of concentrate mixture to be given in addition to maintenance allowance is as follows:
 - a) Deshi cow :1-1.5 kg / day
 - b) Crossbred cow and buffalo: 1.5-2 kg / day

Production ration:

1. It is the additional allowance of ration given to the animal over and above the maintenance ration for the purpose of production like milk , meat , wool and work.
2. It is given to meet the nutrient losses through milk.
3. It helps to maintain milk production to optimum level
4. In lactating animals , the extra allowance of concentrate mixture to be given in addition to maintenance allowance is as below :
 - a) Deshi cow :1 kg / 2.5 -3 kg milk
 - b) Crossbred cow and buffalo: 1 kg / 2-2.5kg milk

Important points in the feeding of Dairy Animals:

1. Use of Chaff cutter: Cattle and buffaloes should be always feed chaffed dry and green fodder .By use of chaff cutter; farmer can prevent wastage of fodder (30-40%). Ideal size of chaffed fodder should be 0.5-1 inches.
2. Dairy animals should be fed balanced ration to meet all their nutrient requirements for maintenance and production.
3. Feeding of concentrates at each milking helps in let down of milk and animal remain calm while milking.
4. Provide at least 5 kilo greens which provide necessary vitamins and minerals.
5. Compound feed should contain 2% mineral mixture. If farmer is preparing his own feed by using grains , cakes and bran then the mineral mixture should fed separately.

6. All the animals should be given at least 30-50grams of mineral mixture daily to improve productive and reproductive efficiency of the animals.
7. Feeding of Bypass fat to crossbred dairy cattle in early lactation (up to 90-120 days post calving) helps to improve fat percentage and milk yield by 10-20%. It also helps to improve conception rate .
8. Provide clean water (requirement of water for adult cattle is 50-80 litres/ day) for 24 hours by arranging automatic waterer in dairy shed .
9. As per the thumb rule , cows should be fed 1 kilo of concentrate feed for every 2 kilo of milk production .Buffaloes , because of their higher fat content in milk , should be fed 1 kilo concentrate for every 2 kilo of milk production.

Chapter - 5

IMPORTANCE OF FEEDING MINERAL MIXTURE IN DAIRY ANIMALS

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Introduction: Minerals are the inorganic compounds required for normal body maintenance, growth and reproduction of dairy cattle and buffaloes. There are about 40 minerals required by the animal body, however only 14 minerals are of major dietary importance. Minerals that are required in relatively large amounts are called as Macro Minerals i.e. Calcium, Phosphorus, Magnesium Sulphur. Those needed in small amounts are classified as micro minerals i.e. Ferrous, Iodine, Copper, Cobalt, Zinc, Molybdenum , Selenium etc. Deficiency of minerals in the diet of animals impairs metabolic functions which affects the growth in calves and production and reproduction in adult dairy animals. Hence daily supplementation of mineral mixture in proper doses is must for all the age group animals as minerals are nowhere synthesized in animals body.

Functions of different Minerals:

- **Calcium (Ca) :**
Required for development and formation of bones and teeth. Helps in clotting of blood. Essential for milk production. Required for contraction of muscles. Deficiency causes milk fever in high yielding animals immediately after parturition.
- **Phosphorus (P) :**
Essential for milk production and required in energy metabolism. Required for formation of bones and teeth. Required for regularity of oestrous cycle and maintenance of fertility. In deficiency, animals eat other than feed and fodder like wood, plastic, bone, wire etc.
- **Magnesium (Mg) :**
Important for integrity of bone and teeth . Involved in protein synthesis and metabolism of carbohydrates and lipids and plays important role in muscle contraction.
- **Sodium, Potassium and Chloride:**
All required for maintenance of osmotic pressure and acid base equilibrium. Potassium helps in contraction and relaxation of heart. Potassium is necessary for protein synthesis in tissues.
- **Sulphur (S):**

Required for protein synthesis and metabolism of carbohydrates and lipids. Sulphur is part of B-Complex vitamins, thiamine and biotin.

- **Copper (Cu):**
Required for haemoglobin synthesis and for tissue pigmentation and normal reproduction functions.
- **Zinc (Zn) :**
Required for spermatogenesis and development of primary and secondary sex organs. Deficiency causes skin disorders like rough hair coat, loss of hair etc.
- **Iodine (I):**
Required for synthesis of thyroid hormones (T3 and T4). Necessary for reproduction and growth of animals.
- **Cobalt (Co):**
Required for the synthesis of Vitamin B12 by the rumen microbes. Essential for haemoglobin synthesis.

Directions for use of mineral mixture:

Before using mineral mixture in dairy farm, always follow advice of qualified veterinary Doctors and instructions given by the manufacturer.

- Young calves: 20-25 grams / day / calf
- Heifers / non lactating animals: 50 grams / day / animal
- Lactating cows and buffaloes: 100-200 grams / day depending upon the level of milk production.
- Feeding of Mineral Mixture: Always feed mineral mixture by mixing it with concentrate feed or by mixing 15-20 grams of common salt to it.

Benefits of feeding of Mineral Mixture:

1. Improves milk production
2. Improves reproduction efficiency of male and female animals.
3. Improves growth and development in calves and heifers hence early puberty.
4. Improves feed intake
5. Improves immunity
6. Improves general health of the animals



- Milk production & reproduction efficiency of male and female animals
- Growth and development in calves and heifers hence early puberty
- Immunity & general health of the animals
- Feed intake

Chapter - 6

Importance of ration balancing programme and recommendation of NDDB for feeding of dairy cattle

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A normal adult animal should be fed 6 Kg dry and 15-20 Kg green fodder per day. Legume and non-legume green fodder should be fed in 1:3 proportion. Green fodder should be harvested at 50% flowering stage. Surplus green fodder should be conserved in the form of ‘hay’ or ‘silage’. Conserved fodder becomes useful during summers or when green fodder is scarce.

General recommendations:

- To optimize milk production and to meet the nutrient requirement of animals, balanced feeding using user-friendly software developed by NDDB may be adopted.
- Animals fed only on dry fodder may be provided Urea Molasses Mineral Block as a supplement to the diet, depending upon its availability.
- For body maintenance and higher efficiency of milk production, ‘compound cattle feed’ / ‘bypassprotein feed’ should also be given .
- Minerals are essential for all metabolic functions of the body, animals’ ration should be supplemented with area specific mineral mixture .
- Changing from one feed to another should not be sudden but in a gradual manner.
- Fodder should be chaffed before feeding, to avoid wastage and increase digestibility.
- Various feed ingredients including the additives, should be mixed to make Sani or total mixed ration (TMR). It would be more appropriate to feed this ration in 3-4 equally divided parts in a day. This would reduce spoilage and increase the digestibility.

Importance of ration balancing :

- The feed given to animals usually comprises one or two locally available concentrate feed ingredients, grasses and crop residues.
- This leads to imbalanced feeding which means that proteins, energy, minerals and vitamins in the ration are either more, or less.
- While imbalanced feeding adversely affects the health and productivity of animals in various ways, it also reduces the net daily income to milk producers from dairying because the potential of milk production of animals is not fully exploited.
- To balance the ration of animals, NDDB has developed a user-friendly software, which can be used by trained and dedicated local resource persons (LRPs) identified for the area.

Benefits of ration balancing programme (RBP)

Using the locally available feed resources, ration of animals is balanced at a least cost

- Increase in milk production with more fat and solids-not-fat
- Increase in the net daily income
- Improved reproduction efficiency
- Reduction in inter-calving period, thereby increase in productive life of animals
- Improvement in general health of animals
- Improved growth rate in calves, leading to early maturity.
- Reduction in methane emission, a potent green house gas (GHG)

Importance of compound cattle feed in milk production

- Cattle feed produced by the Milk Unions/Federations is a balanced source of essential nutrients required for body maintenance, growth and milk production.
- It is manufactured using good quality grains, oil cakes/ meals, brans, molasses, common salt, minerals and vitamins.
- It is comparatively cheaper and highly palatable to the animals.

Recommendation for feeding of cattle feed

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

Importance of feeding of mineral mixture :

Minerals are essential for proper metabolic functions. Mineral mixture contains all the essential minerals in required quantities. Feeding area specific mineral mixture should be preferred.

Benefits of feeding of Mineral mixture :

- Helps improving growth rate in calves.
- Better utilization of absorbed nutrients.
- Increases milk production in animals.
- Improves reproductive efficiency and reduces inter-calving period.
- Increases productive life of animals.
- Improves immunity status.
- Prevents metabolic diseases like milk fever, ketosis, haematuria etc., which occur around calving period.

Feeding recommendation of Mineral Mixture

Calves	20-25 Grams daily
Heifers and Dry animals	50 Grams daily
Milking animals	100-200 Grams daily (as per milk production) or in view of level of mineral mixture in compound cattle feed/concentrate mixture.

Importance of drinking water for dairy animals

Water is required for :

- Digestion of feed and fodder.
- Distribution of absorbed nutrients to various organs.
- Excretion of undesirable and toxic elements through urine.
- Maintenance of body temperature.
- Normally, an adult healthy animal requires 75 to 80 litres of water daily. Since milk contains about 85% water, for every litre of milk produced, additional two and half litres water is required.

Recommendations :

- Animal should have a free access to clean drinking water round the clock.
- During summer, crossbred cows and buffaloes should be given bath twice daily and at least 100 litres of water per day to manage heat.

Care of pregnant animals :

- Adequate health care and nutrition can ensure rapid growth of female calf as well as attaining puberty at an early age. Timely insemination of such animals can help them to calve at 2 to 2 ½ years of age.
- As foetus develops rapidly during last 3 months of pregnancy, adequate care needs to be taken during this time.

Recommendations :

- Animals in the last trimester of pregnancy should not be taken far away for grazing, uneven paths should also be avoided.
- A lactating animal should be dried within a period of 15 days after the 7th month of gestation.
- Pregnant animals should have enough space for standing and sitting comfortably.
- Pregnant animals need suitable ration to reduce the possibility of diseases like milk fever and ketosis at the time of calving and also to ensure adequate milk production.
- Water should be provided round the clock to pregnant animals with a minimum of 75-80 litres of fresh and clean drinking water daily.
- A heifer after 6-7 months of gestation should be tied with milking animals; and its body, back and udder should be massaged. 4-5 days before calving, the animal should be tied in a separate clean and airy area having sunlight. Bedding materials like paddy straw should be spread on the ground for the animal.

- The animal should be kept under observation during the last 1-2 days before calving.

Daily feed requirement of a pregnant animal :

Green fodder	15-20 kg	Oil cake	1 kg
Dry Fodder	4-5kg	Mineral Mixture	50 gram
Compound cattle feed	3kg	Salt	30 gram

Nutritional care after calving

- Immediately after calving, the cow/buffalo has a low appetite and will not eat as much feed as the body may require.
- Cow/buffalo undergoes a lot of stress while calving, therefore, the animal should be given light, palatable, mild laxative ration containing warm rice gruel, boiled rice/wheat bran, boiled millet or wheat mixed with edible oil, bypass fat, Jaggery, Soya, Asafoetida, Methi, Black Cumin, ginger etc. for 2 to 3 days after calving. This kind of diet is also helpful in early expulsion of placenta.
- In addition, the animal should be given tender green fodder and fresh water as much as it wants to drink, but do not give hot water.
- Ensure the milking cow has constant access to clean drinking water and receives required quantity of Area Specific Mineral Mixture daily.

Examples of preparing total mixed ration (TMR) for cows

1. For Dry cow

Ingredients	Quantity		
	Example 1	Example 2	Example 3
Dry fodder	7	7	7
Green fodder	4	10	4
Cattle feed	2	1	0
Oil cake	0	0	1

* Mineral Mixture @ 50g per animal per day should be given

2. Cow yielding 5 litres of milk / day

Ingredients	Quantity		
	Example 1	Example 2	Example 3
Dry fodder	7	7	7
Green fodder	4	10	4
Cattle feed	4	3	0
Oil cake	0	0	2
Wheat bran	0	0	1

* Mineral Mixture @ 100g per animal per day should be given

3. Cow yielding 10 litres of milk / day

Ingredients	Quantity		
	Example 1	Example 2	Example 3
Dry fodder	7	7	7
Green fodder	10	15	5
Cattle feed	6	7	0
Oil cake	2	0	5
Wheat bran	0	0	3

* Mineral Mixture @ 150g per animal per day should be given

Examples of preparing total mixed ration (TMR) for buffaloes

1. For Dry buffalo

Ingredients	Quantity		
	Example 1	Example 2	Example 3
Dry fodder	6	6	6
Green fodder	2	4	10
Cattle feed	0	0	1
Oil cake	2	0	0
Wheat bran	0	3	0

* Mineral Mixture @ 75g per animal per day should be given

2. Buffalo yielding 5 litres of milk per day

Ingredients	Quantity		
	Example 1	Example 2	Example 3
Dry fodder	7	6	7
Green fodder	5	10	2
Cattle feed	5	5	0
Oil cake	0	0	3
Wheat bran	0	0	1

* Mineral Mixture @ 125g per animal per day should be given

3. Buffalo yielding 10 litres of milk per day

Ingredients	Quantity		
	Example 1	Example 2	Example 3
Dry fodder	7	7	7
Green fodder	10	15	5
Cattle feed	6	7	0
Oil cake	2	0	5
Wheat bran	0	0	3

* Mineral Mixture @ 175g per animal per day should be given

Chapter - 7

दुधाळ जनावरांच्या आहारामध्ये बायपास फ्याट मिश्रणाचे महत्व

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आय.सी.ए.आर. - कृषि विज्ञान केंद्र, उत्तर गोवा, आय.सी.ए.आर.- सी.सी.ए.आर.आय., जुने गोवे, गोवा

आपला भारत देश दुग्धोत्पादनात जगात पहिल्या क्रमांकावर आहे. अधिक दूध आणि वेळेवर पैसे मिळण्यासाठी शेतकरी आपल्या गोठ्यात एच.एफ. , जर्सी सारखे संकरीत गायी किंवा सहीवाल , लाल शिंदी सारखे जातिवंत गायी ठेवतात तर काही मुरा , जाफ्राबादी सारखे म्हशी पोसतात आणि रोजच्या दुधाची विक्री गावातील सहकारीदूध संघात करतात. अशा सहकारी दूध संघातील दुधाचे गणित हे पूर्णपणे दुधातील स्निग्धाशारच (फ्याट) अवलंबून असते. जर दुधातील फ्याटचे प्रमाण सरासरीपेक्षा जास्त मिळत असेल तर शेतकऱ्यांना नक्कीच या दूध व्यवसायात अधिक नफा मिळू शकतो.

गाय आणि म्हशी विल्यानंतर शारीरिकदृष्ट्या बलहीन होतात. वीताना एकतर वासरू शरीराबाहेर टाकण्यासाठी लागणारे प्रयत्न तसेच विल्यानंतर लगेचच चीक (पहिले दूध) व तदनंतर दूध काढल्यामुळे या अशा एक किंवा अनेक कारणामुळे सुरुवातीच्या दिवसामध्ये जनावरामध्ये ऊर्जेची कमतरता आढळून येते. अशा पद्धतीचा बदल हा जास्त दूध देण्याच्या जनावरामध्ये म्हणजे संकरीत गायी ज्यांचे दूध उत्पादन दिवसाकाठी 15 लिटरपेक्षा जास्त तसेच म्हशी ज्यांचे दूध उत्पादन 8 लिटरपेक्षा जास्त आहे अशा जनावरामध्ये जास्त दिसून येतो.

अशा पद्धतीने जनावरामध्ये होत असलेल्या बदलाचा दूध उत्पादनावर विपरीत परिणाम होवून अशी जनावरे दूध कमी देतात. दुधात स्निग्धाशाचे (फ्याट) प्रमाण कमी मिळते. अशी जनावरे व्यवस्थित माजावर येत नाहीत, वेळेवर फळत नाहीत. अशा अनेक अडचणीमुळे शेतकरी दुग्धव्यवसायात पाहिजे तेवढी प्रगती साधू शकत नाही.

वरील सर्व समस्यांचे निराकरण करण्यासाठी एकच रामबाण उपाय म्हणजे दुधाळ जनावराना समतोल आहारासोबत बायपास फ्याटचे मिश्रण खावू घालणे हे होय. जनावराना बायपास फ्याटचे मिश्रण खावू घातल्यानंतर दूधवाढी सोबत दुधातील फ्याटचे प्रमाण वाढते.

बायपास फ्याटचे मिश्रण म्हणजे काय ?

खंड करणाऱ्या प्राण्याच्या पोटाचे चार कप्पे असतात (रुमेण, रेटीक्युलम, ओम्याजम आणि अबोम्याजम) . जनावरानि खालेल्या चान्याचे जास्तीत जास्त विघटन रुमेणमध्ये होते व काही प्रमाणात इतर कप्प्यामध्ये होते. काही पोषक घटक जसे स्निग्धाशाचे (फ्याट) जे की ऊर्जेचे स्रोत आहे याचे रुमेण कप्प्यामध्ये जास्त प्रमाणात विघटन झाल्यामुळे जनावरांच्या शरीराला जसेच्या तसे पाहिजे त्या प्रमाणात ऊर्जा मिळत नाही परिणामी जनावरे कमजोर बनतात.

बायपास फ्याटचेमात्र विघटन रुमेणमध्ये न होता पुढे अबोम्याजम या पोटाच्या कप्प्यामध्ये होते त्या मुळे शरीराला उर्जा जास्त मिळतो परिणामी दूध आणि दुधातील फ्याटचे प्रमाण वाढते.

बायपास फ्याटची तयारी :

वनस्पतीजन्य फ्याटी ॲसिड व कॅल्शियम क्षारापासून (कॅल्शियम ओक्साईड) रासायनिक प्रक्रिया करुन बायपास फ्याटची तयारी केली जाते.

बायपास फ्याट मिश्रण जनावरांना देण्याचा योग्य वेळ:

दुधाळ जनावरे विल्या पासून पुढील तीन महिन्यापर्यंत (0-90 दिवस) बायपास फ्याट मिश्रण दिल्यास दूध वाढीवर चांगला परिणाम दिसून येते. या कालावधीनंतर (90- 150 दिवस) बायपास फ्याट मिश्रण दिल्यास दूध वाढीवर परिणाम थोडासा कमी दिसून येते.

बऱ्याच शेतकऱ्याकडे एच. एफ. संकरीत गायी आहेत ज्यांचे दूध उत्पादन जास्त परंतु फ्याटचे प्रमाण दुधात अल्प (3.5 %) असते यामुळे शेतकऱ्यांना हवे तसे मिळकत मिळत नाही परंतु संशोधनात असे सिद्ध झाले की या जातीच्या गायीमध्ये बायपास फ्याट दररोज योग्य प्रमाणात दिल्यास ईतर गायींच्या तुलनेत दूधवाढीच्या व दुधातील फ्याटच्या प्रमाणात अधिक वाढ दिसून आलेले आहे.

बायपास फ्याट मिश्रण जनावरांना देण्याचा योग्य प्रमाण :

दुधाळ जनावरांना सुमारे एक किलो दुधामागे दररोज 15 - 20 ग्रॅम बायपास फ्याट मिश्रण द्यावे लागते.जर आपले जनावर दररोज 10 लिटर दूध देत असेल तर 150 - 200 ग्रॅम बायपास फ्याट मिश्रण खायला द्यावे .

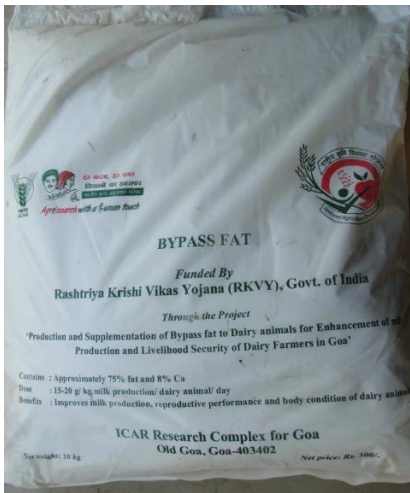
साधारणता जनावरे विण्याच्या पूर्वी 15 दिवसापासून ते विल्यानंतर पाच महिन्यांच्या कालावधीमध्ये बायपास फ्याट मिश्रण खावू घालावे.

बायपास फ्याट मिश्रण खावू घालण्याची पद्धत :

बायपास फ्याट मिश्रण जनावरांना योग्य प्रमाणात खाद्य / पेंढ मध्ये मिसळून द्यावे. बायपास फ्याट मिश्रणाची लागणारी मात्रा दिवसातून एक वेळेस किंवा दिवसातून दोन वेळेस अर्धे अर्धे या प्रमाणात द्यावे.

बायपास फ्याट मिश्रण खावू घालण्याचे फायदे :

1. जनावरांना दररोज बायपास फ्याट मिश्रण खावू घातल्यास त्यांना ऊर्जेची कमतरता भासत नाही.
2. दुधाळ जनावरांना दररोज बायपास फ्याट मिश्रण खावू घातल्यास दुग्धोत्पादनात 15-20 % वाढ दिसू शकते, म्हणजेच दहा लिटर दूध देणारी गाय 11.5 ते 12 लिटर पर्यंत दूध देवू शकते.
3. दुधातील फ्याटचे प्रमाण 0.5 ते 1 % वाढू शकते.
4. उच्चतम दूध देण्याचा कालावधी (पीक मिल्क इल्ड) व एकूणच दूध देण्याचा कालावधी या मध्ये वाढ दिसून येवू शकते.
5. जनावरांचे प्रजोत्पादन नियमित होते जसे की जनावरे वेळेवर माजावर येतात व जनावरातील गाभण राहण्याची प्रक्रिया आणि विण्याची प्रक्रिया सुरळीत पार पडते.
6. विल्यानंतर दुधाळ जनावरांच्या वजनामध्ये घट होण्याचा क्रम कमी होवू शकते.
7. एकंदरीत जनावरांचे स्वास्थ्य सुधारते.
8. हवामानातील बदलाचा दूषपरिणाम अशा जनावरावर कमी दिसून येतो.



Chapter - 8

Enrichment of poor quality roughages with urea

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Introduction :

Poor quality roughages like straws and stovers are generally burned or decomposed in the field itself but this can be very well utilised like a filler material for low producing animals. These low quality roughages can be enriched with urea treatment.

Procedure:

The poor quality roughages like paddy straw, jowar straw or mature grasses are treated with urea water (4 kg urea + 40 litre water) and moisture level is kept 40 % , which is then stored in airtight condition for a period of 21 days till residual ammonia is removed.

Advantages :

The urea treatment breaks the lignocellulose complex and also add nitrogen to the fodder thereby increases its protein value.

Precautions :

The treated straws will be fed after the exposure of air for atleast 10 mins. Uniform spraying of urea water on straws is needed.

Chapter - 9

SILAGE MAKING (BAG METHOD)

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Introduction :

Green fodder is an essential feed component of dairy animals which regulates production and reproduction. Many a times there is scarcity of green fodder and it affects the reproduction as well as increases the cost of production as we have to compensate by concentrates. Therefore it is recommended to store the green fodder in flush season by making silage. Silage making is the controlled fermentation of green fodders followed by storage in airtight condition. Silage can be prepared from cereal fodder crops like jowar , maize and also from grasses as well as legume fodders .

Procedure:

Harvest the crop at pre flowering stage. Dry the fodder till moisture content is reduced to about 65% and chaff it. Fill up the chaffed fodder compactly and uniformly in the inner polythene bag. Trample the mass in inner bag manually and finally close the inner polythene bag to maintain anaerobic conditions inside. Finally close the outer thick polythene bag. After 4-6 weeks silage is ready for feeding.

Advantages :

Silage provides good quality fodder to livestock round the year. Its nutritious value is nearly same as like green fodder. It is palatable and can be prepared in any season Silage can be stored safely for about 1 year without any major change in its nutritive value.

Precautions :

Container should be 100% air tight. If mould / fungus growth is observed after opening the container (after 4-6 weeks), that silage should not fed to the animals.

Note: A bag of this can be prepared using polyethylene sheet or we can also procure it from commercial firms like : Suyog Suppliers, Julewadi , Sangali Dist, Maharashtra. Chaffing of green fodder to 2-3 cm size, filling of chaffed fodder inside the inner polythene bag.

Steps involved in Enriching of poor quality roughages with urea



Step 1. Weighing of urea and paddy straw.



Step 2. Preparation of urea water.



Step 3. Spreading of polythene sheet on ground and putting of paddy straw on the polythene sheet.



Step 4. Sprinkling of 4% urea water on paddy straw heap.



Step 5. Stamping treated paddy straw heap.



Step 6. Complete closure of treated straw in polythene sheet for 21 days.

Steps involved in making silages

	
Stage 1 . Chaffing of green fodder	Stage 2. chaffed green fodder (2-3 cm)
	
Stage 3. pressing of Green fodder to make airtight condition inside the silage bag	Stage 4. completely filled silage bag
	
Stage 5. packaing of internal polythene bag to make airtight condition of silage bag	Stage 6. completely filled silage bag (chaffed green fodder filled and packed in air tight condition)

Chapter - 10

Reproductive management in dairy animals

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Optimal reproductive efficiency is very important for profitable and sustainable farm animal production. Maximum fertility is achieved when well-managed and reproductively healthy female animals are bred with good-quality semen inseminated at the appropriate time and place. The reproductive efficiency is a complex phenomenon controlled by both genetic and non-genetic factors, the non-genetic factors being climate, nutrition, and level of management. The reproductive efficiency varies not only between species and breeds but also among the animals within the same breed. Important reproductive characteristics of cattle and buffalo reared under sub-tropical climate are listed the Table below:

Table 1: Reproductive characteristics of cattle and buffaloes

	Parameter	Cattle (Range)	Buffalo (Range)
1	Age at puberty (months)	15(12-24)	21(15-36)
2	Estrus cycle length (days)	21(14-29)	21 (18-22)
3	Estrus/heat signs duration (hours)	20 (12-30)	21 (17-24)
4	Gestation length (days)	284 (278-293)	310 (305-330)
5	Age at first calving (months)	32 (24-38)	42 (36-58)
6	Calving intervals (months)	13 (12-14)	18 (15-21)

Scientific management and rearing, including judicious application of reproductive techniques, genetic selection and nutrition, are key to good reproductive performance in farm animals. Standard reproductive management involves timely treatment of important reproductive disorders along with successful implementation of scientific breeding practices in the breeding herd.

Infertility in farm animals accounts for major economic losses in dairy farming and dairy industry in India. Infertility is the inability of an animal to reproduce successfully by natural means. Maintaining an infertile animal is an economic loss to the farmer and farming enterprises. The causes of infertility are many and can be complex. Failure to conceive and give birth to a viable young one can be due to malnutrition, infections, congenital defects, management errors and ovulatory or hormonal imbalances in the female. To attain good fertility or high calving rate, both the male and female animals should be well-fed and free from major diseases.

Estrus or heat period is the period of sexual receptivity of female to an active male. Poor heat deduction can cause increased levels of infertility. Considerable skill and awareness is needed to deduct the animals in heat for visible signs. Farmers who maintain good records and spend more time watching the animals obtain better results. Also, in buffaloes, the estrus or heat period is often silent posing a big problem to the farmers to detect the heat. The farmers should closely monitor the animals at least twice a day from early morning to late night. Estrus can be detected by closely observing some important signs in female animals which are listed below:

- Standing to be mounted, attempt to mount other females, increased activity
- Swelling and reddening of the vulva
- Stringy and clear mucus/discharge hanging from vulva
- Frequent bellowing, frequent urination and tail raising
- Drop in milk yield and reduced feed intake

Dairy animals with body weight below 250 kg are not suitable for breeding/A.I.. If heat signs are observed in morning, breed the animal same day at evening. If signs are observed in evening, then breed the animal on next day morning. Animals that do not show estrus or do not come to cycle should be promptly checked and treated. Deworming once in six months should be done for worm infestations to maintain the optimal health status of the animals. Cattle and buffaloes should be fed with a well-balanced diet with energy, protein, minerals and vitamin supplements. This helps in increased conception rate, healthy pregnancy, safe parturition, low incidence of infections and a healthy calf. Feeding adequate quantity of green fodder during pregnancy will avoid blindness in newborn calves and retention of placenta (after birth). Sufficient green fodder, mineral vitamin supplementation and correction of negative energy balance improve fertility. Additional feed allowance and mineral supplementation during last trimester of pregnancy and peak of lactation i.e. steaming up is advised to get a healthy calf and consistent yield.

Also, care of young female calves with good nutrition helps them to attain puberty in time with an optimum body weight of around 250 kg, suitable for breeding and thereby better conception. Maintaining good hygienic environment in and around the farm is also critical part of good farming practice. Infections of the uterus can be largely avoided by having animals bred/mated under hygienic conditions. In natural service, checking the pedigree and breeding history of the breeding bull is very important to avoid inbreeding, congenital defects and infections.

Breeding can be started within three to four months after calving to achieve the goal of one calf per year for economic and profitable dairy farming. Timely diagnosis of pregnancy status is another important aspect for standard reproductive management. After 60-90 days of insemination or natural service, the animals should be checked for pregnancy by qualified veterinarians. Early detection of pregnant animals can ensure timely and adequate care to those animals for successfully delivering healthy calf and can help in identifying non-pregnant females and get them timely treated and crossed.

The pregnant animal should be housed in separate calving pen away from the general herd for better feeding management and parturition care. Pregnant animals should be drained of their milk two months before delivery and given adequate nutrition and exercise. This helps in improving the health of the mother, delivery of a healthy calf with average birth weight, low incidence of diseases and early return of sexual cycle. Pregnant animals should be provided with extra ration/feed to meet the requirement of fast growing fetus as well as store energy for future lactation. Adequate bedding materials should be provided in the shed and floor of the pregnant animal shed should be non-slippery. In advance stage of pregnancy laxative diet should be provided. Unwarranted stress and transportation should be avoided during the last stages of pregnancy.

Calving difficulty (dystocia) is directly associated with a decreased number of calves weaned, due to increased calf and cow mortality. Furthermore, dystocia also has an indirect role in many cases of calf mortality attributed to infectious disease, and in the dam, it suppresses reproductive performance (prolongs the postpartum interval and reduces the conception rate). Farmers should carefully consider all factors like nutrition, climate, selection of sire etc. that influence birth weight to reduce calving difficulties, particularly for first-calf heifers. Nutritional management during pregnancy may affect the incidence of dystocia which increases as cows tend to be weaker. Warmer environments and forced exercise reduce the incidence of dystocia in confinement-raised or stall-fed heifers.

Anestrus or failure to show signs of estrus is an important reproductive disorder. Important reasons include genetic causes, failure to detect oestrus signs, subestrus, weak or silent oestrus, low plane of nutrition- lack of energy and protein, deficiency of minerals, Anoestrus can also be due to uterine pathology such as pyometra, mummified foetus, foetal maceration, mucometra and hydrometra and insufficient hormonal stimuli. Silent, weak or subestrus are most common in buffaloes and requires rectal examination and treatment by qualified veterinary doctor. For satisfactory expression of heat, animals must have adequate space to allow animal-to-animal interaction. For anestrus due to weak body condition, deworming should be carried out and extra feeding of concentrate mixture or grains with adequate amount of green fodder and other roughages, mineral mixture should be properly supplemented. Anestrus cases involving uterine pathology and hormonal stimuli should be handled by qualified veterinary practitioner.

Artificial Insemination (A.I.) is one of the most important reproductive management tool ever devised for the genetic improvement of animals. It is a process of collecting semen from a healthy male animal, processing and depositing it into the reproductive tract of a receptive female animal manually with the help of AI gun or catheter. Both collection and insemination are accomplished through artificial means. The technique of Artificial Insemination (A.I) is a skill requiring adequate knowledge, field experience and patience. Improper AI techniques can negate all other efforts to obtain conception. Good quality semen must be deposited within the reproductive tract of the receptive female at the best location and at the best time to obtain acceptable conception rates. There are several advantages of A.I., the most important are listed below:

1. Rapid genetic gain through extensive use of semen from genetically superior bulls
2. Widespread use of superior male germplasm to produce genetically upgraded progenies/calves
3. Minimizes the spread of sexually transmitted diseases
4. A.I. make selective breeding easier as semen from a proven bull can be easily transported to distant places and can be used for insemination on a large scale
5. Eliminates the cost of maintenance of breeding bull & breeding cost, mating of animals of different sizes is possible through A.I

Recto-vaginal technique is the most widely used AI method. In this method, a sterile, disposable catheter containing thawed semen is inserted into the vagina and then guided into the cervix by means of a gloved hand in the rectum. Part of the semen is deposited just inside the uterus and the remainder in the cervix as the catheter is withdrawn. Critical steps in the AI process include preparation and loading of AI gun, thawing of semen straws and insemination of thawed semen in the reproductive tract.

Maximal conception is obtained when cows are inseminated between mid-estrus and the end of standing estrus, with good results up to 6 hours after estrus. AI success rate is lower when cows are bred prior to mid estrus or later than 6 hours after end of estrus. A successful heat detection program and subsequent proper timing of insemination will pay dividends in increasing reproductive efficiency.

Table 2: A practical recommendation for timing of insemination

Animals showing estrus	Should be inseminated	Too late for good results
In morning	Same day evening	Next day
In afternoon	Next day morning or early afternoon	Next day afternoon

In brief, reproductive performance and efficiency in dairy farm animals can be improved by the following important management options:

1. Proper identification, keeping of accurate breeding records of service, parturition etc.
2. Meeting the adequate nutritional requirements of the breeding herd
3. Regular heat detection (at least-twice daily in frequency)
4. Proper method and timing of A.I. for animals observed in estrus
5. Timely consultation and treatment of females with abnormal discharges, repeat cases
6. Routine pregnancy checkup during 45 days to 60 days after mating/A.I.
7. Provide suitable shelter management especially during extreme climate
8. Maintaining a hygienic environment in and around the farm
9. Proper herd health practices involving deworming and vaccinations

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Chapter - 11

Heat symptoms and importance of identification of Heat/ oestrous in dairy cattle

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Heat or oestrous is a period of powerful sexual desire or interest shown by cow or buffalo. Identification of heat is an art and after identification of heat, animals should be crossed either with elite bull or desirable semen by using artificial insemination technique in correct time. So, every farmer and farm woman should know the symptoms of heat in dairy animals. Once the correct time of service is missed by the owner he has to wait till next 21 days. Again average dairy animals come in heat on 21st day. This period of twenty one days cycle is called oestrus cycle. One heat cycle loss causes huge economic losses to the dairy farmer (i.e. 4000 to 10000/- per month) in the form of expenditure on feed, fodder and losses in the form of milk.

In the field conditions, due to mismatch in the timings of actual starting of heat in animals and insemination results in low conception whereas in natural crossing with scientific breeding practices, conception percentage is high. Generally if animal starts showing symptoms in the morning, it is advisable to do insemination in the evening or vice versa.

Majority of the dairy animals show heat symptoms in the night and many farmers don't go inside the shed in the night to watch their animals. Generally in the morning if he has noticed the symptoms of heat, then he immediately calls the Veterinary doctor or AI worker for insemination. As per the thumb rule, AI worker will come in the evening on the basis of history provided by farmer that his animal was started showing symptoms in the morning. In such cases, animals will not become pregnant due to delay in timing of insemination hence farmer should always take one round around his animals by 10PM to 11 PM .During this period, most of the animals may sit down and it will be easy to see the heat discharges coming from genital tract. Then one AI is required in the morning and if that animal shows still symptoms then he can go for another insemination in the evening of same day.

Phases and stages of oestrous cycle:

There are two phases and four stages of oestrus cycle i.e. Follicular phase which contains two stage like prooestrus and actual oestrous . Second phase is luteal phase which contains two stages i.e . Metestrus and Dioestrus

1. Proestrus: This stage usually lasts for 2 to 3 days and this is starting phase of oestrus. Animal remains under the control of oestrogen hormone and follicle grow on ovary. The uterus become slight turgid or tonic .There is gradual relaxation of cervix and increased secretion of mucous from cervix and vagina. Vulva becomes swollen and after opening of vulval lips , one can see reddening of vaginal mucous membrane.
2. Oestrous: This is the actual period of sexual desire and acceptance of bull. The duration of this phase is 24 hours in the cattle. Mature Graffian follicle form on ovary and there is high

level of oestrogen in blood .The animal exhibits signs of heat .The cervix is relaxed and uterus become erect and turgid. The vaginal mucous membrane becomes dark red. The vulva become more swollen and turgid and copious , clear , shiny and sticky vaginal discharge oozes from the vulva.

3. Metestrus: This phase comes after actual oestrus and lasts for 2-3 days. In this stage there is cessation of all visible changes of heat. The matured graffian follicle on ovary ruptures and ovulation takes place during this phase. The ruptured follicle get replaced by small, soft, developing corpus luteum which secretes a pregnancy maintenance hormone i.e. progesterone. The uterus becomes soft and pliable towards the end and cervix gradually closes. The vaginal mucous membrane becomes pale and vulva becomes normal. In some cows we can notice slight bleeding which is a normal phenomenon.

4. Dioestrous: This phase lasts for 15 days. Corpus luteum fully develops on the ovary. The uterus appears soft and pliable. In successful pregnancy, uterus secretes viscid fluid called uterine milk for the nourishment of zygote. The cervix remains constricted or closed. The vaginal mucous membrane and vulva remains normal. Outcome of this phase will be either animal become pregnant or she will come in heat in next 21 days.

Heat /Oestrus symptoms in dairy animals:

1. Animals become restless, nervous, excited and remain isolated from the herd.
2. Their rumination, feed and water intake reduces.
3. Milk yield drops down during this phase.
4. Animal try to mount on other animal or stands calm when mounted by other animal.
5. Vulva becomes swollen and congested.
6. Transparent, thick, sticky, shiny discharge comes from the vulva and sticks on buttocks, tail and backside of the animal.
7. Animal try to lick other animals.
8. Many animals urinate frequently with raised tail
9. We can observe peculiar movements of back.

Correct time of Insemination: The dairy animals should be inseminated from the middle to the end of oestrous. The cows which found in heat in the morning are inseminated in the evening of the same day and those found in oestrus later in the day are bred in the next morning.



Chapter - 12

गाईतील गाभणकाळाचा तक्ता

Gestational table of cattle

डॉ. संजयकुमार विठ्ठलराव उद्धरवार , विषय तज्ञ (पशूविज्ञान)

आय.सी.ए.आर. - कृषि विज्ञान केंद्र, उत्तर गोवा, आय.सी.ए.आर.- सी.सी.ए.आर.आय., जुने गोवे, गोवा

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दुग्धव्यवसाय फायदेशीर राहावा यासाठी योग्य गायींची निवड, शास्त्रीय पद्धतीत गोठा व्यवस्थापन , संतुलित आहार तसेच योग्य प्रजनन फारच गरजेचे आहे. चांगल्या व्यवस्थापनात गायी वेळेवर माजावर येतात . माजावर आल्यानंतर लगेचच जवळच्या तज्ञ पशूचिकित्सकांना किंवा कृत्रिम गर्भधारणा करणाऱ्या कुशल कर्मचाऱ्याला बोलावून गायी योग्य वेळेत योग्य वीर्यमात्रा वापरून भरवून घेतल्या पाहिजे. शेतकऱ्यांनी खालील दिलेल्या गाईतील गाभणकाळाचा तक्ता दैनंदिन वापरात आणल्यास त्यांना फार फायदा होईल जेणेकरून त्यांना गाय कधी भरवली व गाय कधी विणार हे समजेल आणि त्यानुसार तो गायीची काळजी घेईल व व्यवस्थापनात योग्य बदल करेल.

Record keeping plays central role in dairy farming .Heat detection is very important job of the dairy farmer. After the detection of heat he has to call a Veterinary doctor or AI worker in time for artificial insemination. On the basis of following gestation table, farmer can easily get an idea regarding expected date of calving and in future he will be ready for the calving and its management.

DOS – Date of Service / गाय भरवल्याची तारीख

DOEC – Date of Expected Calving / गाय विण्याची तारीख

DOS	DOEC	DOS	DOEC	DOS	DOEC	DOS	DOEC	DOS	DOEC	DOS	DOEC
Jan-01	Oct-10	Feb-01	Nov-11	Mar-01	Dec-08	Apr-01	Jan-08	May-01	Feb-07	Jun-01	Mar-10
Jan-02	Oct-11	Feb-02	Nov-12	Mar-02	Dec-09	Apr-02	Jan-09	May-02	Feb-08	Jun-02	Mar-11
Jan-03	Oct-12	Feb-03	Nov-13	Mar-03	Dec-10	Apr-03	Jan-10	May-03	Feb-09	Jun-03	Mar-12
Jan-04	Oct-13	Feb-04	Nov-14	Mar-04	Dec-11	Apr-04	Jan-11	May-04	Feb-10	Jun-04	Mar-13
Jan-05	Oct-14	Feb-05	Nov-15	Mar-05	Dec-12	Apr-05	Jan-12	May-05	Feb-11	Jun-05	Mar-14
Jan-06	Oct-15	Feb-06	Nov-16	Mar-06	Dec-13	Apr-06	Jan-13	May-06	Feb-12	Jun-06	Mar-15
Jan-07	Oct-16	Feb-07	Nov-17	Mar-07	Dec-14	Apr-07	Jan-14	May-07	Feb-13	Jun-07	Mar-16
Jan-08	Oct-17	Feb-08	Nov-18	Mar-08	Dec-15	Apr-08	Jan-15	May-08	Feb-14	Jun-08	Mar-17
Jan-09	Oct-18	Feb-09	Nov-19	Mar-09	Dec-16	Apr-09	Jan-16	May-09	Feb-15	Jun-09	Mar-18
Jan-10	Oct-19	Feb-10	Nov-20	Mar-10	Dec-17	Apr-10	Jan-17	May-10	Feb-16	Jun-10	Mar-19
Jan-11	Oct-20	Feb-11	Nov-21	Mar-11	Dec-18	Apr-11	Jan-18	May-11	Feb-17	Jun-11	Mar-20
Jan-12	Oct-21	Feb-12	Nov-22	Mar-12	Dec-19	Apr-12	Jan-19	May-12	Feb-18	Jun-12	Mar-21
Jan-13	Oct-22	Feb-13	Nov-23	Mar-13	Dec-20	Apr-13	Jan-20	May-13	Feb-19	Jun-13	Mar-22
Jan-14	Oct-23	Feb-14	Nov-24	Mar-14	Dec-21	Apr-14	Jan-21	May-14	Feb-20	Jun-14	Mar-23
Jan-15	Oct-24	Feb-15	Nov-25	Mar-15	Dec-22	Apr-15	Jan-22	May-15	Feb-21	Jun-15	Mar-24
Jan-16	Oct-25	Feb-16	Nov-26	Mar-16	Dec-23	Apr-16	Jan-23	May-16	Feb-22	Jun-16	Mar-25
Jan-17	Oct-26	Feb-17	Nov-27	Mar-17	Dec-24	Apr-17	Jan-24	May-17	Feb-23	Jun-17	Mar-26
Jan-18	Oct-27	Feb-18	Nov-28	Mar-18	Dec-25	Apr-18	Jan-25	May-18	Feb-24	Jun-18	Mar-27
Jan-19	Oct-28	Feb-19	Nov-29	Mar-19	Dec-26	Apr-19	Jan-26	May-19	Feb-25	Jun-19	Mar-28
Jan-20	Oct-29	Feb-20	Nov-30	Mar-20	Dec-27	Apr-20	Jan-27	May-20	Feb-26	Jun-20	Mar-29
Jan-21	Oct-30	Feb-21	Nov-31	Mar-21	Dec-28	Apr-21	Jan-28	May-21	Feb-27	Jun-21	Mar-30
Jan-22	Nov-01	Feb-22	Dec-01	Mar-22	Dec-29	Apr-22	Jan-29	May-22	Feb-28	Jun-22	Mar-31
Jan-23	Nov-02	Feb-23	Dec-02	Mar-23	Dec-30	Apr-23	Jan-30	May-23	Mar-01	Jun-23	Apr-01
Jan-24	Nov-03	Feb-24	Dec-03	Mar-24	Dec-31	Apr-24	Jan-31	May-24	Mar-02	Jun-24	Apr-02
Jan-25	Nov-04	Feb-25	Dec-04	Mar-25	Jan-01	Apr-25	Feb-01	May-25	Mar-03	Jun-25	Apr-03
Jan-26	Nov-05	Feb-26	Dec-05	Mar-26	Jan-02	Apr-26	Feb-02	May-26	Mar-04	Jun-26	Apr-04
Jan-27	Nov-06	Feb-27	Dec-06	Mar-27	Jan-03	Apr-27	Feb-03	May-27	Mar-05	Jun-27	Apr-05
Jan-28	Nov-07	Feb-28	Dec-07	Mar-28	Jan-04	Apr-28	Feb-04	May-28	Mar-06	Jun-28	Apr-06
Jan-29	Nov-08			Mar-29	Jan-05	Apr-29	Feb-05	May-29	Mar-07	Jun-29	Apr-07
Jan-30	Nov-09			Mar-30	Jan-06	Apr-30	Feb-06	May-30	Mar-08	Jun-30	Apr-08
Jan-31	Nov-10			Mar-31	Jan-07			May-31	Mar-09		

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DOS	DOEC	DOS	DOEC	DOS	DOEC	DOS	DOEC	DOS	DOEC	DOS	DOEC
Jul-01	Apr-09	Aug-01	May-10	Sep-01	Jun-10	Oct-01	Jul-10	Nov-01	Aug-10	Dec-01	Sep-09
Jul-02	Apr-10	Aug-02	May-11	Sep-02	Jun-11	Oct-02	Jul-11	Nov-02	Aug-11	Dec-02	Sep-10
Jul-03	Apr-11	Aug-03	May-12	Sep-03	Jun-12	Oct-03	Jul-12	Nov-03	Aug-12	Dec-03	Sep-11
Jul-04	Apr-12	Aug-04	May-13	Sep-04	Jun-13	Oct-04	Jul-13	Nov-04	Aug-13	Dec-04	Sep-12
Jul-05	Apr-13	Aug-05	May-14	Sep-05	Jun-14	Oct-05	Jul-14	Nov-05	Aug-14	Dec-05	Sep-13
Jul-06	Apr-14	Aug-06	May-15	Sep-06	Jun-15	Oct-06	Jul-15	Nov-06	Aug-15	Dec-06	Sep-14
Jul-07	Apr-15	Aug-07	May-16	Sep-07	Jun-16	Oct-07	Jul-16	Nov-07	Aug-16	Dec-07	Sep-15
Jul-08	Apr-16	Aug-08	May-17	Sep-08	Jun-17	Oct-08	Jul-17	Nov-08	Aug-17	Dec-08	Sep-16
Jul-09	Apr-17	Aug-09	May-18	Sep-09	Jun-18	Oct-09	Jul-18	Nov-09	Aug-18	Dec-09	Sep-17
Jul-10	Apr-18	Aug-10	May-19	Sep-10	Jun-19	Oct-10	Jul-19	Nov-10	Aug-19	Dec-10	Sep-18
Jul-11	Apr-19	Aug-11	May-20	Sep-11	Jun-20	Oct-11	Jul-20	Nov-11	Aug-20	Dec-11	Sep-19
Jul-12	Apr-20	Aug-12	May-21	Sep-12	Jun-21	Oct-12	Jul-21	Nov-12	Aug-21	Dec-12	Sep-20
Jul-13	Apr-21	Aug-13	May-22	Sep-13	Jun-22	Oct-13	Jul-22	Nov-13	Aug-22	Dec-13	Sep-21
Jul-14	Apr-22	Aug-14	May-23	Sep-14	Jun-23	Oct-14	Jul-23	Nov-14	Aug-23	Dec-14	Sep-22
Jul-15	Apr-23	Aug-15	May-24	Sep-15	Jun-24	Oct-15	Jul-24	Nov-15	Aug-24	Dec-15	Sep-23
Jul-16	Apr-24	Aug-16	May-25	Sep-16	Jun-25	Oct-16	Jul-25	Nov-16	Aug-25	Dec-16	Sep-24
Jul-17	Apr-25	Aug-17	May-26	Sep-17	Jun-26	Oct-17	Jul-26	Nov-17	Aug-26	Dec-17	Sep-25
Jul-18	Apr-26	Aug-18	May-27	Sep-18	Jun-27	Oct-18	Jul-27	Nov-18	Aug-27	Dec-18	Sep-26
Jul-19	Apr-27	Aug-19	May-28	Sep-19	Jun-28	Oct-19	Jul-28	Nov-19	Aug-28	Dec-19	Sep-27
Jul-20	Apr-28	Aug-20	May-29	Sep-20	Jun-29	Oct-20	Jul-29	Nov-20	Aug-29	Dec-20	Sep-28
Jul-21	Apr-29	Aug-21	May-30	Sep-21	Jun-30	Oct-21	Jul-30	Nov-21	Aug-30	Dec-21	Sep-29
Jul-22	Apr-30	Aug-22	May-31	Sep-22	Jul-01	Oct-22	Jul-31	Nov-22	Aug-31	Dec-22	Sep-30
Jul-23	May-01	Aug-23	Jun-01	Sep-23	Jul-02	Oct-23	Aug-01	Nov-23	Sep-01	Dec-23	Oct-01
Jul-24	May-02	Aug-24	Jun-02	Sep-24	Jul-03	Oct-24	Aug-02	Nov-24	Sep-02	Dec-24	Oct-02
Jul-25	May-03	Aug-25	Jun-03	Sep-25	Jul-04	Oct-25	Aug-03	Nov-25	Sep-03	Dec-25	Oct-03
Jul-26	May-04	Aug-26	Jun-04	Sep-26	Jul-05	Oct-26	Aug-04	Nov-26	Sep-04	Dec-26	Oct-04
Jul-27	May-05	Aug-27	Jun-05	Sep-27	Jul-06	Oct-27	Aug-05	Nov-27	Sep-05	Dec-27	Oct-05
Jul-28	May-06	Aug-28	Jun-06	Sep-28	Jul-07	Oct-28	Aug-06	Nov-28	Sep-06	Dec-28	Oct-06
Jul-29	May-07	Aug-29	Jun-07	Sep-29	Jul-08	Oct-29	Aug-07	Nov-29	Sep-07	Dec-29	Oct-07
Jul-30	May-08	Aug-30	Jun-08	Sep-30	Jul-09	Oct-30	Aug-08	Nov-30	Sep-08	Dec-30	Oct-08
Jul-31	May-09	Aug-31	Jun-09			Oct-31	Aug-09			Dec-31	Oct-09

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Chapter - 13

Identification of Healthy and diseased animals

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To prevent herd from disease outbreak or to identify diseased animal and separation of such animals from rest of the healthy animals, every farmer should have basic knowledge of identification of healthy and diseased animal. Following table helps to every farmer in identification of diseased animal.

Parameter	Healthy	Diseased
Appetite	Normal	Reduced / absent
Water intake	Normal	Usually reduced
Milk yield	Normal	Decreased
Rumination	More frequently	Less frequent or stops
Body condition	Normal	Most emaciated ie weak
Look of the animal	Active	Dull
Gait	Move feely with ease	Move slowly @ with difficulty
Head	Forward and raised	Downwards
Eyes	Bright , wet, wide open	Dull, dry or profuse lacrimation , partially or completely closed
Ears	Erect and move frequently	Drooping & move less frequently
Mouth	Wet and without odour	Dry or profuse salivation & usually bad odour
Nose	No discharge	May be some discharge
Muzzle	moist	Dry
Skin / hair coat	Smooth & glossy	Rough and dull
Dung	semisolid	Hard or loose
Urine	Slightly yellowish	Dark yellow, coffee coloured or pinkish
Tail movement	Quite frequently	Less frequently
Temp	Normal (101.6F)	Mostly increased
Respiration	Normal	Increased
Pulse rate	normal	Increased

Chapter - 14

Important diseases of cattle and preventive measures

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India is endemic to many diseases that cause severe economic losses due to drastic reduction in the production capacity . Some of the diseases are even highly fatal. Fortunately, vaccines are available for most of these diseases in our country and can be easily controlled if timely vaccination is carried out in a mass scale, covering a large proportion of the susceptible population (at least 80%). Following are some of the important diseases which can be prevented by vaccination.

A. Foot and mouth disease (FMD)

A highly contagious viral disease & spreads through contact, contaminated water, feed and air. Disease is rarely fatal for adults, however the milk production, fertility in females and draft power of males are severely impaired for life after recovery from disease. Usually fatal in calves. Also affects sheep, goat (usually sub-clinically and are maintenance hosts) and pigs, which are amplification hosts (multiplies the virus around 3000 fold).

Symptoms

- Drastic drop in milk production and working capacity (draft animals).
- Fever and serous nasal discharge and excessive salivation.
- Vesicles may be seen on tongue, dental pad, lips, gums etc.
- Vesicle in inter-digital cleft may lead to lameness.
- Lesions on teat may lead to mastitis.
- Loss in condition may persist even after recovery.

Prevention

Get your animals aged 4 months and above vaccinated once in 6 months. Infected animals should be immediately separated since all excretions and secretions from infected animals contain the virus. All feed and fodder in contact with the infected animal should be destroyed. All equipment used should be cleaned and disinfected with 4% sodium carbonate solution or as suggested by a veterinarian.

Healthy animals should not be handled by persons in contact with infected animals. The infected premises should be disinfected with 4% sodium carbonate solution or with the disinfectant suggested by a veterinarian. Vaccinating sheep, goat and pigs would control the disease to a better extent. Informing authorities promptly would enable them to initiate control measures at the earliest which will help in limiting the spread of the disease.

Management of FMD

Treatment is only symptomatic; the disease will run its course. Emollients may be applied on lesions to soothe pain. Contact veterinarian for suitable advice

B. Haemorrhagic Septicaemia:

This is an acute bacterial disease of cattle and buffaloes which usually occurs during monsoon. Mortality rate may be as high as 80 %. Germs of this disease survive longer in humid and waterlogged conditions.

Symptoms

- High temperature, sudden decrease in milk yield.
- Salivation and serous nasal discharge.
- Severe oedema of the throat region.
- Difficulty in breathing, animal produces a grunting sound.
- Animal usually dies within 1-2 days of showing symptoms.
- Buffaloes are generally more susceptible than cattle.
- Animals with clinical signs, particularly buffalo, rarely recover.
- In endemic areas, most deaths seen in older calves and young adults.

Prevention

- Segregate the sick animal from healthy ones and avoid contamination of feed, fodder and water.
- Avoid crowding especially during wet seasons.
- Vaccinate all animals which are 6 months and above of age annually before the onset of monsoon in endemic areas.

Treatment

- Treatment is usually ineffective unless treated very early, that is during the stage when fever sets in.
- Few animals survive once clinical signs develop.
- Case fatality approaches 100% if treatment is not followed at the initial stage of infection.

C. Black Quarter :

An acute disease of cattle characterized by emphysematous swelling usually in heavy muscles. Buffaloes usually suffer from a milder form. Contaminated pasture appears to be major source of infection. Healthy animals in the age group 6 months to 2 years are generally affected.

Symptoms

- Sudden high fever (107°F-108°F) and the animal stops eating and ruminating.
- Characteristic hot and painful swelling develops on loin and buttocks causing lameness.
- Swelling sometimes affects shoulders, chest and neck also.
- When pressed, a crackling sound is heard because of the gas accumulation in the swellings.
- Animal dies within 24-48 hrs of appearance of symptoms. At this juncture, swellings become cold and painless.

Prevention

Vaccinate all animals which are 6 months and above of age annually before the onset of monsoon in endemic areas. Burning the upper layer of soil with straw to eliminate spores may be of help in endemic areas. Sprinkle lime over carcass at the time of burial.

Treatment

Treatment may be effective in initial stages of infection. However in most cases treatment is not worth the while.

D. Brucellosis:

- An important bacterial disease of cattle and buffalo.
- Leads to loss in milk production, loss of calf, birth of weak or diseased calf ,repeat breeding and even mastitis.
- Humans may also get the disease from consumption of raw milk of infected animal or contact with uterine discharges.
- The disease is very much prevalent in India, both in humans and animals.

Symptoms :

- Abortion occurs typically after 5th month of pregnancy.
- In an infected animal, chances of abortion reduces with number of calvings.
- No abortions may be observed after 4th calving, but dam and calf remain infected.
- Placental retention may lead to infection and even death of the animal.

Prevention:

- Vaccinate female calves (not male calves) between 4-8 months of age.
- Only one vaccination is required in its lifetime to protect it from brucellosis.
- Any abortion from 5th month onwards should be suspected for brucellosis.
- Ideally such animals should be culled. If culling is not possible, isolate the animal immediately for a minimum of 20 days after calving/abortion.
- The aborted foetus, placenta, contaminated bedding, feed etc, should be buried (at least 4 feet deep) after a liberal sprinkling of lime. These materials contain very high bacterial loads and if disposed improperly cause the spread of disease by contaminating food sources (pasture, feed, water etc).
- Disinfect the shed after isolating the aborted animal.
- When the animal is in isolation, disinfect the lochial discharges (which also contain high bacterial loads) daily with 1-2% NaOH or 5% sodium hypochlorite (bleach) solution till the discharges cease (usually by 10 –15 days).
- Do not handle infected material with bare hands since the disease is zoonotic.

Treatment:

- There is no effective treatment once the animal is infected since the bacteria remains in the body of the animal. Consult a veterinarian in case of suspicion.
- Disease in humans is curable provided proper treatment regimen is followed.

E. Rabies :

- A highly fatal viral disease mainly transmitted by bite of a rabid dog.
- Humans can get the disease through bites of rabid dogs.
- Wild carnivores and bats also present a considerable risk where the disease is prevalent.
- The disease is endemic in India.

Symptoms :

- Hyperexcitability.
- Drooling of saliva
- Peculiar hoarse sound (bellowing)
- Aggression or paralysis
- The animal dies within 24-48 hours after appearance of first sign, which may be mostly seen within 3 weeks or as late as 5-6 months of the dog bite.
- Once symptoms are seen, death is inevitable.

Prevention :

- Wash the wound immediately in running water for 5-10 minutes.
- Gently clean the wound with bath soap.
- Consult a veterinarian immediately.
- Carry out post-bite vaccination in suspected cases. (0day,3rd day,7th day,14th day,28th day and 90th day)
- Protect your pet dogs and cats against the disease through annual vaccination

F) Anthrax:

- A highly fatal bacterial disease affecting all farm animals.
- Disease is characterized by high fever, respiratory distress, bleeding from orifices and sudden death.
- Infection is due to ingestion of contaminated feed and fodder with spores of the bacteria, which can survive for up to 30 years in the soil.
- Treatment is usually ineffective unless done at very early stages.
- Humans get infection by eating infected raw meat, contact with infected animals or by inhalation of spores.

Prevention:

- Regular annual vaccination of animals in endemic areas will prevent the disease from occurring.
- Vaccination may be carried out at least a month prior to expected disease occurrence in endemic areas.
- Never open a carcass of an animal suspected to have died from Anthrax.
- Contact a veterinarian immediately if the above symptoms are seen and seek advice on control measures to be adopted.

F. Theileriosis (a protozoan disease)

It is an important protozoan disease of exotic and crossbred cattle. This disease is caused by *Theileria annulata* or *Theileria Parva* and transmitted by ticks. Indian breeds of cattle (Zebu) are comparatively resistant. Buffaloes are also infected but symptoms are mild.

Symptoms :

Fever, swollen peripheral lymph nodes, pallour of mucous membranes, anaemia, nasal discharge, jaundice, salivation, rapid and shallow breathing, watery eyes etc are common symptoms.

Cattle lose condition rapidly. Some animals show nervous signs characterized by stepping gait, head pressing, recumbency, unconsciousness and death.

Prevention and treatment:

Regular tick control is the most effective way to keep these infections in check. Seek veterinary treatment if above symptoms of any of the above diseases are seen, since treatment is most effective in the initial stages. Delays may result in death.

For control of theileriosis, vaccinate all exotic and crossbred animals aged 3 months and above, once in its lifetime.

Vaccination schedules for cattle and buffaloes:

S.No	Name of Disease	Age at first dose	Booster dose	Subsequent dose(s)
1	Foot and mouth Disease	4 months and above	1 month after first dose	Six monthly
2.	Haemorrhagic Septicaemia	6 months and above		Annually in endemic areas
3	Black Quarter	6 months and above		Annually in endemic areas
4	Brucellosis	4-8 months after age (only female calves)		Once in lifetime
5	Theileriosis	3 months of age and above		Once in lifetime. only required for crossbred and exotic cattle.
6	Anthrax	4 months and above		Annually in endemic areas
7	Rabies	Immediately after suspected harm	4 th day	7,14, 28 and 90 (optional) days after first dose.

Chapter - 15

Tick born infections in cattle and their treatment

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Anaplasmosis, Babesiosis and Theileriosis are three important diseases in cattle transmitted by tick bite.

A. Anaplasmosis:

Anaplasmosis is caused by a small type of bacteria called rickettsia. Anaplasmosis can also be spread by blood contaminated needles or AI gloves. Calves are more resistant to anaplasmosis than older cattle. Carriers exist in endemic areas which act as reservoirs of infection. Chronically infected cattle may relapse in adulthood.

Symptoms :

Fever, fall in milk production, progressive anaemia, jaundice, abortion are the common symptoms. In later stages, inappetence, in coordinated movements, breathlessness when exerted, and a rapid pounding pulse are usually seen and animals may succumb. The disease is curable if treated promptly in early stages.

Treatment :

Specific treatment : Oxytetracycline @10 mg /kg iv for 5-7 days ; Diminazene (Beenil) 20% 8-10 mg/kg body weight

Supportive treatment : Iron preparations oral or parentally ; inj. Liver extract with vit B-complex IM

B. Babesiosis:

Babesiosis is caused by a type of microbe called protozoa –Babesia bigemina o Babesia bovis transmitted mainly through tick bites..

Symptoms :

High Fever, inappetence, increased respiratory rate, sharp decrease in milk production, muscle tremors, anaemia, jaundice, abortion, constipation or diarrhoea are the common symptoms. Curable if treated promptly. In later stages, loss of weight with haemoglobinuria is seen. Nervous symptoms may also be seen. It is better to repeat treatment if colour of urine does return to normal by 24 hours after treatment.

Babesiosis is not to be confused with “Red Water Disease” which is an acute highly fatal bacterial disease seen especially in areas with liver fluke infestation.

Treatment :

Specific treatment : Diminazene (Beenil) 20% 8-10 mg/kg body weight

Supportive treatment : Iron preparations oral or parentally ; inj. Liver extract with vit B-complex IM

C. Trypanosomiasis :

An important disease of cattle and buffalo caused by protozoa. Transmitted mechanically by biting flies. Cattle and buffalo also are reservoir hosts to horses and camels. Blood from infected animal, occasionally meat and milk are the sources of infection. There is severe loss of productivity due to anaemia. Animals under stress are more susceptible to the disease.

Symptoms :

Progressive anaemia, weight loss and weakness. Abortions, infertility and stillbirth may occur in buffaloes. Cattle may have a chronic course with high mortality and may last up to 2 years. Death may occur in 2 weeks to 2 months. Oedematous swellings of the lower parts of the body (legs, briskets and abdomen) may be seen. Lymph nodes also may be swollen. Nervous signs like head tilt, circling, blindness, hyper-excitability, paddling movements may also be seen.

Prevention

- Control fly population .
- Sufficient ventilation and sunlight should be available in the shed.
- Insecticide applications may be done in the shed and surrounding areas under advice of a veterinarian.

Treatment:

Specific treatment : Quinapyramin (Trquin, Tribexin) 20% @3-5mg/kg body weight

Diminazene (Beenil) 20% 8-10 mg/kg body weight

Supportive treatment : Inj. Dextrose or glucose 25% IV ; Inj. Liver extract with vit B-complex IM

Ticks and fly control:

- Ticks transmit diseases like anaplasmosis, theileriosis and babesiosis. Biting flies transmit diseases like Surra and Ephemial fever .
- Heavy infestations may lead to anaemia and significant loss in productivity.
- Tick and biting flies cause severe discomfort to the animal.
- May cause allergic reactions at the biting sites.
- They lay a large number of eggs resulting in further increase in population.

Tick control :

- Any newly purchased animal should be completely de-ticked before allowing to mix with other animals.
- Carry out periodic application of acaricide on the animal.
- Each adult tick lays around 3000 eggs and the larvae can survive from 2-7 months , based on the climate, without feeding.
- All cracks and crevices in the cattle shed therefore should be sprayed with a higher concentration of the acaricide (Deltamethrin , cypermethrin etc) along with application on the body to avoid re-infestation.
- Flaming also can be done using a flame gun if available, with a little bit of caution.
- The acaricide group should be changed often to avoid resistance from developing.
- The acaricide should be applied in proper concentration.
- Seek advice from a veterinarian on the appropriate acaricide and its dosage.

II Fly Control

- Proper manure and urine disposal on a regular basis. Disposal should be done at a reasonable distance from the cattle shed.
- Any stagnation of drainage should be avoided.
- Smoking the shed with raw leaves (neem leaf preferred) especially during evenings would help reduce the nuisance.
- Fly repellents may be used in proper concentration.
- Natural repellants like neem oil etc, may be applied regularly to repel both biting flies and ticks. This does not have any harmful effects of chemicals and chances of resistance developing are also remote. Application should be always done against the direction of the hair and should cover the entire body, especially underbelly and legs.

Chapter - 16

Mastitis and its control measures

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Hygiene plays much significant role in keeping dairy business profitable. Milker, milking animal and surrounding of the animal i.e shed should always be clean. Disturbance in the hygiene among any one of these three factors, causes mastitis in dairy animals. *Mastitis is a multi-etiological complex disease, which is defined as inflammation of parenchyma of mammary glands and is characterized by physical, chemical and bacteriological changes in milk and pathological changes in glandular tissue.*

Mastitis is common in high yielding cattle and buffaloes. Crossbred animals are more prone to this disease. Animals does not die due to this disease but it causes heavy economic losses to the farmer. In this disease, losses occurs in the form of reduction in milk yield (70%), throwing of contaminated milk outside (9 % loss), expenditure on treatment (7% loss) and in some cases of chronic mastitis due to complete and irreparable damage to udder, market value of animal goes down (14 % loss).

Damage to one teat / quarter in this disease, causes 25% loss in the form of milk and money. Drinking of Milk from mastitis affected teats causes many affections in humans like diarrhoea, sore throat, brucellosis and TB etc. In ICAR survey in Goa, it was observed that 60% milk samples were positive for subclinical mastitis and 80 % milking animals showed one or more quarters affected with mastitis. In India Annual losses due to clinical and subclinical mastitis alone is nearly Rs. 16,702 millions .

Etiology of mastitis:

1. Microorganism :

- A. **Bacteria** : Most common bacteria which causes mastitis are *Staphylococcus aureus*, *S. agalctiae*, *S. faecalis*, *S. pyogens*, *Klebsiella spp.*, *Mycobacterium bovis*, *E. coli*, *Brucella abortus*, *Leptosira pomona* and *Pasterulla multocida* etc
- B. **Virus**: Sometimes mastitis comes secondary to viral diseases like Foot and Mouth disease, Cow pox etc.
- C. **Fungal organism**: Some fungal agents also causes mastitis like *Trichosporum spp.*, *Aspergillus fumigatus*, *candida spp*
- D. **Trauma to teats or udder** : Trauma, irrespective of cause to teats or udder may responsible for causation of mastitis. Teat damage due to application of excess force by calf at the time of suckling or Kicking by other animal or rough flooring.

E. Wrong Milking method : Most of the farmers use knuckling method for removing milk which causes internal damage to the teats .

F. Incomplete milking : incomplete milking causes remaining of some milk in the udder which causes mastitis.

G. Unhygienic condition :

a. **Milker :**

Bad habits of milker such as tobacco chewing , untrimmed nails , dirty clothes , milking without washing hands predisposes animal for causation of mastitis.

b. **Milking Animal :**

Backside of the animal especially hind legs, tail , buttocks , udder and teats should be washed with clean water. Sidestepping this practice may cause mastitis.

c. **Unhygienic condition of shed:**

Inadequate sunlight reaching into the shed, improper aeration, improper drainage

H. Environmental factors :

A) Nutritional Deficiency: Deficiency of vitamin E and Selenium in the feed.

B) Housing: uncommon in loose housing system than with tied housing systems.

C) Climate : intense cold , draughts , excessive humidity or heat

D) Feeding of silage: silage fed animals is more prone to mastitis.

How mastitis occurs in the dairy animals:

Mastitis is common in high yielding cows and buffaloes. Most of the milking animals sit on the ground after each milking to get rid of the milking stress. Teat opening remains open for a period of 30 minutes to one hour after milking. During this period if floor is not clean or contaminated and animal sits on the ground then there are chances of mastitis causing organisms to enter inside the udder through teat opening. These microorganism causes damage to the milk alveoli hence milk yield decreases. Delay in the treatment of such animals causes lot of damage to the milk forming cells and in chronic cases fibrosis develops inside the udder and such teats become blind. In severe form of mastitis, all the teats become blind and animal may become complete un- productive.

Symptoms of mastitis: on the basis of symptoms, mastitis is divided into two types:

A) Clinical mastitis:

1. In severe form of mastitis, animal suffers with fever and off feed.
2. Udder becomes red, painful, swollen and hard
3. Taste and appearance of the milk changes.
4. Milk contains clots, blood stains particles, pus, mucous etc.

B) Subclinical mastitis:

1. Milk appears normal.
2. No visible changes in udder and teats.
3. Day by day milk production goes down.

Diagnosis of mastitis :

1. Diagnosis of mastitis can be made on the basis of signs and symptoms.
2. Based on signs , it is difficult to identify subclinical mastitis hence one simple test called as “ California Mastitis Test “ can be used for detection of sub clinical mastitis at the farmers field. In this test , equal amount of milk and reagent need to be taken in the paddle and mixed gently . If the clotting of the mixture takes place then it is indicative of positive test for mastitis.

Treatment:

1. Immediate treatment of teat and udder injuries is required.
2. Mastitis infected animals need to be treated with intra mammary infusions while intra muscular preparations used to control secondary infections and also for treating mastitis.

Prevention of mastitis:

1. Maintain hygienic condition in and around dairy farm.
2. Dry cow therapy with intra mammary infusion.
3. Provide mineral mixture 50-100 gram daily .
4. Complete removal of milk during milking.
5. Always milk healthy milking animals first later on milk known mastitis affected animals.
6. After milking , animals should not allow to sit on the floor hence either offer feed / fodder otherwise let them loose for grazing or exercise for a period of 30 minutes to 1 hour.
7. Teat dip cup: The use of teat dip cup is the best method for prevention of mastitis .Every time after post milking, dipping is needed. In this method, all the teats should be immersed in the cup which contains iodine solution. The diluted iodine get plugs in the teat opening and chances of pathogen entry inside the udder stops.



Chapter - 17

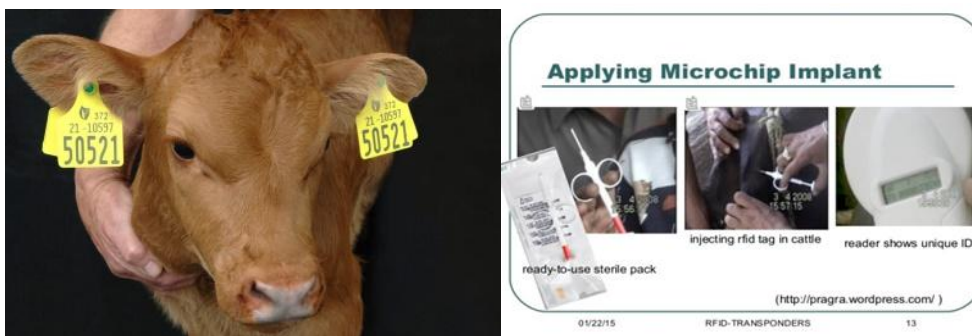
General management practices to be followed in dairy farm

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There are many general management practices which helps dairy farmer to run his Dairy farm smoothly to yield and market a worthwhile product.

A) Identification of animals:

Identification of animals is required to keep correct data of farm animals which helps in scientific feeding, housing, breeding and marketing of herd .There are many methods of identification of dairy cattle like calling by the name if they have very few in number but if they are more in number then farmer can go for Ear tagging by fixing plastic tags on the ear. If plastic tag is fall off then that should be replaced with another one immediately. Neck tagging is another method where metallic or plastic tags tie in the neck chain, thread or wire.



Another method of injecting microchip inside the body particularly at the site of base of ear or neck region is popularised especially in animals which are given under government schemes and subsidies and insurance. For the reading of microchip, reader is essential. This is accurate method of identification and keeping data of large number of animals. No way farmer can cheat or to be cheated by any agency.

B) Disbudding:

This management practice helps to make animals safe for handling and management. We can avoid fighting and possible injuries especially to udder and teats by sharp and pointed horns .This practice helps in doing good management particularly in animals which are to be reared in loose housing system. This reduces floor space requirement per animal.



In this process horn buds of young calves are removed at the age of 2-3 weeks when horn buds can be easily palpated. After clipping about 2cm area around the buds, infusion of local anaesthetic (2% lignocaine) is required to relieve pain. Later on by using red hot electrical dehorner bud has to be cauterised for 15 to 30 seconds. Application of Tr. Iodine at the site is required for 3-5 days. Generally disbudding is not practiced in indigenous cattle .

C) Castration of male calves by using Burdizzo castrator :

This management practice is needed to avoid inbreeding and unwanted crossing from undesirable bulls. In this method, after casting the bull / male calf, slightly testis are pulled with a pressure and spermatic cords of both the testicals are located and held firmly . By using Burdizzo castrator spermatic cord of both the testicles crushed. This is a bloodless method of castration .The desirable age for castration is 4 to 6 months.



D) Milking :

Correct milking is a combination of an art and science of drawing milk from a lactating animal. All the economics of the dairy farming is directly dependent on milking. Milking is totally controlled by hormonal activity in which oxytocin which secretes from pituitary gland plays important role for the letting down of milk from udder.



Milking should be completed within 7 minutes. Calves sucking action or gentle massage of teats stimulate letting down of milk. Milking should be gentle and quick. Before the actual milking, animals should be washed with water especially hind quarters, back portion of the cow, tail, udder and teats. Afterwards again washing of udder and teats is required .Diluted potassium permanganate water can be used for this purpose. Milking should always be done by an experienced person who is free from all

bad habits, communicable diseases like TB and his or her nails should be trimmed properly. First few strips from each teat should be checked on Strip cup so as to check the status of mastitis. Never allow calf to suckle in the end of milking because last stripping of milk is rich in Fat. One fourth to half of the required concentrates of morning and evening should be offered while

milking helps in keeping animal calm .No visitors should be allowed and don't disturb the animals in any way while milking . While doing hand milking , always milk should be removed completely with full hand milking which is the correct method of milking.

Images of full hand milking / stripping / knuckling method



Never use knuckling method of milking which is wrong method in which there may be chances of occurrence of injury to the teats. In machine milking, machine is used for milking instead of hands. More hygienic milk is produced in machine milking. Less time is required for milking and even trained school children and women can use the milking machine.

While machine milking care should be taken to check proper vacuum (Normally machine operated at 10-15 inches vacuum) and pulsation (normal pulsation rate is 50/minute). Follow instruction of milking machine company for changing oil, liners or any other accessories time to time.

After removing the milking cups from teats always remove left over milk from the teats which helps in preventing occurrence of mastitis. All the time after each milking use teat dip cup for prevention of mastitis.

D) Grooming :

In this practice, animals are brushed or combed by using specially designed brush or curry comb. Daily grooming gives human touch and helps to develop bonding between owner and animal. Grooming improves look of the animal by making skin coat smooth, clean and glossy. This also helps in improving blood and lymph circulation of skin and removes dead hairs, dust, dirt, mud and ectoparasites like ticks .Grooming is required for clean milk production.

E) Ringing :

In this practice a non rusting material like aluminium or copper ring is introduced by making a puncture or hole in the nasal septum of bull and locked by screw. This ring helps to tie rope which can be used for parading the bull or for easy control of the bull.



F) Hoof trimming: in this process overgrown or uneven hooves are to be trimmed by using hoof trimmer or hoof knife. Animals which are maintained in the stall-fed and not allowed for exercise or grazing due to space constraint are more likely to affect for overgrowth or uneven shape of hooves. This problem causes uneasiness to the animals in walking and standing. Such animals remain under continuous stress which indirectly effects on milking. Hence once in two to three months hoof trimming is required for stall fed animals. Using of rubber mats helps to provide comfort to the animals and also helps to relieve stress to some extent.



G) Culling: To avoid further losses in the dairy farming, around 10 % of less productive, unproductive, untreatable, problematic animals which are unfit for further service are to be removed from the herd.

H) Drying off: In this practice lactating but advance pregnant animals are allowed to become dry approximately sixty days before the next calving to provide sufficient rest to milk producing organs i.e. udder and for better development of foetus. Drying off is done by intermittent milking then incomplete milking and complete or abrupt cessation of milking.

I) Dry Cow therapy: For prevention of mastitis, dry cow therapy is essential. In this practice after ensuring that no milk is there in the udder after last milking of drying off procedure, teats are washed thoroughly and suitable antibiotic containing intra mammary tubes in each teat is infused.

Image of intramammary tube infusion and use of Teats dip Cup



J) Weighing of cattle: To know the proper growth in animals and to provide scientific feeding as per the different physiological conditions, weighing of animals is needed. Weighing helps in judging the general health of animals. The cattle should be weighed usually once a month. Most of schemes of Animal Husbandry or dairy cooperative societies in raising calves are directly linked to the weight of animal.

1. Direct Method: In this method calves or adult animals are measured on weighing balance / weighing bridge.

Image of Weighing balance and calf



2. Indirect method: In most of the farms and villages, weighing balance / weighing bridge is not available. In such cases, with a very simple technique by using measuring tape we can estimate weights of cattle by measuring chest girth and body length of cattle.

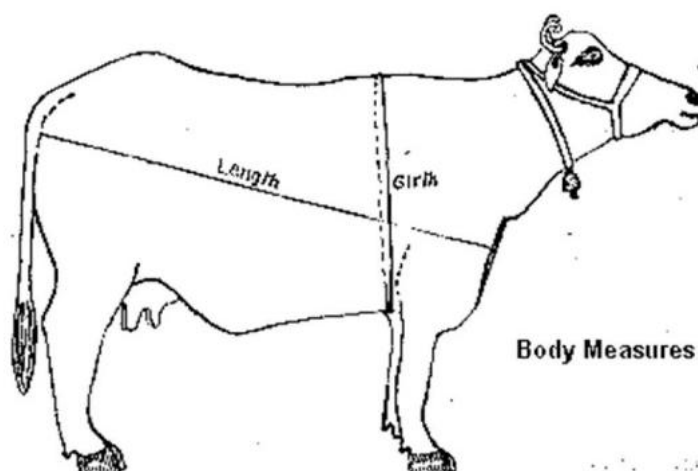
Calculation of body weight in kilo by using Shaffer's formula :

$$\text{Live Body Weight (Kilo)} = \frac{\text{Length} \times \text{Girth} \times \text{Girth}}{660}$$

Where,

Length = Distance between point of shoulder to pin bones / pint of buttocks in inches

Girth: Entire circumference of the body behind the point of elbow in inches.



K) Dairy Farm Records: For maintaining the records of various activities of dairy farm, different registers are required. Now most of the dairy farmers are using various software's to record data in computers. Records help us to judge profits or losses at any time of the year. It helps us in culling of the animals. It helps in perspective planning of the business.

Following records should be maintained by all dairy farmers:

1. Stock Registers: Stock of all the items purchased for farm with opening balance, closing balance, received and total issue.
2. Calf register : includes date of birth, weight at birth , id number, breed , sex weaning date , remarks
3. Milk records : Animal wise morning and evening milk , out sales morning and evening and milk issued to calves
4. Feed and fodder register: Green fodder, hydroponics, silage , dry fodder and concentrates offered morning and evening with opening balance , closing balance , received and total issue .
5. Herd Health Register : Vaccination and deworming record.
6. Mortality register : animal ID number , date of illness , symptoms, Treatment , date and time of death , post mortem report
7. Cattle breeding register : animal ID no , date of showing heat, date of service, bull no / semen straw number, next date of heat, pregnancy diagnosis date (60-90 days after service), pregnancy confirmation, date of expected calving.
8. Calving register : animal ID no, calving date , calving problems, normal calving , calf weight

History and pedigree Sheet:

Animal ID number, date of birth , date of purchase, Sire Number, Dams number, Dams milk yield , Lactation yield, lactation length , dry days etc.

Chapter - 18

Milk and milk products

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Value Addition in Milk

Milk is often regarded as being nature’s most complete food. It earns this reputation by providing many of the nutrients which are essential for the growth of the human body. Being an excellent source of protein and having abundance of vitamins and minerals, particularly calcium, milk can make a positive contribution to the health of a nation. Milk is a perishable commodity and spoils very easily. Its low acidity and high nutrient content make it the perfect breeding ground for bacteria, including those which cause food poisoning (pathogens).

Bacteria from the animal, utensils, hands and insects may contaminate the milk and their destruction is the main reason for processing. The preservation of the milk can be achieved by fermentation, heating, cooling, removal of water and by concentration or separation of components, to produce foods such as butter or cheese. Fermented-milk products such as yoghurt and soured milk contain bacteria from the Lactobacilli group. These bacteria occur naturally in the digestive tract and have a cleansing and healing effect. Many people suffer from a condition known as ‘lactose intolerance’. This means that they are unable to digest the milk fat (lactose). Such people can, however, tolerate milk if it is fermented to produce foods such as yoghurt. During fermentation, lactic acid producing bacteria break down lactose, and in doing so eliminate the cause of irritation.

The type of animal, its quality and its diet can lead to differences in the colour, flavour, and composition of milk. Infections in the animals which cause illness may be passed directly to the consumer through milk. It is therefore extremely important that quality-control tests are carried out to ensure that the bacterial activity in raw milk is of an acceptable level, and that no harmful bacteria remain in the processed products. The price paid for milk usually dependent upon the milk –fat content, and this may be determined either at the collection stage or at the dairy using a piece of equipment known as a butyrometer. Additionally the specific gravity can be measured using a hydrometer. This can also be used as an aid to detect adulteration.

Milk can be kept for longer periods of time if it is heated to destroy the bacteria or cooled to slow their growth. Pasteurization and sterilization are the two most commonly-used heat treatments. Technically, it is possible for both to be carried out on a small scale, but they are most usually performed on a larger industrial scale due to the need for qualified, experienced staff and accurate and strictly controlled hygienic processing conditions. Pasteurization is a relatively mild heat treatment, (usually performed below 100⁰ C) which is

used to extend the shelf life of milk for several days. It preserves the milk by the inactivation of enzymes and destruction of heat-sensitive micro organisms, but causes minimal changes to the nutritive value or sensory characteristics of a food. Some heat resistant bacteria survive to spoil the milk after a few days, but these bacteria do not cause food poisoning.

When milk is left to stand for some time, fat globules rise to the surface forming a layer of fat (or cream). This can be separated leaving behind skimmed milk as a by-product. There are different types of cream each with different fat concentrations: single (or light) cream contains 18 percent milk fat whereas double (or heavy) cream normally contains 30 percent milk fat. Cream is a luxury item and may be used as an accompaniment to coffee, as a filling in cakes and an ingredient in ice cream. Butter is a semi-solid mass which contains approximately 80-85 percent milk fat and 15-20 percent water. It is yellow/white in colour, with a bland flavour and a slightly salty taste. It is a valuable product that has a high demand for domestic use in some countries and as an ingredient in other food processing (e.g. for confectionary and bakery uses).

Ghee is made from butter which has been heated and clarified. At ambient temperature it is a semi solid mass with a granular texture, but on melting ($40^{\circ}\text{C}+$) it turns into a clear, thin liquid. It has a high demand in some countries for domestic use, as an ingredient for local food production (for example bakeries and confectionery manufacturers), and as an export commodity. Yoghurt is a fermented milk product that evolved by allowing naturally contaminated milk to sour at a warm temperature. Yoghurt can be unsweetened, set or stirred. Curd is the name given to a yoghurt type product made from buffalo milk.

Cheese is made from milk by the combined action of lactic acid bacteria and the enzyme rennin (known as rennet). Just as a cream is a concentrated form of milk fat, cheese is a concentrated form of milk protein. The differences in cheeses that are produced in different regions result from variations in the composition and type of milk, variations in the process and the bacteria used. The different cheese varieties can be classified as either hard or soft.



Chapter - 19

A. I. Technique in Cattle

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A.I. Technique
in Cattle

The recto-vaginal technique is the most commonly used method to artificially inseminate cattle. The basic skills required to perform this technique can be obtained with about three days practice under professional instruction and supervision. Additional proficiency and confidence will be achieved with further work on your own.

The first step in the insemination process is to restrain the animal to be inseminated. There are several things to keep in mind when choosing a location for inseminating cattle including:

- Safety of both the animal and the inseminator.
- Ease of use.
- Shelter from adverse weather.

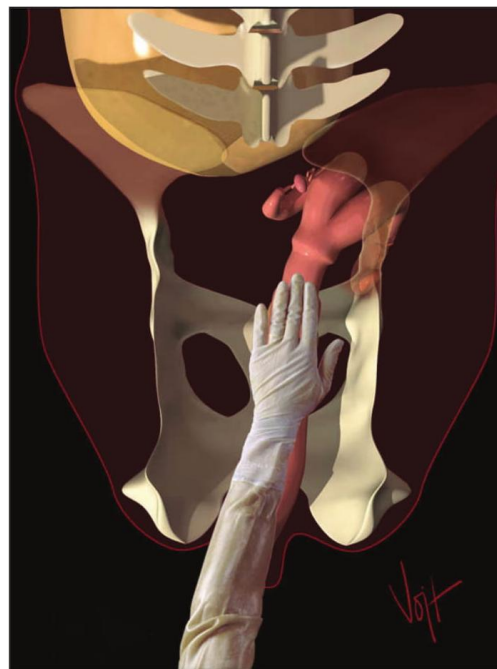
Regardless of whether you are left or right handed, it is recommended that you use your left hand in the rectum to manipulate the reproductive tract and the right hand to manipulate the insemination gun. This is because the rumen or stomach of the cow lies on the left side of the abdominal cavity, displacing the reproductive tract slightly to the right. Thus, you will find it much easier to locate and manipulate the tract with your left as opposed to right hand.

A gentle pat on the rump or a soft-spoken word as you approach for insemination, will help to avoid startling or surprising the animal. Raise the tail with your right hand and gently massage the rectum with the lubricated glove on your left hand. Place the tail on the back side of your left forearm so it will not interfere with the insemination process. Cup your fingers together in a pointed fashion and insert your hand in the rectum, up to the wrist.

Gently wipe the vulva with a paper towel to remove excess manure and debris. Be careful not to apply excessive pressure, which may smear or push manure into the vulva and vagina. With your left hand make a fist and press down directly on top of the vulva. This will spread the vulva lips allowing clear access to insert the gun tip several inches into the vagina before contacting the vaginal walls. Insert the gun at a 30° upward angle to avoid entering the urethral opening and bladder located on the floor of the vagina. With the gun about 6 to 8 inches inside the vagina, raise the rear of the gun to a somewhat level position and slide it forward until it contacts the external portion of

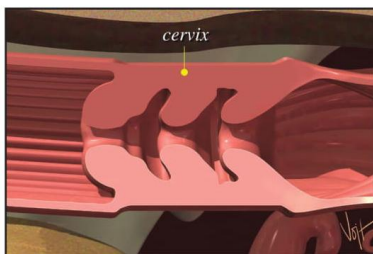
Some of the most important aspects to remember when inseminating a cow to attain maximum breeding efficiency are:

- Be gentle. Don't use too much force.
- Insemination is a two-step process. Get the gun to the cervix, and then place the cervix over the gun.
- Deposit the semen just through the cervix into the uterine body.
- Take your time.
- Relax.

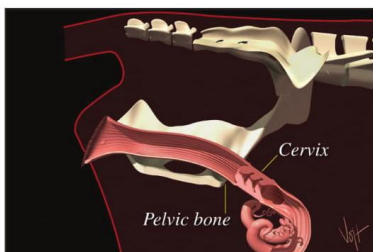


Because the rumen displaces the reproductive tract to the right, it is much easier to locate and manipulate the tract with your left hand.

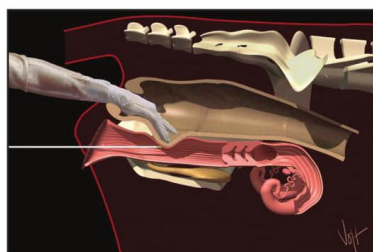
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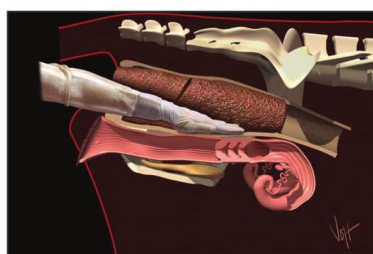
The opening into the cervix protrudes back into the vagina.



The cervix is located on the floor of the pelvic cavity near the anterior end of the pelvic bone.



As you insert the breeding gun into the vagina, keep your gloved hand even with the gun tip.



Keep your open hand flat against the floor of the rectum, allowing manure to pass over the top of your hand and arm.

the cervix. You will note a distinct gristly sensation on the gun when it contacts the end of the cervix.

The cervix, consists of dense connective tissue and muscle and is your primary landmark for inseminating cattle. It has often been described as having the size and consistency of a turkey neck. The size will vary, with post partum interval and age of the animal. The cervix usually has three or four annular rings or folds. The opening into the cervix protrudes back into the vagina. This forms a 360° blind-ended pocket completely around the cervical opening. This pocket is referred to as the fornix. In most cows, the cervix will be located on the floor of the pelvic cavity near the anterior end of the pelvic bone. In older cows with large reproductive tracts, the cervix may rest slightly over the pelvic bone and down into the abdominal cavity.

To become a successful inseminator it is very important that you always know where the tip of the insemination gun is located. The walls of the vagina consist of thin-layered muscle and loose connective tissue. The insemination gun can be easily felt with your palpating hand. As you insert the breeding gun into the vagina, keep your gloved hand even with the gun tip.

Manure in the rectum can often interfere with your ability to palpate the cervix and gun tip. However, it is seldom necessary to remove all the manure from the bowel. Instead, keep your open hand flat against the floor of the rectum, allowing the manure to pass over the top of your hand and arm.

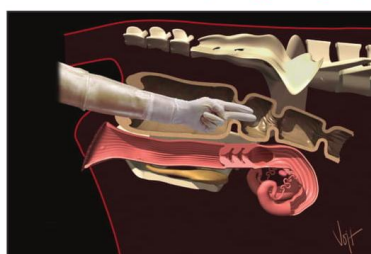
While handling the cervix you may notice rectal constriction rings attempting to force your arm from the cow. To relax these rings, place two fingers through the center of a ring and massage back and forth. The constriction ring will eventually relax, pass over your hand and arm, and you can continue the palpation process.

Because the reproductive tract is freely movable, cows that have strong rectal and abdominal contractions in response to being palpated may actually push their reproductive tract back into the pelvic cavity. This will cause many folds to form in the vagina. In such cases, the insemination gun will often get caught in these folds and little or no progress will be made until they are removed. If you can locate the cervix, grasp it and push it forward. This will straighten the vagina and the gun should pass freely up to the cervix. If you cannot locate the cervix, encircle the gun tip with your thumb and forefingers. With a straightening motion of your wrist, gently “milk” the folds out of the vagina a little at a time. Slide the gun forward and repeat the process until the cervix is reached.

At this point it is important for you to understand that inseminating a cow is a two-step process. The first step is to get the gun tip to the cervix. To accomplish this you

must work the vagina and cervix forward, away from you to straighten the vaginal folds. If you do not feel the gristly sensation of the cervix on the gun, you are still in step one of the process.

Once the gun is in contact with the external surface of the cervix you are ready to begin step 2. In step 2, you place the cervix on or over the insemination gun. That's



To relax rectal constriction rings, insert two fingers through the center of the ring and massage back and forth.

right, the cervix is placed on the gun, the gun is not passed through the cervix. Excessive movement or probing with the insemination gun during the second step is seldom productive and in fact, is very often counterproductive. Ground gained is often lost and we find ourselves back in a vaginal fold. **The key to mastering step 2 of the insemination process is to know how to hold and manipulate the cervix and concentrating on doing the work with the hand inside the cow, not the one holding the gun.**

When the gun first contacts the cervix, you will usually find that the tip is in the fornix directly over top of the opening. **Grasp the external opening to the cervix with the thumb on top and forefingers underneath.** This closes the fornix at top and bottom. As in step 1 we must still know the location of the gun tip. This is accomplished with the palm and third and fourth fingers of your palpating hand. **Use your palm and these two fingers to guide the gun tip to the cervical opening located between your thumb and forefingers.**

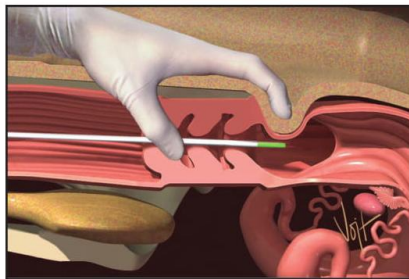
With gentle probing the opening should be located. You will feel the gun slide forward until it contacts the second cervical ring. **Maintain gentle but steady forward pressure on the gun and slide your thumb and forefingers just in front of the gun tip and re-grasp the cervix.** Because the cervix is composed of dense connective tissue and muscle, it is difficult to clearly distinguish the gun tip when it is located within this structure. However, you can determine the approximate location by bending the cervix. **Using the flexibility of your wrist, twist and bend the cervix until you feel the second ring slide over the gun tip.** Repeat the process until all the rings have been passed over the gun tip. In some cases, it may be necessary to bend the cervix at a 90° angle to clear the cervical folds. Remember, you are placing the cervix over the gun, not the gun through the cervix.

A slight jiggle or “give-and-go” of the gun may sometimes be necessary to help pass by a fold, but for the most part gentle forward pressure is all that is necessary and gun movement should be minimal.

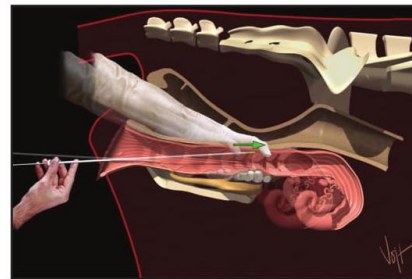
When all rings of the cervix have been cleared, the gun should slide forward freely with little resistance. Since the uterine wall is very thin, you will once again be able to clearly feel the insemination gun. You are now ready to check your placement and deposit the semen. Rotate your gloved hand until it lies on top of the cervix. With your index finger, locate the far end of the cervix. **Pull back on the gun until you feel the tip directly underneath your finger near the internal opening of the cervix. Raise your finger and slowly deposit the semen.**

Push the plunger slowly so that drops of semen fall directly into the uterine body.

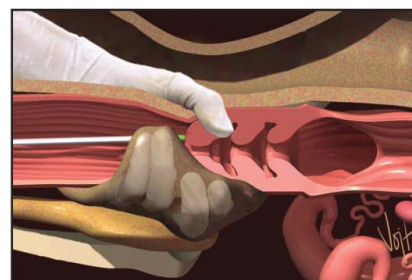
With proper A.I. technique and gun placement, semen will be deposited in the uterine body. Uterine contractions will then transport spermatozoa forward to the horns and oviducts with a good distribution of both sides.



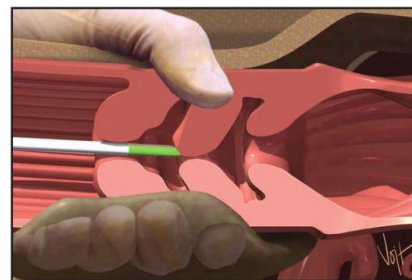
Use your index finger to check gun placement (1/4 inch past the end of the cervix) before depositing semen.



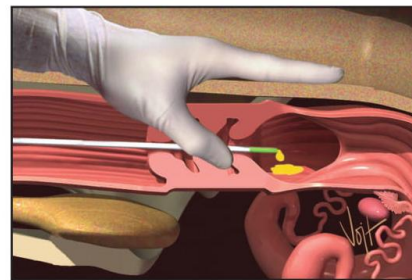
Grasp the cervix and push it forward to straighten vaginal folds.



Grasp the external opening to the cervix with the thumb on top and the forefingers underneath to close the fornix and guide the gun tip into the cervix.

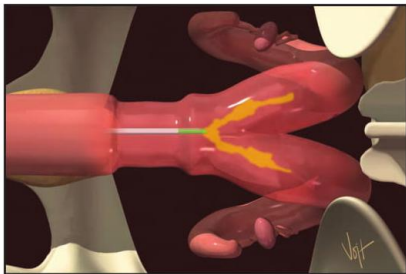


Using the flexibility of your wrist, twist and bend the cervix until you feel the second ring slide over the gun tip.

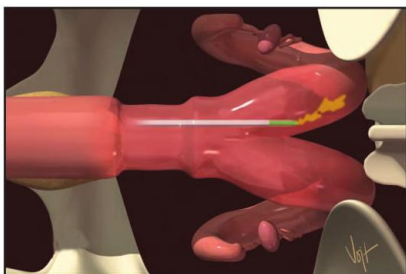


Push the plunger slowly so that drops of semen fall directly into the uterine body.

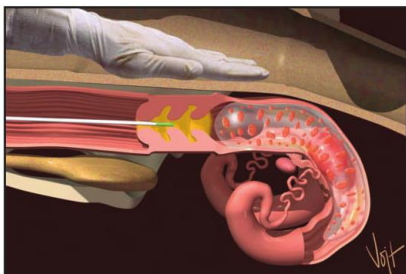
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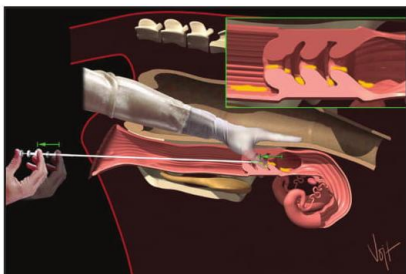
With proper A.I. technique and gun placement, semen will be deposited in the uterine body and contractions will transport spermatozoa forward to the horns and oviducts.



If the gun is more than 1 inch through the cervix, all the semen will be deposited into only one horn.



If you encounter cervical mucus which feels thick and sticky on the gun in a cow that has been previously inseminated, she may be pregnant. In this case, deposit the semen halfway through the cervix.



Make sure you push in with the plunger and do not pull back on the gun. Pulling back may result in much of the semen dose being deposited in the cervix and vagina.

When the insemination gun is more than 1" through the cervix, all the semen will be deposited in only one horn. This creates a situation of uneven semen distribution. Should the animal ovulate from the opposite horn, conception rates may be compromised.

Be sure to raise your finger after checking gun placement. Not doing so may obstruct one horn, again creating a situation of uneven semen distribution. When checking gun tip placement, be careful not to apply excessive pressure. The delicate uterine lining is easily damaged, predisposing the cow to uterine infections and reduced fertility.

Make sure you push in with the plunger and do not pull back on the gun. Pulling back may result in much of the semen dose being deposited in the cervix and vagina instead of the uterine body.

Although the recommended site of semen deposition is in the uterine body, research suggests that when exact gun tip placement is in doubt, depositing semen slightly into one uterine horn is less likely to compromise fertility than cervical deposition. However, **If the cervical mucus of a cow which has been previously inseminated feels thick and sticky on the gun, she may be pregnant. In this case deposit the semen about halfway through the cervix.**

After properly depositing semen, slowly pull the gun from the reproductive tract. Remove the gloved hand from the rectum and shake off the excess manure. Check the gun tip for signs of blood, infection or semen leakage inside the sheath. Make notes for your veterinarian or future reference where appropriate. Remove the sheath from the gun and hold it in the gloved hand. **For the final time, check to confirm which bull you have used.** Remove the glove starting at the top of your arm by turning it inside out as you remove it. Remove air from the glove and tie a knot at the open end to trap manure, the sheath and dirt inside. Dispose of the used glove in a proper receptacle. Wipe the gun clean and dry and return it to the proper storage location.

Some of the most important aspects to remember when inseminating a cow to attain maximum breeding efficiency are:

- **Be gentle. Don't use too much force.**
- **Insemination is a two-step process. Get the gun to the cervix, and then place the cervix over the gun.**
- **Deposit the semen just through the cervix into the uterine body.**
- **Take your time.**
- **Relax.**

Correct insemination procedures will result in better breeding efficiencies. More selection pressure can then be placed on economic traits such as milk and beef production enabling you and your family to realize a higher return on your semen investment dollars. ♦



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Chapter - 20

Importance of cow urine & dung

A. R. Desai, Principal Scientist (Horticulture),
ICAR – Central Coastal Agricultural Research Institute, Old Goa, Goa.

Introduction:

From time immemorial, livestock components have been an integral part of Indian farming system. Local cows especially have played a vibrant role in our ancestral farming practices. However, it is a matter of a great regret that in the name of modernizing agricultural production practices, integrated farming systems existed earlier, were disintegrated, thereby leading to “mono-cropping” patterns, isolated commercial dairy farming, etc. This was further continued in the concept of green revolution which inadvertently invaded the traditional practices of using livestock components especially the local cows and bullocks for milk, farm yard manure and farm operations. Adoption of improved varieties highly responsive to chemical fertilizers, tractors and farm machineries in modern agriculture completely side-lined the traditional, time tested agrarian practices followed for the centuries. This has led to a phenomenal paradigm shift in Indian agriculture *per se*, however, for ephemeral benefits. Paradoxically, it is now being felt that overriding the traditional knowledge has not done anything good as an option, only when we started confronting with several new problems in our life like loss of soil fertility, increased infestation of pests and diseases, human health hazards, environmental problems, etc. Considering these, several schools of thought, of late, have started revisiting traditional practices again for their inherent sustainable features and advantages. It is at this juncture, re-introduction of livestock, especially, cows and bullocks into the farming system for the obvious advantages has assumed paramount significance in the present context with a view to produce safe and nutritious food on a sustainable basis for the cause of posterities and the mankind. With this background, a brief write up is presented below highlighting the importance of cow dung and cow urine and their effective application in farming practices.

Indigenous Cow Breeds

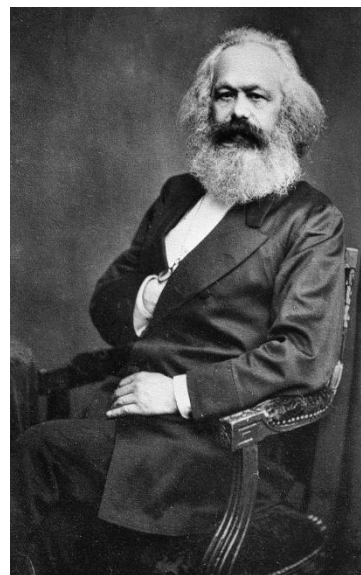
Most Indian cow breeds represent *Bos indicus* group. India has 37 pure cattle breeds. Five of these namely, Sahiwal, Gir, Red Sindhi, Tharparkar and Rathi are popularly known for their milk production. Other breeds, such as Kankrej, Ongole, Krishna valley, Deoni and Harijana, belong to dual purpose breeds that have both milch and draught qualities and hence are suitable even for field operations. The rest are pure draught breeds known for their ability to do the hard work in fields also for local transportation.

Thus, cows are companion of farmers for long time past and the use of cow dung and cow urine in day today life had been part and parcel of social life. Besides the best quality milk of Indian cows for obvious health benefits, cow dung and urine are used as manure and bio-fertilizer for boosting the soil fertility for crop husbandry. The knowledge about the disinfectant properties of cow dung and cow-urine was very much sound among the people for which reason, these were being used for plastering the house wall, front & backyards of house and making cow dung cakes for fuel and also for preparing medicinal concoctions like panchgavya and arka etc. Unfortunately these practices are seldom seen in the present day life, because of which we are ignorantly denied of the benefits of the companionship of cows and merits of using cow dung and cow urine for different purpose.

Capitalism and Soil depletion:

[Karl Marx](#) wrote of the role of [capitalism](#) in soil depletion.

- All progress in capitalistic agriculture is a progress in the art, not only of robbing the labourer, but of robbing the soil;
- all progress in increasing the fertility of the soil for a given time, is a progress towards ruining the lasting sources of that fertility.
- The more a country starts its development on the foundation of modern industry, like the United States, for example, the more rapid is this process of destruction.
- Capitalist production, therefore, develops technology, and the combining together of various processes into a social whole, only by sapping the original sources of all wealth — the soil and the labourer.



Therefore, the importance of cow manure and cow urine arplaying vital role in Indian Agriculture especially in organic farming for safe and nutritious food.

What is Cow dung?

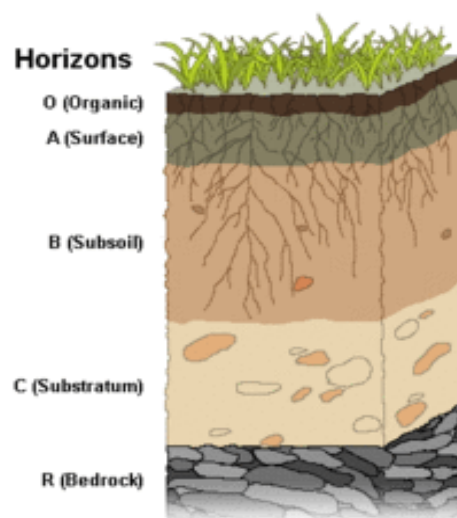
Dung is the waste product of bovine animal species. These species include domestic **cattle**("cows"), bison ("buffalo"), yak, and water buffalo.**Cow dung** is the undigested residue of plant matter which has passed through the animal's gut.

Soil Fertility

Soil fertility refers to the ability of a soil to sustain agricultural plant growth, i.e. to provide plant habitat and result in sustained and consistent yields of high quality.

A fertile soil has the following properties:

- The ability to supply [essential plant nutrients](#), soil, and water in adequate amounts and proportions for plant growth and reproduction;
- The absence of toxic substances harming plant growth.
- Sufficient soil depth for adequate root growth and water retention;
- Good internal [drainage](#), allowing sufficient aeration for optimal root growth (although some plants, such as rice, tolerate waterlogging);
- Topsoil with sufficient [soil organic matter](#) for healthy [soil structure](#) and [soil moisture](#) retention;
- [Soil pH](#) in the range 5.5 to 7.0
- Adequate concentrations of [essential plant nutrients](#) in plant-available forms;
- Presence of a range of [microorganisms](#) that support plant growth.



Land has lost its fertility

If the nutritional elements from soil which are consumed by crops are not replenished after each crop season, the soil loses its fertility gradually. The food grains grown on such soil become nutritionally poorer and eventually the land becomes barren and gets transformed into a wasteland. The following Table shows the quantum of nutritional elements absorbed by some major crops from the soil, indicated as per acre consumption.

Table : The quantities of plant nutrients removed from soil by different crops (kg./ha)

Crop	Yield (grain) kg/ha	Nitrogen (n)	Phosphorous	Potassium
Rice	2240	34	22	67
Wheat	1568	56	24	67
Sugarcane	67200	90	17	202

Source : "Handbook of agriculture" (1987) pp.213 Indian Council of Agricultural Research (ICAR)

To replenish such nutrients consumed by crops from the soil, cattle dung or organic manure, is the best, cheapest, harmless and most easily available manure. Now, let us have a look at nutrients contained in dung and urine of different animals which help in restoring fertility to the soil. The following table indicates the contents of some of the basic nutrients of dung manure.

Table : The average nutrient contents of manure

Type of manure	% Nitrogen (n)	% phosphoric acid (p ₂ o ₅)	% Potash
Dung of cow/buffalo	0.3-0.4	0.1-0.2	0.1-0.3
Horse dung	0.4-0.5	0.3-0.4	0.3-0.4
Dung of sheep and goat	0.5-0.7	0.4-0.6	0.3-1.0
Cow/buffalo urine	0.9-1.2	Nil	0.5-1.0
Horse urine	1.2-1.5	Nil	1.3-1.5
Sheep/goat urine	1.5-1.7	Nil	1.8-2.0

Source : *"Handbook of Agriculture" (1987) pp. 215, Indian Council of Agricultural Research (ICAR)*

Thus, if soil has to be prevented from becoming barren, it is necessary to apply 10 bullock-cart loads or 5 tonnes of dung manure for each acre of land. The remaining shortfall in maintaining fertility of soil is made up by dung and urine of sheep and goats which wander on farms everywhere. The Indian council of Agricultural Research has found by experiments that if the farms are properly ploughed and if 5 tonnes of dung manure is used for each acre, then our agricultural land is capable of giving normal yields of crops per acre:

Organic Farming :: Organic Inputs and Techniques

Jeevamrut:

It is the most commonly used organic liquid nutrient product in organic farming. It is considered to be an excellent source of 'natural carbon', 'biomass', 'Nitrogen', 'Phosphorous', 'Potassium' and lot of other micro nutrients required for the crops. As compared to other forms of manure, composts, vermi-compost, Jeevamrut can be prepared very quickly and has proven to be lot more effective. Usage of Jeevamrut along with other manures can also prove to be beneficial.

A Goa-based organic farmer ISA ALVARES says that this product not only “enables the soil to re-stock its populations of beneficial soil microbes, but also helps control disease. The Organic Farming Association of India has published this farmer’s recipes and the method of preparation of Jeevamrut which has the following ingredients .

Preparation:

Add 10 kg cow dung, 5 lts. of cow urine, 1 kg black jaggery, 1kg lentil powder, handful of soil in 200 lts. of water. First lentil powder and jaggery are mixed and then cow dung is added. Keep the solution for 2 to 7 days in the shade or fermentation.

Application:

For a liquid foliar spray, Apply 5% to 10% in water, and for soil, use 100-200 lts. per acre during irrigation. According to growth of the crop and convenience one can use it once at an interval of 7 – 15 days. Spray during dawn or dusk on any crop, for promoting growth, flowering and yield increase.

Shri Palekar, a free lance organic farming promoter, has also formulated “Ghana jeevamrut” (Ghan-Jiwamrita) product with following method.

Take 100 Kg Local Cow Dung, 2 Kg Jaggery, 2 Kg Pulses flour, Handful soil from the bund. Then mix it well by adding small amount of Cow Urine. Then spread it & keep it in the shadow for drying. Afterwards make its powder by hand & apply to the crops in the proportion of 100 Kg FYM & 10 Kg Ghan-Jiwamrita

Following table depicts the Laboratory Analysis of Jeevamrut

No	Parameters	Unit Value
1 .	pH	05.99
2	E. Conductivity mmhos/cm	02.88
3.	Moisture %	99.58
4	Ash %	00.24
	Organic Carbon %	00.10
	Organic Matter %	00.18
	C/N -	02.24
Macro Nutrients		
	Nitrogen %	00.047
	2 Phosphorous (as) ppm	173.78
	Potassium (as) ppm	567.68
	Calcium ppm	135.72
	Magnesium ppm	288.76
Micro Nutrients		
	Iron ppm	23.92
	Manganese ppm	00.56
	Zinc ppm	09.80
	Copper ppm	27.63

Advantages of Jeevamrut:

- It acts as an agent to increase the microbial count and friendly bacteria in the soil.
- As the preparation time is only 4-5 days, it can be used effectively and frequently
- Usage of Jeevamrut helps increase the earthworm count in the soil; earthworm leads to a very porous quality soil which has a higher water holding capacity, improves aeration, bring up minerals from deep in the subsurface that are often in short supply in surface layers
- If used consistently it can eradicate the need for chemical fertilizers completely
- Improves the PH of the soil
- Suitable for all crops and increases the yield and cuts down on entire expenses of Chemical fertilizers.

For large quantities, it is (Jeevamrut) is prepared with following ingredients.

1. 1000 Liters of Water
2. 50 KG Indian/Desi Breed Cow Dung (It has been observed that the nutrient values found in Indian breed cows is much higher than the hybrid ones)
3. 50 Liters of Cow Urine (Gomutra)
4. 10-12 KG of Gram Flour (Besan) (Other Pulses flour can also be taken)
5. 10-12 KG of Jaggery (Gudh)
6. Two Handfuls of Soil taken from the roots of Banyan Tree (or any other old tree found close to the farm. This act as source of friendly bacteria and enzymes required for the good health of soil). The above ingredients should be stored in a cool place and away from sunlight. The mixture needs to be stirred couple of times (10 mins every time) for 4 days. The ingredients ferment and Jeevamrut is prepared for the use. This Jeevamrut can now be used for 2-3 days. Beyond the 8th day of preparation, the bacterial colonies in the liquid start reducing. It is beneficial to do a live mulching (mulching with help of grass, hay, sugarcane straw remains etc.) along with the Jeevamrut application. Mulching will help the earthworms (Gandul / Kenchua) to work in the soil till upper most layer bringing more porosity and minerals till the surface.

Hurdles faced with usage of Jeevamrut:

Jeevamrut is prepared from animal remains and naturally it has a very foul smell. Also, as it is in liquid state it isn't as easy to handle as the regular solid fertilizers. The liquid also, has a shelf life of not more than 10-12 days beyond which it isn't effective to be used. Due to these factors, Jeevamrut has to reach each crop quickly and consistently. It's drenching has to be at the roots of the plants. Farmers with smaller plots have tried to manually drench Jeevamrut, however labor turns out to be a major challenge. First, finding labor to work in such foul smell (which even animals get repelled from) is difficult and secondly, manual drenching on a consistent basis to an average plot of 5 acres will require 4-5 labor. The wages for the labor will be anywhere between Rs. 15-25,000. This takes out the feasibility out of this method of farming.

Overcoming the Hurdles:

The above hurdles can be overcome if we automate the Jeevamrut irrigation. The automation can be achieved using the existing drip / sprinkle irrigation on the farm to irrigate the entire crop. For this we will need to filter the Jeevamrut to remove all the suspended particles in it which can cause blockages/choking the nozzles of drip irrigation or sprinkle irrigation. There is a product named "Pruthviraj Jeevamrut Filter[2]" available for filtration of all organic slurry. With help of such product one can use Jeevamrut effectively and get rid of hazardous chemical fertilizers.

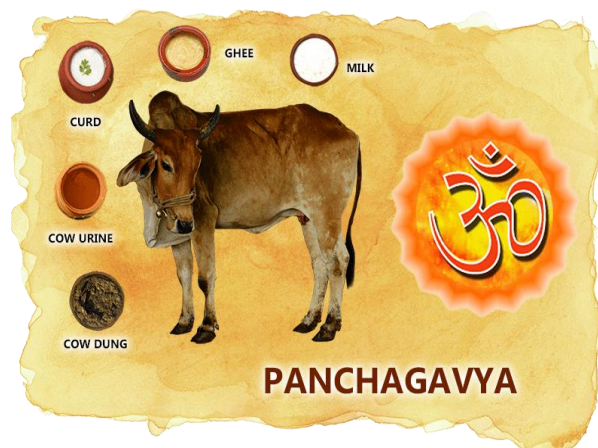
Source : AgriCult 18 January 2017 facebook

Each person can standardize the preparation of the product oneself based on the one's own experience in crop cultivation, considering the local conditions.

Panchagavya

Panchagavya, an organic product has the potential to play the role of promoting growth and providing immunity in plant system. Panchagavya consists of nine products viz. cow dung, cow urine, milk, curd, jaggery, ghee, banana, Tender coconut and water. When suitably mixed and used, these have miraculous effects.

1. Cow dung - 7 kg
2. Cow ghee - 1 kg
3. Mix the above two ingredients thoroughly both in morning and evening hours and keep it for 3 days
4. Cow Urine - 10 liters
5. Water - 10 liters
6. After 3 days mix cow urine and water and keep it for 15 days with regular mixing both in morning and evening hours. After 15 days mix the following and panchagavya will be ready after 30 days.
7. Cow milk - 3 liters
8. Cow curd - 2 liters
9. Tender coconut water - 3 liters
10. Jaggery - 3 kg
11. Well ripened poovan banana – 12 nos.



**Cow dung****Cow urine****Cow ghee****Milk****Water****Cow curd****Jaggery****Tender Coconut****Well ripened
poovan banana****Preparation :**

All the above items can be added to a wide mouthed mud pot, concrete tank or plastic can as per the above order. The container should be kept open under shade. The content is to be stirred twice a day both in morning and evening. The Panchagavya stock solution will be ready after 30 days. (Care should be taken not to mix buffalo products. The products of local breeds of cow is said to have potency than exotic breeds). It should be kept in the shade and covered with a wire mesh or plastic mosquito net to prevent houseflies from laying eggs and the formation of maggots in the solution. If sugarcane juice is not available add 500 g of jaggery dissolved in 3 liter of water.

Physico chemical and biological properties of Panchagavya**Chemical composition**

pH	: 5.45
EC dSm2	: 10.22
Total N (ppm)	: 229
Total P (ppm)	: 209
Total K (ppm)	: 232
Sodium	: 90
Calcium	: 25
IAA (ppm)	: 8.5
GA (ppm)	: 3.5

Microbial Load

<i>Fungi</i>	: 38800/ml
<i>Bacteria</i>	: 1880000/ml
<i>Lactobacillus</i>	: 2260000/ml
<i>Total anaerobes</i>	: 10000/ml
<i>Acid formers</i>	: 360/ml
<i>Methanogen</i>	: 250/ml

Physico-chemical properties of Panchagavya revealed that they possess almost all the major nutrients, micro nutrients and growth hormones (IAA & GA) required for crop growth. Predominance of fermentative microorganisms like yeast and lactobacillus might be due to the combined effect of low pH, milk products and addition of jaggery/sugarcane juice as substrate for their growth.

The low pH of the medium was due to the production of organic acids by the fermentative microbes as evidenced by the population dynamics and organic detection in GC analysis. Lactobacillus produces various beneficial metabolites such as organic acids, hydrogen peroxide and antibiotics, which are effective against other pathogenic microorganisms besides its growth. GC-MS analysis resulted in following compounds of fatty acids, alkanes, alconol and alcohols.

Fatty acids	Alkanes	Alconol and Alcohols
Oleic acids	Decane	Heptanol
Palmitic acid	Octane	Tetracosanol
Myristic	Heptane	Hexadecanol
Deconore	Hexadecane	Octadeconol
Deconomic	Oridecane	Methanol, Propanol, Butanol and Ethanol
Octanoic		
Hexanoic		
Octadeconoic		
Tetradecoic		
Acetic, propionic, butyric, caproic and valeric acids		

Beneficial effects of Panchagavya on commercial crops:

Mango :

1. Induces dense flowering with more female flowers
2. Irregular or alternate bearing habit is not experienced and continues to fruit regularly
3. Enhances keeping quality by 12 days in room temperature
4. Flavour and aroma are extraordinary

Acid lime:

1. Continuous flowering is ensured round the year, Fruits are plumpy with strong aroma ,
2. Shelf life is extended by 10 days

Guava:

1. Higher TSS, Shelf life is extended by 5 days, Banana,
2. In addition to adding with irrigation water and spraying, 3% solution (100 ml) was tied up at the naval end of the bunch after the male bud is removed. The bunch size becomes uniform. One month earlier harvest was witnessed. The size of the top and bottom hands was uniformly big.

Turmeric:

Enhances the yield by 22%, Extra long fingers, Ensure low drainage loss, Narrows the ratio of mother and finger rhizomes, Helps survival of dragon fly, spider etc which in turn reduce pest and disease load, Sold for premium price as mother/seed rhizome, Enriches the curcumin content

Jasmine:

Exceptional aroma and fragrance, No incidence of bud worm, Continuous flowering throughout the year

Vegetables :

Yield enhancement by 18% and in few cases like Cucumber, the yield is doubled
Wholesome vegetables with shiny and appealing skin, Extended shelf life, Very tasty with strong flavour, Generally panchagavya is recommended for all the crops as foliar spray at 30 % level (3 litre panchagavya in 100 litres of water).

Recommended dosage

Spray system : 3% solution was found to be most effective compared to the higher and lower concentrations investigated. Three litres of Panchagavya to every 100 litres of water is ideal for all crops. The power sprayers of 10 litres capacity may need 300 ml/tank. When sprayed with power sprayer, sediments are to be filtered and when sprayed with hand operated sprayers, the nozzle with higher pore size has to be used.

Flow system : The solution of Panchagavya can be mixed with irrigation water at 50 litres per hectare either through drip irrigation or flow irrigation

Seed/seedling treatment:

3% solution of Panchagavya can be used to soak the seeds or dip the seedlings before planting. Soaking for 20 minutes is sufficient. Rhizomes of Turmeric, Ginger and sets of Sugarcane can be soaked for 30 minutes before planting.

Seed storage

3% of Panchagavya solution can be used to dip the seeds before drying and storing them.

Periodicity:

1. Pre flowering phase : Once in 15 days, two sprays depending upon duration of crops
2. Flowering and pod setting stage : Once in 10 days, two sprays, Fruit/Pod maturation stage, : Once during pod maturation

Time of application of Panchagavya for different crops is given as follows

Crops	Time schedule
Rice	10,15,30 and 50th days after transplanting
Sunflower	30,45 and 60 days after sowing
Black gram	Rainfed: 1st flowering and 15 days after flowering Irrigated: 15, 25 and 40 days after sowing
Green gram	15, 25, 30, 40 and 50 days after sowing
Castor	30 and 45 days after sowing
Bhendi	30, 45, 60 and 75 days after sowing
Moringa	Before flowering and during pod formation
Tomato	Nursery and 40 days after transplanting: seed treatment with 1 % for 12 hrs
Onion	0, 45 and 60 days after transplanting
Rose	At the time of pruning and budding
Jasmine	Bud initiation and setting
Vanilla	Dipping setts before planting

Effect of Panchagavya**Leaf :**

Plants sprayed with Panchagavya invariably produce bigger leaves and develop denser canopy. The photosynthetic system is activated for enhanced biological efficiency, enabling synthesis of maximum metabolites and photosynthates.

Stem:

The trunk produces side shoots, which are sturdy and capable of carrying maximum fruits to maturity. Branching is comparatively high.

Roots:

The rooting is profuse and dense. Further they remain fresh for a long time. The roots spread and grow into deeper layers were also observed. All such roots help maximum intake of nutrients and water.

Yield :

There will be yield depression under normal circumstances, when the land is converted to organic farming from inorganic systems of culture. The key feature of Panchagavya is its efficacy to restore the yield level of all crops when the land is converted from inorganic cultural system to organic culture from the very first year. The harvest is advanced by 15 days in all the crops. It not only enhances the shelf life of vegetables, fruits and grains, but also improves the taste. By reducing or replacing costly chemical inputs, Panchagavya ensures higher profit and liberates the organic farmers from loan.

Drought Hardiness:

A thin oily film is formed on the leaves and stems, thus reducing the evaporation of water. The deep and extensive roots developed by the plants allow to withstand long dry periods. Both the above factors contribute to reduce the irrigation water requirement by 30% and to ensure drought hardiness.

Panchagavya for animal health

Panchagavya is a living elixir of many micro organisms, bacteria, fungi, proteins, carbohydrates, fats, amino acids, vitamins, enzymes, known and unknown growth promoting factors micronutrients trace elements antioxidant and immunity enhancing factors.

When taken orally by animals and human beings, the living micro organisms in the Panchagavya stimulate the immune system and produce lot of antibodies against the ingested microorganisms. It acts like vaccine. This response of the body increases the immunity of animals and humans and thus helps to prevent illness and cures disease. It slows down the aging process and restores youthfulness. The other factors present in Panchagavya improve appetite, digestion and assimilation and elimination of toxins in the body. Constipation is totally cured. Thus the animals and humans become hale and healthy with shining hair and skin. The weight gains are impressive.

Pigs:

Panchagavya was mixed with drinking water or feed at the rate of 10 ml – 50 ml/pig depending upon the age and weight. The pigs became healthy and disease free. They gained weight at a faster rate. The feed to weight conversion ratio increased tremendously. This helped the piggery owners to reduce the feed cost and to get very good returns due to increased weight.

Goats and Sheep:

The goats and sheep became healthy and gained more weight in a short period after having administered 10 ml to 20 ml Panchagavya per animal per day depending upon the age.

Cows:

By mixing Panchagavya with animal feed and water at the rate of 100 ml per cow per day, cows become healthier with increased milk yield, fat content and SNF. The rate of conception increased. The retained placenta, mastitis and foot and mouth disease became things of the past. Now the skin of the cow is shiny with more hair and looks more beautiful. Instead of spraying urea on paddy straw (hay) before staking, a few farmers sprayed the 3 percent solution of Panchagavya, layer after layer during the staking and allowed it to ferment. The cows preferred such hay compared to unsprayed hay stock.

Poultry:

When mixed with the feed or drinking water at the rate of 1 ml per bird per day, the birds became disease-free and healthy. They laid bigger eggs for longer periods. In broiler chickens the weight gain was impressive and the feed-to-weight conversion ratio improved.

Fish:

Panchagavya was applied daily with fresh cow dung in fish ponds. It increased the growth of algae, weeds and small worms in the pond, thus increasing the food availability to fish. The only precaution is that fresh water must be added to the ponds at frequent intervals. Otherwise, the growth of algae, weeds and other organisms will compete with the fish for available soluble oxygen in water. Alternatively, mechanical agitators can also be used to increase the oxygen content in the water. In ten months time each fish grew to a weight of 2 to 3 kgs. With reduced death rate of small fingerlings and increased weight of marketable fish, the fisheries became more profitable.

(Source : Selvaraj, N., B. Anitha, B. Anusha and M. Guru Saraswathi. 2007. *Organic Horticulture. Horticultural Research Station, Tamil Nadu Agricultural University, Udhagamandalam-643 001*)

Dashparni Ark : An organic Pesticide.

It is also commonly used in the organic farming for the management of pests and disease of crops.

Required Ingredients are presented in the following table.

S.No.	Ingredient Name	Qty in Litres/Kgs/Nos
1	Vembu (Neem) Leaves	5 Kgs
2	Unni chedi (Lantana camara) Leaves	2 Kgs
3	Pungam (Pongamia pinnata) Leaves	2 Kgs
4	Arali (Indian Oleander) Leaves	2 Kgs
5	Kattamanakku (Jatropha) or Amanakku (Castor) Leaves	2 Kgs
6	Shindilakodi (Tinospora cordifolia) Leaves	2 Kgs
7	Seetha Pazham (Custard Apple) Leaves	2 Kgs
8	Erukkan (Calotropis gigantean) Leaves	2 Kgs
9	Pappali Pazham (Papaya) Leaves	2 Kgs
10	Nochi (Vitex Negundo Linn) Leaves	2 Kgs
11	Cow Urine	5 Litres
12	Cow Dung	2 Kgs
13	Water	170 Litres

Method of Preparation

1. Take a 200 Litre vessel (either plastic drum or similar ones).
2. Pour the Water first.
3. Submerge all the 10 different leaves in the water.
4. Pour the Cow Urine and Cow Dung on top of the submerged leaves.
5. Mix them well and leave it for 5 days.
6. On the Sixth Day, add 5-7 litres of water and again mix all the contents in the vessel.
7. Leave the same as it is for a month.
8. The Dashparni Ark is ready to use after filtering it.

Method of Storage

The pesticide should be kept in the shade and covered with a wire mesh or plastic mosquito net to prevent houseflies from laying eggs and the formation of maggots (worms) in the solution. This is applicable during the preparation as well as during the shelf life of the pesticide as well.

How long can we store the Pesticide?

The pesticide can be stored for 4 months in good condition.

How to use the Pesticide?

Spray System - The pesticide can be applied as a foliar spray.

- Dilute **125 ml** of the pesticide with **10 Litres** of water or
- Dilute **2.5 Litres** of the pesticide with **200 Litres** of water for One Acre.

Ref : <http://agricultureforeverybody.blogspot.in/2016/06/pesticides-dashparni-ark.html>

Plant Protection

- a. Cow urine: old cow urine diluted with water in ratio of 1:20 and used as foliar spray is not only effective in the management of pathogens & insects, but also acts as effective growth promoter for the crop.
- b. Fermented curd water: in some parts of Central India fermented curd water (butter milk or Chaah) is also being used for the management of white fly, jassids, aphids etc.

Dashparni extract

Crush following plant parts in a 500-lit drum. Take Neem leaves-5 kg, *Vitex negundo* leaves-2 kg, Aristolochia leaves - 2 kg, Papaya (*Carica papaya*)-2 kg, *Tinospora cordifolia* leaves-2kg, *Annona squamosa* (Custard apple) leaves-2 kg, *Pongamia pinnata* (Karanja) leaves-2 kg, *Ticinus communis* (Castor) leaves- 2 kg, *Nerium indicum*- 2 kg, *Calotropis procera* leaves-2 kg, Green chilly paste-2 kg, Garlic paste-250 g, Cow dung-3 kg, Cow urine-5 lit, Water-200 lit. Crush all the ingredients and ferment for one month. Keep the drum in shade and covered with gunny bag. Shake regularly three times a day. Extract after crushing and filtering. The extract can be stored up to 6 months and is sufficient for one acre.

Some broad-spectrum botanical pesticides

Neemastra:

Crush 5 kg neem leaves in water, add 5 lit cow urine and 2 kg cow dung, ferment for 24 hours with intermittent stirring, filter squeeze the extract and dilute to 100 lit, use as foliar spray over one acre, useful against sucking pests and mealy bugs.

Brahmastra:

- Crush 3 kg neem leaves in 10 lit cow urine.
- Crush 2 kg custard apple leaf, 2 kg papaya leaf, 2 kg pomegranate leaves, 2 kg guava leaves in water.
- Mix the two and boil 5 times at some interval till it become half
- Keep for 24 hrs, then filter squeeze the extract. This can be stored in bottles for 6 months.
- Useful against sucking pests, pod/fruit borers.
- Dilute 2-2.5 lit of this extract to 100 lit for 1 acre.

(Source : http://agritech.tnau.ac.in/org_farm/orgfarm_ofk_pltprotection.html)

(Source : Selvaraj, N., B. Anitha, B. Anusha and M. Guru Saraswathi. 2007. *Organic Horticulture. Horticultural Research Station, Tamil Nadu Agricultural University, Udthagamandalam-643 001*)

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Chapter - 21

Vermicomposting

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What is Vermicomposting?

It is an art and technology of rearing earthworms to convert organic wastes into rich and useful manure with numerous advantages. It can be easily done as household/ colony activity or can be pursued as a small scale enterprise to bring handsome returns to the owner by disposing off and utilizing waste in a eco friendly manner.

Species:

Earthworms are broadly divided into three classes namely surface feeders (Epigeic), deep burrowers (Endogiec) and the intermediate species (Anaciec). In vermiculture, mostly surface feeders are widely used. Some of the efficient species used in vermiculture are Eisenia Foetida, Perionyx excavates and Eudrillus euginae.

ICAR - Krishi Vigyan Kendra recommends Eudrillus euginae due to its better adaptability, high conversion rate, high fecundity and superiority in comparison to other species followed by Eisenia Foetida, under the agro- climatic condition of Goa.

Requirements:

To start vermiculture, one should get culture from reliable source. Vermiculture can be done in any container with drainage hole. The ideal feed consists of 80% bio degradable agro waste/biomass and at least 15-20% fermented cow dung for rapid conversion of the waste.

Precautions:

Care however should be taken to protect the earthworms from its enemies like ants, lizards, cockroaches, termites, rats, etc. by providing barrier of water channel around the unit. Other pre requisites like shade, moisture and continuous feed stock with 15-20% fermented cow dung for rapid bio conversion should be ensured.

Procedure:

Start filling container or tank installed in a shady place with

1. Basal layer of gravel followed by sand and soil each of 2-3 cm and profuse watering.
2. Thick layer of slowly degrading material like coconut husk and cow dung slurry and well rotted cow dung.
3. Introduce the earthworm culture @ 0.5-1kg for every running meter of the tank. For small containers, 150-200 gm culture is sufficient.
4. It is advisable to pre-digest the waste by keeping it in sun and watering intermittently. Never feed fresh waste as it may generate heat and cause earthworm mortality.
5. Gradually fill the container or the tank by layers and ideally keep a ratio of 4:1 (plant: animal waste) which will ensure quality compost.

For outdoor units, a twin of convenient length and 2.5 to 3 ft height and 0.9 mt width is ideal for harvesting the compost. It is advisable to plaster the ground and provide water channel all around the unit to ward off chances of infestation with ants and other nocturnal enemies. A shade is provided to the entire unit to protect it from sunlight. Normally, height of 8 ft at the centre is suggested.

Population Dynamics:

Earthworms are hermaphrodites and prolific breeders. After mating, each worm lays a capsule containing on an average three juveniles. The cocoons hatch in 13 – 17 days and turns into adult in 4-6 weeks time. Each earthworm on an average may give rise to 250-300 young ones/ year depending on the temperature and other local factors.

Stages in Vermicomposting:

The stages in vermicomposting are predigestion, feeding, harvesting, vermicomposting, sieving and bagging. The earthworms voraciously feed on the bio degradable waste material and convert it into black mass within a period of 35-45 days under ideal conditions. Formation of granular vermicast on the surface of the filled tank is an indication of full conversion of waste into value added vermicompost.

For a ideal unit the conversion rate of 65% is achieved during this period. (i.e. 100 kg of waste turns into 60-65 kg of quality vermicompost.)

Harvesting:

It is necessary to separate the earthworms/juveniles and cocoons from the compost and this is achieved during harvesting stage. The wet vermicompost should be heaped for 3-5 days and allowed to dry by running fingers from bottom to top. Any cocoon, juvenile or adult should be transferred in a container with cow dung. The earthworms do not like light and therefore gather at the house in form of a ball entangled together. They can be reused for further composting.

Composition:

The quality of vermicompost depends on the raw material used for feeding. The nutrient present in the vermicompost are easily soluble in water and easily available to the plants. It is a rich source of not only nitrogen, phosphorous and potash but also a store house of many micronutrients, vitamins, antibiotics, enzymes like Protease, Amylase, Lipase, Cellulose, Chitinase, which helps in disintegrating organic matter, it also contains Calcium humate, which stabilizes the soil and check erosion. Growth promoting hormones like cytokines and auxines and other useful micro flora, which is so vital for healthy plant growth. It also contains Vitamins of B group or pro vitamins D or free Amino acids besides antibiotic and antibacterial substances.

What does vermicompost do?

1. It helps to aerate the soil.
2. Improves water holding capacity of soil.
3. Higher cation exchange capacity helps in nutrients uptake.
4. Release antibiotic and anti bacterial substances which gives disease and pest resistance to the crop.
5. Improves intake rate of water by 50% and water holding capacity of soil by 17%.
6. Supplies micro nutrients in available form.

How to use vermicompost?

Household plants	250-300 gm/pot
Horticultural crops/orchard	5-10 kg/plant
Field crops like vegetables/flowers	2-3 t/ha

How to know genuineness?

To test the spurious product, dissolve some vermicompost in a glass beaker containing water and stir it. Leave it undisturbed for 5-10 minutes. Two distinct layers of water and vermicast can be seen without turbidity. In case of spurious material water becomes turbid.

Vermiwash Preparation:

Vermiwash unit can be prepared in any container or drum for which an outlet is provided at the bottom with a tap. The layers in the unit are same as that of vermicomposting unit. The unit is moistened every day keeping the tap open for 20-25 minutes. The unit is ready on the 16th day. The tap is closed and on top of the unit a 5 litre vessel water with perforations is allowed to gradually sprinkle water. The tap is opened next day to collect Vermiwash.

Vermiwash is a potent nutrient as well as bio pesticide with many beneficial enzymes, hormones, bacteria, calcium humate and other microflora which can be used as soil drench and spray after diluting it in the ratio 1:50 for big plants and 1:100 for small plants. Plant growth promoters like cytokinin and auxins, vitamins of B group or pro vitamin D or free amino acids, antibiotic and anti bacterial substances.



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