

GAUSHALA

This is the first composite manual on Gaushala management. From building to effective management, veterinary medicine and sustainable economic ideas, the manual is a tool for all those who want to make new Gaushalas and those who want to remodel theirs so that these shelters become true homes for needy animals.

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Many people who start and run Gaushalas believe that simply confining cattle in an enclosure and putting feed, fodder (dry and green) and water for them is all they have to do. This is not so and the incredibly high mortality rate of each Gaushala cannot be explained away by simply saying that the animals were in poor condition when they arrived.

In most Gaushalas, the animals are kept very poorly. They stand in the open during rain, hot sun or cold. There is usually overcrowding and the animals cannot move freely. The food is either inadequate or placed in such a way that only the dominant/aggressive animals get it. It is usually the cheapest dry hay. The water trough is badly placed. Sewage/drainage systems do not exist and the animals stand in their own faeces, which to us is "useful gobar", but to them is simply the discard of their bodies. Their feet become infected, they cannot sit or stand and they die quickly from decreased immunity and increased infection.

Most Gaushalas do not even have a veterinarian or a surgical unit. If an animal falls down, it stays down till it dies. The unqualified staff have no idea of how to even diagnose the problem. A Gaushala may have a mandir in it venerating the cow, but it rarely has a sickbay in which the animal is treated.

Cattle kept in Gaushalas are rarely segregated and calves wander between the large animals and are seldom allowed access to feed and fodder. Bulls mount cows even if they are not in heat, often killing them.

After some time, Gaushalas degenerate into semi dairies. The group controlling the Gaushala starts segregating the milking cows from the old and sick ones. These are fed better, made to breed and the milk is collected and distributed among these people. The calves are often sold on the sly to butchers.

Gaushalas are also discriminatory in receiving animals. They will take cows but not bullocks or bulls. The males are accepted only after payment in the form of donation and at times, the animals are again set free to not come back at night. They will not take buffaloes, which are equally badly treated and form the greater part of animals that are taken for illegal slaughter.

This manual has been produced in order to make Gaushalas, which are essentially hospital/shelters for large animals especially cows, more sensitive to the needs of the animals that are sought to be "saved". We have given pointers on how to make Gaushalas financially viable.

This is the only manual of its kind. It has taken two years to put together. I wish I could say that we saw some really good Gaushalas while we were researching it but, alas, while some were better than others, none of them were truly gentle, loving homes for animals that need professional care. It is not good enough to simply put cows into pens and pat yourself on the back. It must be ensured that they are happy to be there. I hope this manual will help make conditions better for these poor unfortunates.

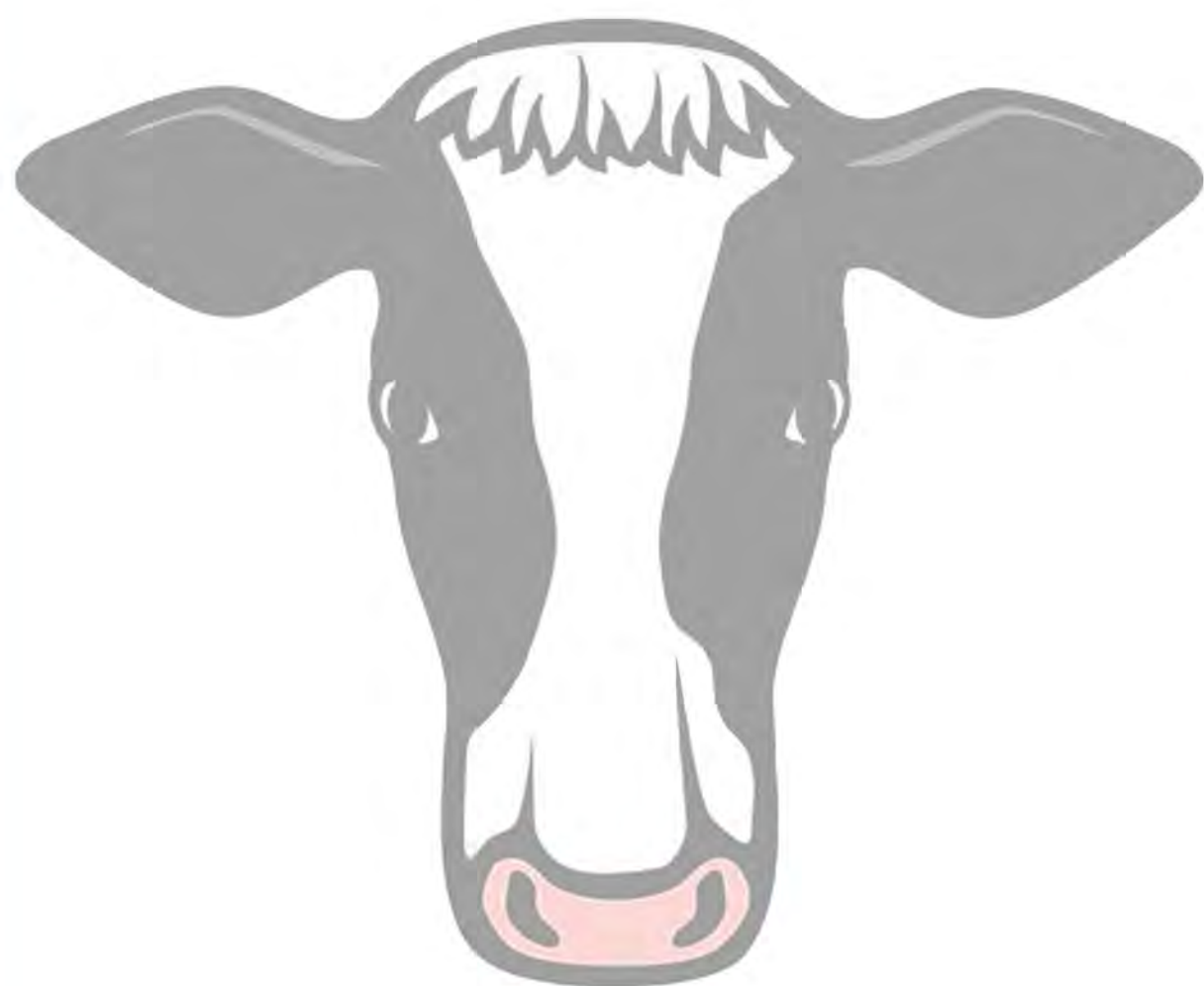
Manela Sanjay Gandhi



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1 | INTRODUCTION

Gaushala literally means home for cows and is meant to rescue, shelter, protect, feed, treat and rehabilitate weak, sick, injured, handicapped and abandoned homeless cattle. These are the institutions of India's great cultural heritage giving concrete example of India's reverence and affection for animals, particularly for cows.



Worshipping the bull–Bail Pola festival, Maharashtra.

The origin of Gaushalas can be traced back to the Vedic period when social customs and rules laid great emphasis on protection and development of cows for home and oxen for agricultural work.

Presently there are more than five thousand Gaushalas in India. They house over six lakh cows maintained at an annual cost running into thousands of crores. Most of the Gaushalas are being run as charity institutions. The resources of these Gaushalas differ widely in respect to the number and quality of cattle in them, availability of land, their finances and organisation.



Overcrowding in a Gaushala and cattle killed in a Gaushala due to faulty drainage. Cow slaughter and cow killed in Gaushalas mismanagement are two sides of the same coin.

The major challenges faced by Gaushalas are similar i.e. inadequate resources, lack of trained manpower and empathetic veterinarians. The animals in Gaushalas are old, infirm and maintaining their health is a challenge. Management personnel, do not have a proper scientific knowledge of feeding, housing, care and management of these animals.

In addition to this, most Gaushalas do not have the required land for proper housing and grazing of their animals. Since fodder and pasturage are also deficient in these Gaushalas, a large number of cows are kept in a state of semi starvation and disease.

It has been realised that institutions with better organisation and management can be self sufficient centres for the welfare for cows, turning Gaushalas into home than prison.

The five freedoms to aim for a Gaushala are:

- (1) Freedom from hunger and thirst by ready access to fresh water and a diet to maintain full health and vigour.
- (2) Freedom from discomfort by providing an appropriate environment including shelter and comfortable resting area.
- (3) Freedom from pain, injury and disease by prevention or rapid diagnosis and treatment.
- (4) Freedom to express normal behaviour by providing sufficient space, proper facilities and company of the animal's own kind.
- (5) Freedom from fear and distress by ensuring conditions and treatment, which remove mental suffering.

These five freedoms can act as a checklist of ideal conditions by which we can assess strength and weakness of any Gaushala and work on their improvement.

The problem is that Gaushalas are run like charities and exist mainly on random donations. Also cattle are seen only as productive when they produce milk. However if a Gaushala were to be a thriving business on its own, doing good and making money this would help the cows and change the perspective of people and policy makers who see dry cattle as a nuisance and simply as charity cases due to religion.

A dry cow is an extremely useful resource just for its dung and urine, and the existence of a good efficient Gaushala boosts the fertility of the land, increases crop yields and makes farming more lucrative and healthier by removing the need for pesticides and fertilizers.

A Gaushala was a common installation in every village. It needs to be revived and seen as an essential part of Indian agricultural rejuvenation.

The need of the hour is to open more modern Gaushalas and to strengthen and upgrade the existing Gaushalas so that all free roaming cattle are accommodated properly and their well-being and welfare can be ensured. Gaushalas, once considered as an economic drain today have a lot of potential for production of bio-fertilizers, organic pesticides and insecticides, organic energy, methane gas, panchgavya and other medicines. These



"The question is not, "Can they reason?" nor, "Can they talk?" but "Can they suffer?"

have huge potential to become self-sustainable economic units by bringing about improvement in breeding, feeding, housing and healthcare of animals along with proper cattle waste utilization.

In this manual, an effort has been made to present standard and practical information on the scientific aspects of housing, feeding, healthcare and waste utilization in a simple and precise form. Comprehensive plans for reorganisation and improvement of existing Gaushalas along with setting up of new Gaushalas have also been extensively discussed.



Fig 1. Layout of Gaushala for Housing 500 cattle

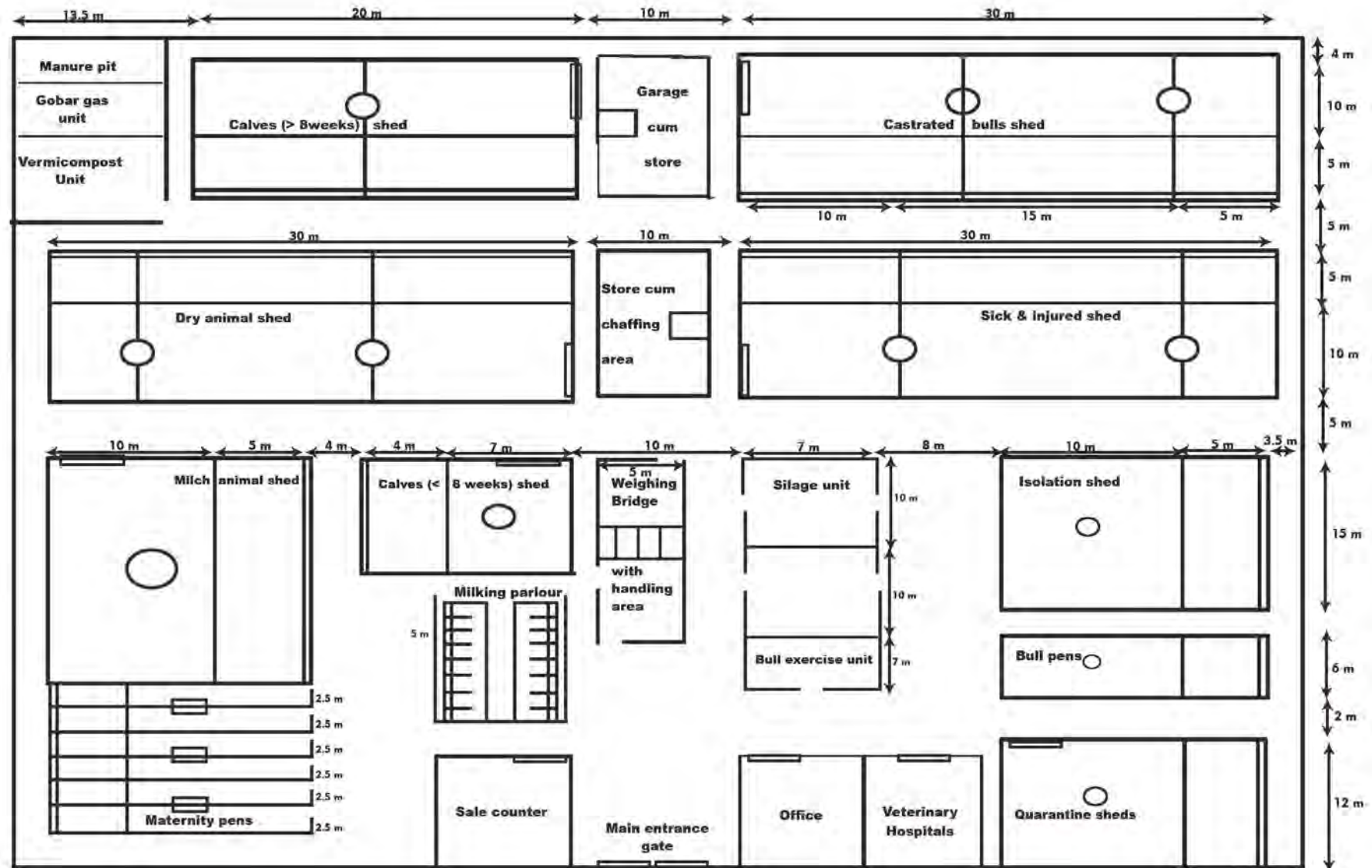
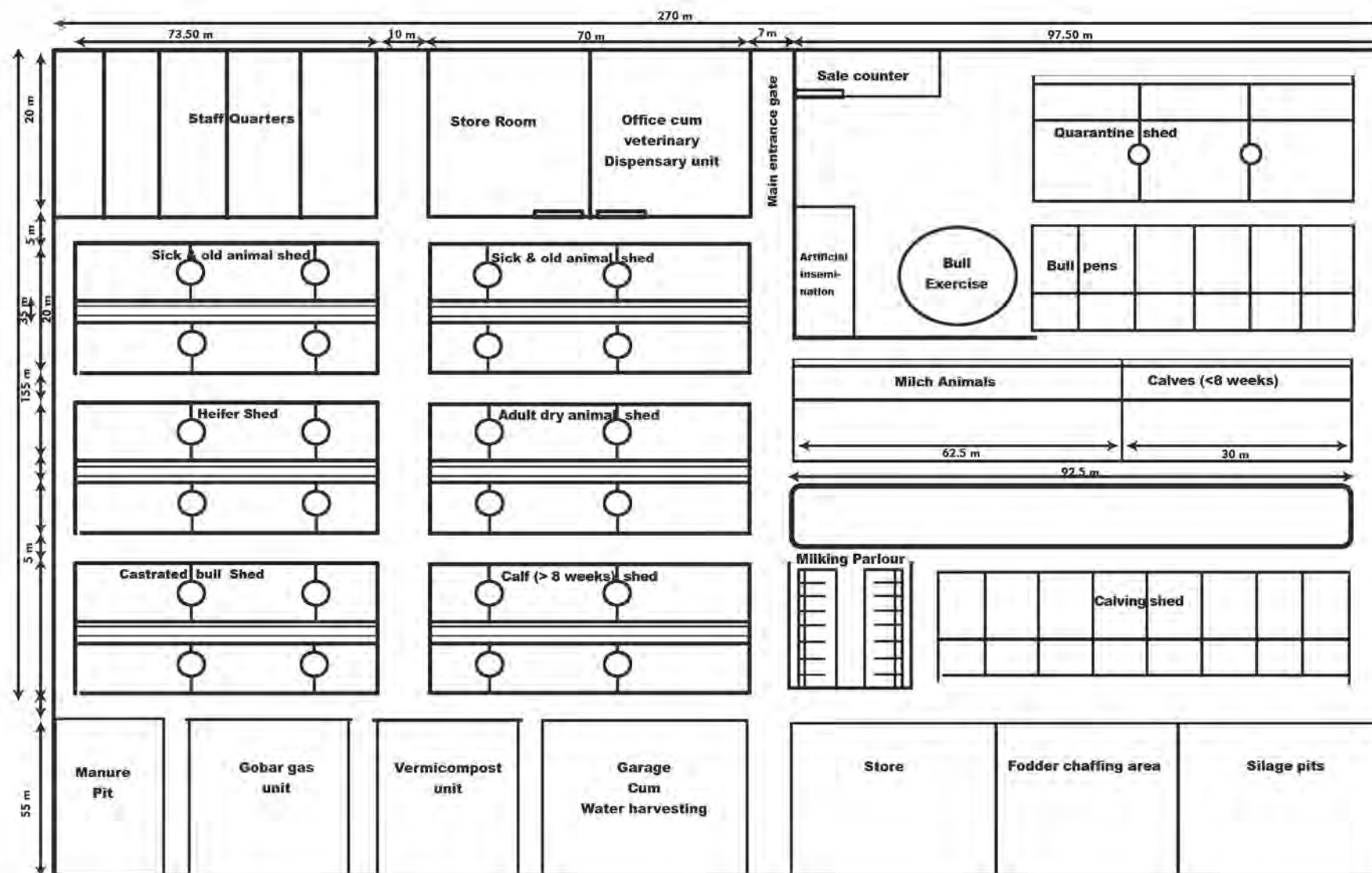


Fig 2. Layout of Gaushala for housing 3000-5000 cattle



2 | HOUSING FACILITIES

Gaushalas are set up to rescue and take care of cattle that has been abandoned or illegally sent for slaughter. Feeding, watering, medical care, maintaining better hygiene and welfare along with providing comfort and protection from inclement weather to the cattle are the primary functions of a Gaushala.

This section lays out guidelines for building Gaushala facilities suiting different climatic conditions.

Layout of Gaushala

The layout of a Gaushala is intended to show the size, number and location of different functional units, which would cater best to the requirements of cattle as well as ease of labour for staff. The layout primarily depends on the herd strength and the land available for construction of different facilities. Attention to details of location and structure has a great effect on the health and comfort of cattle as well as keeping the cost of construction and maintenance low.

A. Land requirement

For opening or running a Gaushala of 500-800 animals effectively, a minimum space of 1.5-2.0 acres is required. Similarly, opening or running a Gaushala of 2500 and 5000 animals effectively requires a minimum space of 5 and 10 acres, respectively. Suitable layouts for Gaushala of different sizes (500-800 cattle and more than 3000-5000 cattle) are given in Fig. 1 and Fig. 2.

B. Important considerations in layout of Gaushala

1. In order to provide maximum comfort and welfare of residing animals, diseased, blind and recumbent (lying/collapsed) animals should be housed in separate sheds. Recumbent and blind animals are house separately in order to prevent injuries. Animals with diseases (eg. Tuberculosis, Foot and mouth disease, Haemorrhagic septicaemia) that spread quickly require to be housed in isolation quarters.
2. Pregnant and young animals should be housed in separate sheds for their safety.
3. In order to save labour, lactating animals may be housed separately. However, if the number of animals are low they can be housed with other animals.
4. Quarantine sheds should be located at the entrance of the Gaushala. New entrants, rescued and rehabilitated cows, and those from a place where they may have been exposed to the risk of infection, must be quarantined for 15 days to 1 month to detect any disease before they are allowed into the herd.

Selection of Site for Setting up a New Gaushala

Most Gaushalas are built on donated land and there is very little scope for negotiation regarding the choice of land. Nevertheless, while planning to set up a new and ideal

Gaushala the choice of location should be the first consideration and emphasis should be made on the below mentioned points regarding selection of site.

A. Location and Shape

Ideally, a Gaushala should be located near a city so that facilities are easily accessible and there is an assured market for Gaushala products like milk, panchgavya, gobar gas, vermi-compost manure and other materials produced with the aim of making Gaushalas self-sufficient. Instead of being in the heart of an urban area, a small distance from it is preferable. Villages close to cities, on highways leading into cities are ideally suited for setting up Gaushalas.

Proximity to forest and grazing/agricultural land are also beneficial features that can be taken into account while selecting a site for the Gaushala. Besides providing a calm and noise free environment, cost of feeding would reduce substantially.

B. Availability of water

Water must be available round the year, and it must be plentiful at the site of Gaushala. Water level and its quality should not be overlooked while selecting site as contaminated water can be a potential cause of health issues.

The water pH (levels of acidity) should fall between 5.5 and 9.0, which is conducive to the health of both cattle and humans.

C. Topography

The land on which the Gaushala is proposed to be built should not have uneven, undulating or abrupt slopes as it increases the cost of setting up of the Gaushala. The facility should be at a higher elevation than the surrounding ground to allow for drainage.

The land to be selected for setting up of Gaushala should be porous with gentle slope so that drainage of rainwater as well as waste from various management activities is efficient, and the Gaushala remains dry.



Cow drinking water from a water trough. The water in the trough has not been changed and green algae has formed.

D. Connectivity

The site for construction of the Gaushala should be located near an all weather concrete or tar road ensuring round the year connectivity for ease of working staff, volunteers and devotees reaching the Gaushala. Poorly developed or bad roads will stop them from making regular visits to Gaushalas and offer their services.

In addition to this, commute time for staff increases with poor connectivity and



Buildings should be placed and constructed such that direct sunlight can reach the platforms, gutters and mangers in the cattle shed.

management will end up in paying extra salary to staff to start living in the Gaushala itself or somewhere nearby.

E. Sun exposure and wind protection

In hot and humid areas an ideal site will allow buildings to be placed such that direct sunlight can reach the platforms, gutters and mangers in the cattle shed without increasing the ambient temperature inside the cattle house. Sunlight is a disinfectant.

In cold areas, Gaushala buildings should be located at a site having maximum sun exposure on the north and south sides. They must protect the cows from the winds. A Gaushala building site with as many trees as possible around it is ideal, as trees act as windbreaker along with providing natural shade.

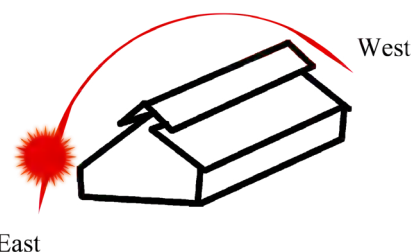


Direct sunlight reaches the fence line feed manger of the cattle shed, while the area under the shed is perfectly shaded. Direct sunlight acts as a disinfectant decreasing the number of disease-causing micro-organisms.

F. Orientation of sheds

Gaushalas in tropical and subtropical climates of India should be such that they efficiently protect cattle from extreme heat, i.e. soaring temperatures, and particularly from direct sunlight. Providing shade becomes an important factor.

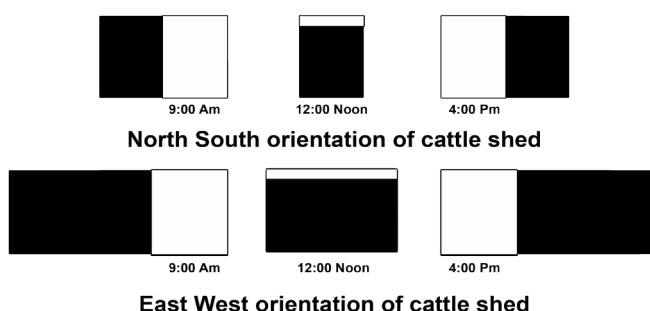
In places with prolonged summers, longitudinal axis of cattle sheds should be in east to west direction. Only then, some part of the floor under the roof will be in shade through out the day.



East-West orientation of cattle sheds is best suited for Gaushalas in hot areas.

This shaded area should be paved with concrete to keep the animals dry and hygienic.

In colder parts of India, the longitudinal axis of cattle sheds should be in north to south direction. With the north-south orientation, every part of the floor area under and on either side of the roof will receive sunlight at some point of time during the day.



Diagrammatic representation of North South and East West orientation of cattle shed showing position of shaded area at 9:00 AM, 12:00 Noon and 4:00 PM, respectively. While some part of the shed would always be under shade in case of East West orientation, North South orientation ensures maximum sun exposure.

Also, if paving the shaded area under sheds with concrete is not possible, the north-south

orientation is the best choice in order to keep the area as dry as possible. This will help to keep the animals dry, warm and more hygienic. North south orientation of sheds will be better for cattle in cold areas of country because:

- This facilitates drying of ground under sheds more easily thus aiding in better sanitation.
- Animals can easily move towards the shade side of the shelter (which is west side before noon and east side after noon).

Questions to be taken care of before site selection: -

1. Should the land be leased or purchased? Does the site have room for expansion?
2. Is the site located on high ground with good natural drainage?
3. Can the site be easily reached by public transport? This may be important for staff and visitors.
4. Water/drainage/electricity connectivity of Gaushala and at what cost?
5. What building materials are readily available in the area?
6. What materials are recommended suitable as per local climatic conditions?
7. Should you convert an existing building or build a new one? Upgradation may be cheaper, but may not be as comfortable as a new Gaushala.
8. What is the cooperation level of local people?
9. How will you dispose of the cow dung?

Cattle Housing

Keeping in view the diversity, in terms of the types of cattle and environmental conditions, the loose housing system can be used throughout India with slight modifications, alterations, additions and deletions according to the specific needs of the area in question.

Loose house system

In this housing system, cows are kept loose throughout the day and night. The animals are more comfortable as they can move about freely, are not restrained and can exercise at will. In it, an open field is provided with a shelter along one side under which the animals can rest when it is very hot and which protects them from rains and cold weather. This housing system has a continuous manger (feed bunk) for feeding under



Each loose house pen holds about 80-100 cows and is cared for by one family at Shree Pathmeda Godham Mahatirth in Rehsil, Rajasthan. The cows are housed with appropriate stocking density but the landscape is devoid of any tree plantation for the comfort of the animals.

sheltered standing space, and a common water trough in unsheltered space. Feeding and management of cattle is easier in it because of common feeding and watering arrangement. The loose house is enclosed by means of walls, iron railings or plain-wire fence.

Generally, 1/3rd of the total area should be provided with shelter while 2/3rd is kept open/unsheltered. But, if the stocking density is high and large number of animals are to be housed in the Gaushala, the area under shelter may be increased to half of total area.

Planting shady trees inside the loose housing would reduce the requirement of area under artificial shade to 1/10th of total fenced area as compared to minimum requirement of 1/3rd in treeless conditions. Trees reduce the ambient air temperature beneath the canopy.

The loose house is the system of choice for housing cattle in Gaushalas throughout India except in the Himalayan region.

Space Requirements For Animals

The Indian Standards Institute (ISI) has brought out certain standards of space requirements for farm animals. Although, these standards are for dairy houses, the dimensions of Gaushala sheds can be similar, incorporating need-based modifications.

A. Floor Space Requirement

The cattle enclosure should give them enough space to move around, interact with each other, move away from the dominant ones, lie down and rest for as long as they want.

The floor space requirements of cows under loose housing system is given in Table below.

Sr. No.	Type of animal	Floor space per animal (metre ²)	
		Covered area	Open area
1	Calves	1.5	3.0
2	Heifers	2.0	4.0
3	Adult cows	3.5	7.0
4	Pregnant cows	12.0	24.0
6	Bulls	12.0	24.0
7	Buffaloes	4.0	8.0

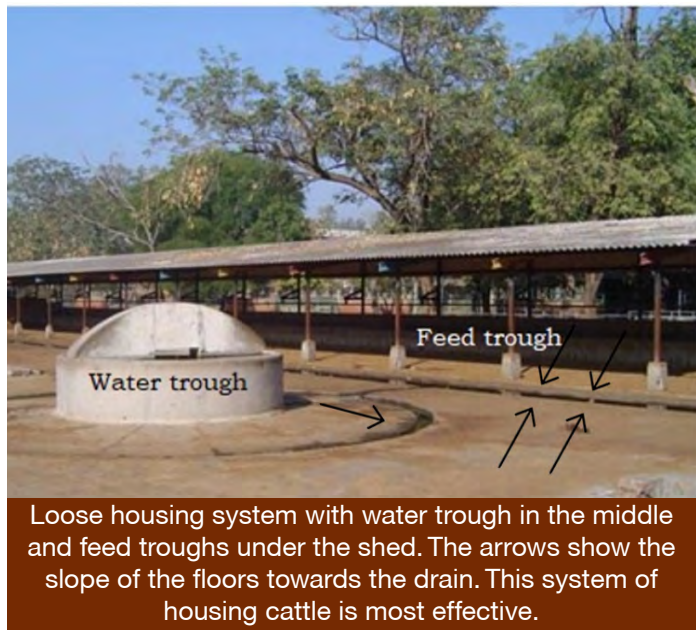
B. Feeding and Watering Space Requirement

Dimensions of mangers and water troughs should be such that animals of all categories have a free access to these. Feeding and watering space requirement for different categories of cattle in Gaushala:

Type of animal	Space per animal (feet)	Total manger length in a pen for 100 animals (feet)	Total water trough length in a pen for 100 animals (feet)
Adult cattle	2.0-2.5	200-250	20-25
Heifers	1.5-2.0	150-200	15-20
Calves	1.3-1.6	130-160	13-16

Manger length depends on the feeding schedule. If green fodder is given once or twice daily, the cattle will rush to eat it. Therefore, the length of the manger has to be long so that all the animals can eat at the same time without aggression. However if green fodder is part of the food the entire day then different cows will eat at different times and the manger length can be shorter.

Generally, all the animals in a pen may feed at the same time, but all animals don't drink water simultaneously. Thus, while the length of the manger should be sufficient to provide enough feeding space for all the animals in the pen, it will be sufficient if the length of water trough is provided for only 10 per cent of the animals in that pen.



Loose housing system with water trough in the middle and feed troughs under the shed. The arrows show the slope of the floors towards the drain. This system of housing cattle is most effective.

C. Space Requirement for Waste Disposal

Well fed dairy cows produce 20-30 kg of dung per day. A weak Gaushala animal will not produce less than 20 kg if fed properly. This dung has to be gathered and stored. Roughly, an average of 2 cubic metres is required to store the dung of a cow. Which means that two manure pits are needed with a size of 20 metres X 15 metres with a depth of a minimum 2 metres in order to accommodate the dung of 500-800 animals for three months. This manure has to be emptied every three months and can be sold or given away to farmers.

D. Space Requirement for stores

The stores at the Gaushalas will be required for storing concentrate feed, dry fodder and equipment.

Approximate storage space (cubed metres or volume) required per quintal for different types of feeds and fodder has been given in Table.

Hay (Loose)	1.60
Hay (Baled)	0.70
Hay (Chopped)	0.60
Straw (Loose)	3.00
Straw (baled)	0.70
Bran	0.50
Grain and oil cakes	0.17

The space for construction of stores is further determined on the presumption that 0.2 m³ storage space is required per adult animal in the Gaushala. Building stores based on these approximations checks wastage of storage space (excessively large stores) as well as the requirements for expansion due to inadequate space.

Maximum number of animals in a shed in relation to social heirarchy

Cows are highly social animals and naturally form groups. Males and females tend to form separate groups, except during the breeding season, and the young calves tend to form small groups in the proximity of the female group. Within their groups, these herd animals engage in complex interactions to communicate dominance, subordination and peer bonding within the group. They have a strict linear hierarchical structure with the most dominant animal at the top.



Picture of overstocked cattle shed in a Gaushala. It could also be injurious to the caretakers working in such cattle sheds.

In addition, when new adult cattle are rescued/adopted and introduced into a Gaushala, adult animals meeting for the first time are likely to fight to establish dominant/subordinate relationships amongst themselves.

The groups formed can live in perfect harmony as long as each animal knows its place and gives way to animals of higher rank. However, the order is not static and bound to change with cattle of lower rank in later stage of life dominating others whose position is normally higher, and fast-growing and maturing animals may move up the ladder of social order.

The introduction of new animals into a group or the mixing of groups will normally lead to fighting until a new social order is established, and this may cause a growth check as well as injury to them.

The building layout must allow space for this and therefore narrow passages and corners where an aggressive dominant animal can trap another animal should be avoided in pens and yards. The order usually remains stable provided the group is small so that all animals in it can remember the positions of the others, i.e. fewer than 80 in case of cows. However, ISI standards are much lower than 80 and vary according to the category of animal to be housed. Though flexibility can be shown in case of category of animals that are housed in groups, bulls and pregnant animals (15 days prior to giving birth) should be housed singly. Since no Gaushala has the luxury of housing single animals in a pen and it is cruelty to the animal as well, it is advised that all bulls should be castrated on entry as soon as they are strong enough to withstand the operation. This reduces or eliminates aggression.

Sr. No.	Type of animal	Maximum number of animals per shed
1	Calves	30
2	Heifers	30
3	Adult cows	50
4	Pregnant cows	1
6	Bulls	1
7	Buffaloes	50

Construction details of various structures\buildings in a Gushala

Any building construction starts from foundation and rises gradually from floors, plinths to walls and roofs. An ideal Gaushala should have the following buildings and structures necessary for the proper care and management of cattle population of different categories.

A. Primary cowshed

1. Roof

The roof of the cowshed in Gaushala should be light, strong, durable, weather proof, a bad conductor of heat and free from the tendency to condense moisture inside. It is obviously the most important part of the cowshed, as it provides protection from weather conditions, notably rain, frost, snow and direct sunlight.

Types of roof:

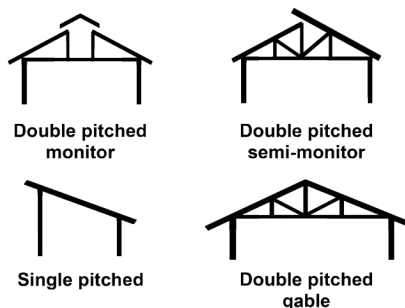
There are two types of roofs: Sloping and Flat.

Sloping or Pitched roofs are best in medium to heavy rainfall areas. These have a slope of more than 10 degrees to the horizontal surface. Sloping or Pitched roofs are more economical than flat roofs as they do not require intermediate columns for support. In areas with heavy snowfall, steeper slopes are provided to reduce snow load on roof.



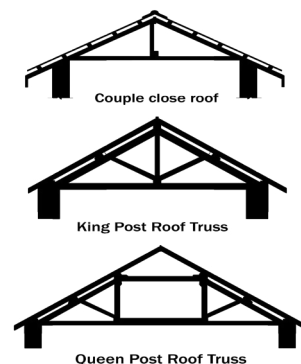
Mono pitched roof for housing cattle.

The sloping roof can be mono pitched/sloped or double pitched/sloped depending on the requirement of building. Mono pitch roofs should not exceed a width of 10 metre. For mono pitched roof, the supporting walls or posts are higher on one side than the other.



Types of Roofs

Truss types of double pitched roofs



Truss types for double pitched roofs.

If the building needs to be larger, double pitched roof is used with wider span. For double

pitched roofs, it is customary to fix roof trusses or roof frames. A couple closed roof or a collar beam roof is suitable for span of up to 6 metres. A king post has to be used for still wider spans. In any case, width of more than 27 meters is not recommended due to lack of ventilation. It becomes difficult to deliver clean, fresh air into the centre.

Flat roofs should have a slope from 1 degree to 5 degrees only. This slope is provided to prevent rain water stagnancy on top of the roof. These are used in only in low rainfall, dry areas and need the support of intermediate columns.

Materials:

Corrugated asbestos cement sheets are recommended for cowsheds due to their comparatively lower costs. These are best suited in almost all parts of the country, have a self-life of 35-40 years, and require minimum maintenance.



Corrugated asbestos cement sheet as roofing material for roofs of Gaushala is most preferred.

Corrugated mild steel (MS)/corrugated galvanized iron (GI)/corrugated asbestos cement/ corrugated aluminium sheets also have many advantages such as fire resistance, reparability, reasonably long life, and are hygienic and economical in the long run. Also, these being light materials do not require heavy roof supporting structures and are the suggested materials for building roofs of sheds. The metal roof materials used for the Gaushala building should be corrugated as it increases the strength of the material.



Corrugated aluminium sheet roofing in cow shed.

Tin is the least appropriate material for animal house roofing of cattle sheds in Gaushala because it absorbs heat.

Wood makes the most comfortable roofs, being the best insulator but is liable to fire risks and is costly.

Thatch and bamboo are readily available and cheap materials. These are good insulators and can be put over rough and cheap trusses. However, these are unhygienic, especially during monsoons and harbor insects, flies, cobwebs and vermin and are highly prone to fire hazards. Though, initial investment in thatch roofs is small, they are costly in the long run due to high cost of maintenance and frequent replacements.



Traditional wood, bamboo and thatch roofs.

Construction:

The cowshed roof is supported with pillars. These may be built either of stone, a column of bricks laid in cement mortar, cast iron pipes or hard wooden posts based on the availability and cost. Each of them should be placed at an interval of 15 feet.

The roof should have a minimum height of 10 feet from floor to roof at the lowest point.

In very hot regions, a ceiling of wooden planks, stout country cloth, old gunny bags, tarpaulin cloth, compressed or loose straw should be fixed to the underside of the roof for better heat insulation. For similar reasons, the upper surface of roof should be painted white, while the under surface is painted with darker colours.



Overhang of 0.9-1.0 m.

The recommended overhang for open-sided sheds is 0.9-1.0 meters. Fit all the roofs at their lower edge with a 15 cm half galvanized sheet gutter to convey and discharge rainwater for easy drainage. In dry regions, the rainwater can be diverted and stored in tanks for future use.

The cowsheds with double pitched/sloped roof structure should have a separate roof over the middle gallery (central feeding passage). The separate roof which will have a gap of about 1.5 foot to facilitate smoother passage of the air and to provide better ventilation and lighting.

2. Floor

The surface of the floor should be non-slippery and free of edges or fittings that may cause injury to animals besides being hard, impervious to water and easy to clean. Characteristics of a good floor in Gaushala can be summed up as:

- Provides a relatively dry walking and resting surface to animals
- Provides firm and comfortable footing to animals
- Is durable and easy to clean



Grooved concrete flooring under covered area of shed for housing of cattle.

Materials:

Flooring can be constructed with stone or bricks laid and set in cement or with lime mortar, stone-slab flooring etc. However, cement concrete floors are recommended due to their comparatively low cost and also keeping in view non-slippery nature, durability and comfort for animals.

Construction:

The floor should be laid over a firm foundation, the height of which should be normally 50-100 cm above ground (and should be made higher in areas where heavy rainfall and dampness in soil is expected). The foundation is usually constructed with bricks or stones masonry and should be able to bear heavy weights.

Cattle are less confident while moving



Grooved concrete floor under construction.

over smooth surfaced floors. So, grooved concrete flooring should be used in cowsheds. Basic guidelines for grooving of concrete:

- Parallel grooves on concrete floor should be spaced 35 mm apart
- Groove width should not exceed 10 mm
- Grooved edges should be smooth
- Lateral grooves (that go from side to side of a cow) produce less slip than longitudinal grooves (that run from head to tail)
- The surface of cement floors can also be roughened or grooved by imprinting the impression of a piece of expanded metal or suitable wire mesh on the surface while the concrete is still moist.



Grooved floor with proper slope towards underground drainage system inside the covered area of a shed.

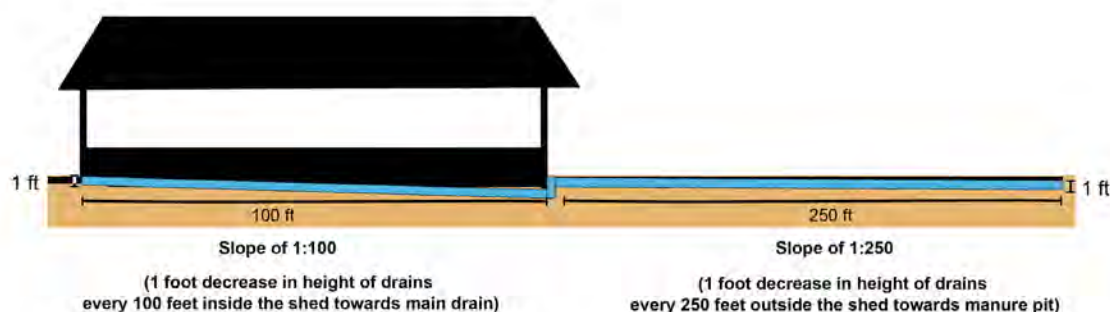


Brick lined floor in cattle shed. Although non slippery nature of floor is favourable, complete cleaning of manure on a brick lined floor is not possible.

Cleaning of grooved floors is a cumbersome job and requires application of pressure washer. Specialized equipment for cleaning the grooves has been discussed on page 44.

Under no circumstances should the floors be left kutcha/unpaved, as they will tend to retain moisture, harbour disease causing organisms and cause major issues of hygiene.

The ability of the floor to cope with, hold and direct excess liquids towards drainage should also be a key construction feature. A floor slope of 1 in 20 (1 cm per 20 cm of length should be lowered towards the drain) should be provided/used around water



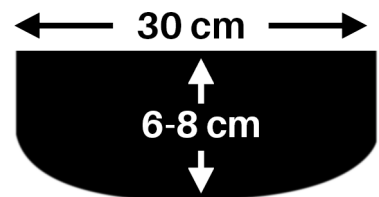
Cross sectional view showing slope of drains inside and outside the cattle shed.

troughs where excessive spilling of water takes place and regular drainage is needed.

The floors under covered area should have a slope of 1 in 40 from manger towards the drain and 1 in 60 is the required slope gradient in the open areas. The passageways of all the buildings should also have a slope gradient of 1 in 80.

3. Drainage

The liquid manure and wash water from the shed is collected by shallow drains/channels which should be "U" shaped with a width of 30 cm and a depth of 6 to 8 cm. A slope of 1 ft. for every 100 feet length shall be provided to the drains inside the cow sheds to allow the flow of urine and wash water from inside to outside the shed.

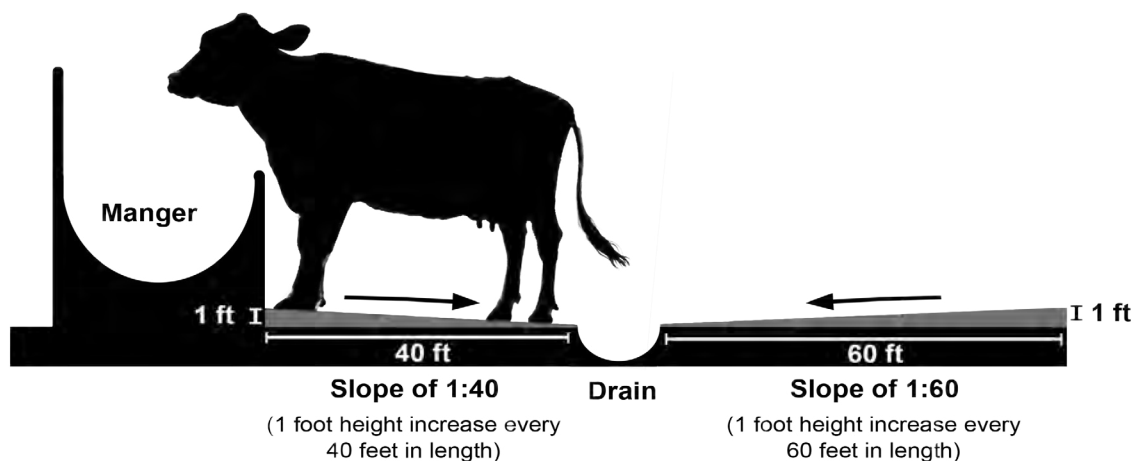


U shaped drains

The edges of the drains should be rounded so that they do not damage the hooves of cows. The drains in different cowsheds should be made continuous by routing them through intervening fences and partition walls.

The drains should then be connected to an open surface main drain (dimensions: 90 cm wide on top and 20 cm wide at bottom with a depth of 30 cm from top to bottom). The slope of the drain should be 1 foot for every 250 feet of length towards the liquid manure storage tank usually located near crop fields.

The material used to construct the drains should be cement concrete.



Cross sectional view showing slope of drains inside and outside the cattle shed.

4. Walls

The walls of the Gaushala can be constructed with materials like brick, stones or concrete with variable thickness depending on the location and function with thickness of 9 inches and 12 inches and 4.5 inches respectively.

For ordinary (non-weight bearing) walls, an ideal brick wall's thickness should not exceed 9 inches. Non-weight bearing walls are only partitions having no load of super structure. Weight bearing brick walls of the cowsheds should be constructed of 12 inches' thickness. Walls supporting the roof and wall portions with which animals come in direct contact must be robust and materials such as brick, stone or cement concrete should be used for construction of lower parts of such walls.

Walls should be erected over a foundation of sufficient strength. The depth of foundation should be 2.5 feet for both load bearing and non-load bearing walls. However, a cement concrete slab of 3 feet in length 6 inches in depth is laid as foundation in case of load bearing walls.

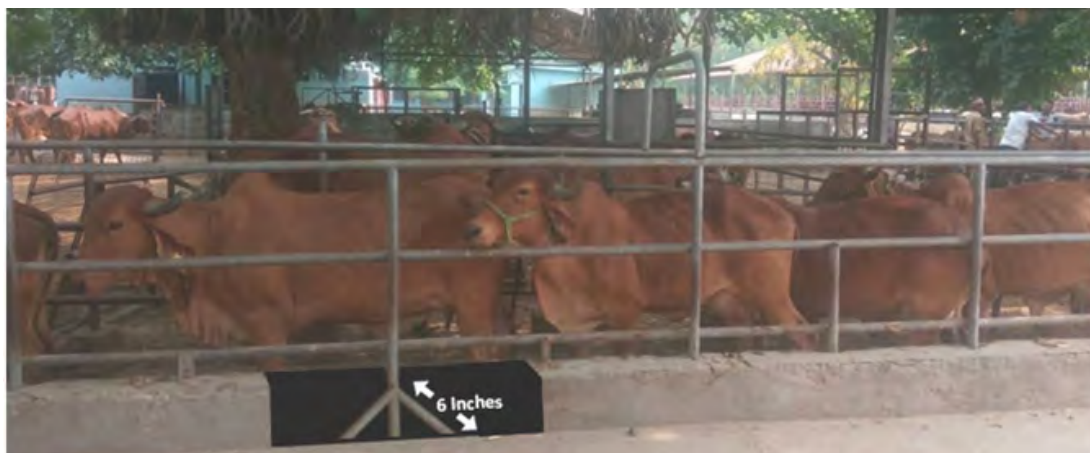
The height and strength of the wall depends upon the age and category of animals to be housed in the building e.g. the walls should be stronger and more durable for housing bulls as compared to calves. Otherwise, 5 feet high and 12 inches' thick wall is sufficient for all the categories of animals. The walls should be finished with hard cement plaster and made washable for maintaining hygienic conditions and prevent it from becoming breeding ground for insects, ticks and mites. Usually the inner face of walls is plastered and the outer one left unplastered in low rainfall areas.

Corners should be filled and rounded to prevent accumulation of dust and external parasites. The sharp edges and angles should be rounded off to prevent accident and injury to the animals.

Stone or brick walls are costly but are more durable and hygienic, while bamboo and mud walls are economical but are temporary and it is difficult to maintain clean and hygienic conditions in them.

Fences as a replacement of walls

In conditions of financial paucity, walls and partitions can also be made of galvanized corrugated iron or asbestos sheets by fixing them to posts placed 2.5 to 3.0 metre apart. The fences should be made using galvanized iron (GI) pipes with a diameter of 2 inches. The three pipe rails of the fence should be fixed at a distance of 2 feet, 3.5 feet and 5 feet from the ground level with a total height of 5 feet from the ground level. The supporting posts for these rails should be 6 feet long (1 feet underground and 5 feet over the ground level). These supporting posts should be fixed at a distance of 6 feet from each other.



Fences as a replacement of walls and tree plantation giving the most comfortable housing for the animals.

An angle iron piece (6 inches long) should be welded horizontally at the base of these posts before grouting to strengthen its grip in the foundation. These supporting posts should be grouted in a circular cement concrete foundation with a diameter of 9 inches and a depth of 21 inches.

Due to wetting with cow urine, dung and water the iron posts at the base get rusted and

corroded over a period of time and this is the major reason of their damage. In order to avoid this, the foundation for fixing the fence post should be up to 9 inches above the ground level. The total length of the foundation for fixing the fence posts will thus be 21 inches (9 inches over the ground and 12 inches underground).

5. Gates



Distant view of 3 hinged gates in the modern head to head cattle sheds (2 into the entrance of cattle sheds and 1 into the central feeding passage).



Picture of a hinged gate at the entrance of central feeding passage in a modern shed.

The gate should be wide enough to allow the passage of tractors (as they are used for various maintenance activities).

- Iron gates are preferred for their durability, strength, ease of installation and economical nature in the long run.
- Hinged gates are better than double bar gates.
- Gate of the sheds should be located centrally and should be 8-10 feet wide.
- The gates should be free from protrusions and sharp edges that can hurt an animal.

6. Electrical fittings

The only essential electrical fittings required are those for artificial lighting. These can be energy saving CFLs/LEDs and can be powered through solar panels, if possible. However, electrical wiring need to be placed in cowshed such that the plug points are located at appropriate places that allow electricity supply to ceiling fans, grooming brush, water foggers and light in all the enclosures. Care should be taken to ensure that electrical fittings are beyond the reach of animals.

In tropical regions, provision of fan with foggers or mist cooling must be installed to protect the animals from severe heat stress during summer months and in hot climate areas.



Well insulated electrical switch board and fittings mounted on a pillar on a pillar at approximate height of 6 feet (well beyond the reach of animals).



Picture of a fan fitted with fogger for keeping the temperature inside the shed low.

For protecting the animals from cold stress during winter provide automated wind breaks of tarpaulins operated with motor or manually on the windward (from where wind is coming) side of the shed

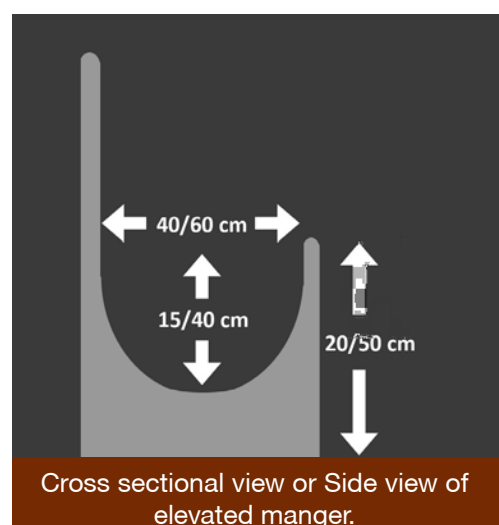
7.Manger

Manger should be constructed under covered area. In addition, the manger should be of continuous type.

Construction:

Mangers are recommended to be built with reinforced cement concrete. The inside and outside of the manger should be plastered with cement. The surface should be rounded off and finished smooth. The top of manger walls shall be rounded rather than flat to avoid any injury to the animals while feeding. Mild iron plates may should be fixed over the curve of the manger to avoid injury to the dewlap of the cows.

A long pipe of 2.5 inch diameter shall be fitted all along the length of the manger just above and parallel to the inner wall. This pipe can be fixed either by erecting it alongside and parallel to the inner wall of manger or by means of a series of angle iron brackets coming out from roof supporting posts. This pipe



Cross sectional view or Side view of elevated manger.

prevents cattle from getting in to the manger or jumping out over the manger.

A. Dimensions of elevated manger

The feed mangers in cowsheds should be designed such that the animals cannot get in to them. Dimensions of the such elevated mangers are:

Category of animal	Dimensions of mangers (cm)		
	Width	Depth	Height of inner wall
Adult cows and buffaloes	60	40	50
Calves	40	15	20

B. Dimensions of fence line manger

A better system is the alternate fence line system in which the manger is constructed at ground level. Standard dimensions for the construction of fence-line feed barriers for cattle are as under:



Elevated manger for feeding of cattle in Gaushala. The long pipe prevents animals from jumping into the manger.

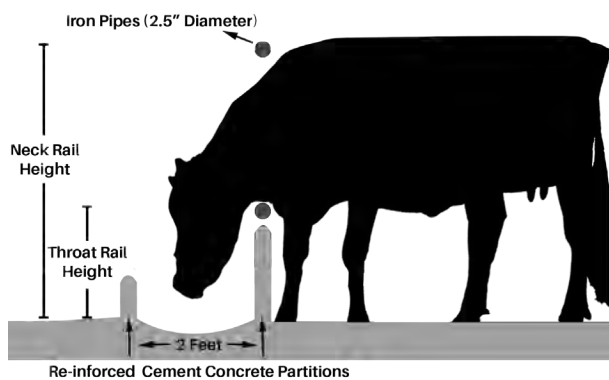
Sr. no.	Age/category of animal	Throat height (in cm)	Height of neck rail (in cm)
1	Calves (< 1year)	40	75
2	Heifers (1-3 year)	45	95
3	Adult cows (> 3year)	60	120

The neck rail should be made of galvanized iron pipes with 2.5-inch diameter. So as to reduce aggression and fighting at the time of feeding, the fence line may be partitioned for allowing individual feeding at the distance of 2 feet each in case of adult cows.

Elevated manger verses fence-line feedings system

Elevated mangers presently used for feeding of cattle in Gaushalas are made up of cement concrete. These are the traditional and most widely used design of mangers. However, fence line feeding system allows access to feed from ground level while preventing the cows from walking and defecating on the feed by the use of fencing. It is economical to construct fence line mangers as it reduces the cost of building feed mangers. Fence line feeding system is the most time and labour efficient way of delivering large amounts of feeds to large group of animals and is safe for workers and cattle.

The fence line feeding design improves digestion of feed in cows by allowing cows to eat in a grazing position. Feed tossing by animals is also reduced in fence line feeding due to lower manger height elevation, as compared to the elevated mangers.



Fence-line feeding system.



Fence line feeding system of cattle allowing grazing like behaviour from ground level.

Fence line manger is constructed at same level on which delivery of feed is required. This allows the manger to be easily cleaned mechanically or by hand which saves labour and time.

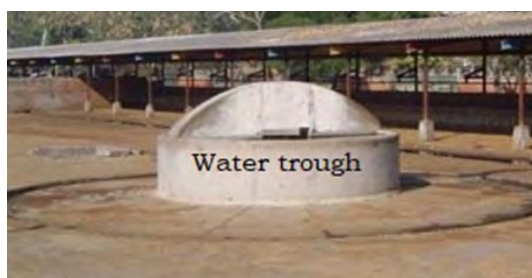
Because of absence of outer manger wall in fence line feeding, it allows good air-circulation in the feeding area. In fence line feeding, animals head is in natural grazing position. Feeding with their head in the downward position directly improves digestion of animals.

8. Water Trough

Water troughs in Gaushalas should be designed such that the animals cannot get in to them. Water troughs should be constructed in the loafing/open area. The access area should be sufficiently wide to permit free movement of animals. It should not be directly under a tree to prevent contamination from leaves, excreta of birds, dust etc.

Troughs constructed in the open should be covered with roof to prevent water getting very hot during the summer season. A two-metre wide paved platform should be provided around the water troughs to withstand heavy movement of the animals and permit easy washing and cleaning.

Water troughs are to be built with reinforced cement concrete and plasterer with cement. The edges should be rounded off and surface finished smooth. The height of inner wall of water trough should not be more than 50 cm in case of adult animals and 20 cm in case of calves for ease of access to water. The depth of the water trough should not be more than 40 cm and 15 cm in case of adult animals and calves, respectively as the water beyond these depths would not be accessible to them. A 2.5 inch diameter pipe should be fitted above and parallel to the inner wall of water trough to prevent animals from jumping into the water troughs. There should be a provision of water outlet (hole) at the bottom of the trough for empty the trough for the purpose of cleaning and white washing. There should be



Water trough in the middle of open area of loose housing system.



Water trough at the corner of a shed with a tap and fence over it to prevent animals jumping into the trough.

a tap to refill the water.

B. Sheds for sick and old animals

These are the sheds for special care of needy cows that are afflicted with ill health, injuries, disease, or are nearing their end. The structures will need special housing conditions for specialized treatment, proper handling and support of animals. The sick animal house should be isolated and positioned at a reasonable distance away from healthy animal sheds.

It can be reasonably presumed that in a large sized Gaushala the number of animals with special needs including sick animals will normally range between 20-25 percent of the total animals. Accordingly, in a Gaushala proposed to be set up for housing 1000 animals the housing facilities for about 200 old and sick animals need to be created.

Out of these 200 animals with special needs it is presumed that about 10 animals will be in critical condition requiring intensive care at any given time. Therefore, there should be 10 individual pens for housing critically ill animals requiring intensive care.

Individual sick animal units for one cow should be sized as 3 metre x 4 metre covered shed and another 3 metre x 4 metre open common paddock area adjoining the covered shed with a partition gate in between. Water and feed trough should be placed inside covered area of the shed. The pen should also have facilities for tying of the animal so that one worker can easily restrain a cow for close examination and administering treatment. These houses need to have comfortable flooring and good lighting arrangements. They should also have facilities for the workers to have a bath and to change clothes in order to maintain protocols related to infectious diseases.

The sick animal bay should be set up to house a minimum of 50 adult cows and 50 adult bulls/bullocks and 50 calves. Also, there should be facilities for housing minimum of 20 lame and another 20 blind animals in separate pens.

The sick and old animals with special needs require greater climatic protection. Their housing requirements are greater and more complex as compared to normal animals. The loose house recommended for normal animals thus require to be suitably modified in order to make it offer greater protection from high as well as low ambient temperature, from strong hot and cold winds, and heavy rains.

1. Roof

The roof should be of a single or double slope type at a height of 14 feet at the highest point and 10 feet at lowest point. The materials used should be the same as those used for the construction of the primary Gaushala cowshed.

2. Floor



Sick and old animals housed together on a sand floor. Food is offered individually to each animal.

The flooring in these sheds should be the same as those of the main shelter area.

Keeping in view the requirement for additional comfort, good quality removable rubber mats or permanently fixed mattresses should be placed over the floors. Alternatively, ample amount (at least 6 inches thick) of dry and clean bedding material (details discussed in bedding management on page 60) should be provided over the floors (which have to be replaced daily).

Special provision of sand flooring should also be put in place for recumbent and paralyzed animals. Pressure/bed sores which are common in recumbent and paralyzed animals are much easier to prevent than to treat. Using a sling (Page 42) is good for the muscles, circulation, respiration and spirits of recumbent animals. In addition, regularly shifting position of animals also prevents bed sores.

The floor of the paddocks for housing animals suffering from lameness should be sand bedded. Sand bed requires extra maintenance. Remove all damp/wet spots and concentration/pile of manure from the stall daily (preferably twice). Refill the stall with fresh sand every week. The need to add sand into the stall can be easily determined by visually examining/inspecting the shed. When the sand gets too low, cows will be more uncomfortable and this should be avoided.



3. Drainage

The suggested construction practices for the drainage system are the same as those for the main Gaushala. However, the drains originating from these sheds should not pass those where healthy animals, in order to mitigate the spread of diseases. The slope of the drains outside sheds is from healthy animals shed to diseased animals shed and not the other way around.

4. Walls

The protocols for building walls can be the same as those for the primary Gaushala cowshed. Only brick walls should be used in the construction of sheds for sick animals as fencing leads to the spread of communicable diseases.

These animals should be housed in sheds, the covered area of which have walls on three sides up to the roof with an adjacent open common paddock for roaming, exercise and rest. Temporary addition of tarpaulin sheets on sides of covered area in standard cowshed could negate the necessity of building walls up to the roof. This would further add to the multi-utility of the shed for different categories of animals depending on their numbers.

Shady trees should be planted in the centre of these open paddocks for added climatic protection. Diseased animals prefer tree shade to artificial shade.

Walls facing the paddock should not be more than 5 feet in height so to facilitate observation. The open paddocks adjoining the sheds should be enclosed by a wall and built 9 inches in thickness.

5. Gates

The shed should have a 10 feet wide and 5 feet high hinged iron gate in the center for easy movement of animals and workers.

6. Electrical Fittings

The shelter for these animals shall have a special provision for comfortable microclimate inside the sheds. For this the shed should have provision of ceiling fan, exhaust fans, heating and cooling devices etc. The shed must be well ventilated and have provision of supplementary light. Motorized/manual slings (details discussed in equipment chapter on page 42) need to be installed to aid in care of animals that have lost mobility.



Sequence of photographs showing manual operated sling aiding a paralysed cow to stand up.

7. Manger

The feeding in these sheds needs to be done manually using wheelbarrows, as tractor trollies cannot be used to prevent spread of diseases. The feeding passage thus should have 7 feet wide and 5 feet high gates on both ends to permit ease in manual feeding. Some of the animals housed in these sheds will not be able to reach the manger and water trough, so feed and water should be made available to them individually in durable containers as per the prescribed diet schedule.



Group of calves feeding in the feed manger.

8. Water Trough

The water troughs made of cement concrete should be constructed inside the sheds using the same construction protocol as for the main Gaushala cattle shed.

C. Calf Shed

The construction of the calf shed will follow the same protocols as the main Gaushala shed, but varies in the number of animals that can be housed in a specific area, and in the size of mangers and water troughs. Male and female calves can be kept together till they are one year old.

The dimensions of mangers and water troughs for calves (defined as animals up to one year of age) are as under:

Dimensions of mangers/water trough (cm)		
Width	Depth	Height of inner wall

40	15	20
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The standard dimension for the construction of fence-line feed mangers for calves are as under:

Age/category of animal	Throat height (cm)	Height of neck rail (cm)
Calves (< 1year)		

D. Maternity/Calving pens

These sheds are meant for pregnant cows which are to be shifted to individual calving pens about 2 weeks prior to the expected date of calving.

These pens should have provision for individual feeding and watering both inside the covered area as well as the open area. The bedding material should be soft to meet the requirement of higher comfort levels for these cows (details discussed in bedding management on page 60).



Individual maternity pen for near and post parturition cows having provision of adequate bedding material.

All construction protocols for this shed will be the same as those of the primary shed of the Gaushala, barring the space requirement modification. The animals need to be placed in individual pens, which have 12 metre² covered area and about 24 metre² open area.

E. Bull pens

Special pens need to be constructed for bulls as they might display aggressive behaviour towards each other as well as other animals. The issue of aggression can have devastating consequences especially at the time when the female animal is in heat. Bulls are extremely strong and capable of causing extensive destruction as well as grievous injuries to other animals.

Individual housing is the only method by which these animals can be cared for in a Gaushala. A bullpen should ideally have a minimum of 12 metre² covered resting area and a large open exercise area of 24 metre².

All other construction protocols used for the main Gaushala shed (except those for constructing walls and gates) can be followed.

1. Walls

The walls of the pen must be at least 12 inches in thickness and 5 feet in height.

In case of fencing, eight horizontal rails of minimum of 2 inches diameter GI pipes should be installed up to a height of 5 feet and fixed to posts which are a minimum of 5 inches in diameter, and not more than 6 feet apart.

2. Gates

The gate of bullpens must be so designed that the bull cannot lift it off its hinges and there should be at least one safe exit where the staff can escape for its safety, as and when required. It is important to reemphasise that bulls should be castrated.

F. Quarantine sheds

Quarantine sheds are built to reduce the risk of introducing dangerous infectious diseases from outside into the Gaushala, by segregation of apparently healthy cattle (introduced into the Gaushala for the first time), which have been exposed to the risk of infection.

The quarantine period provides a monitoring period during which animals that were incubating disease on the day of arrival are likely to show symptoms. The idea is to allow sufficient time for any contagious disease that quarantine animals may have in the incubation stage, to become active and obvious. The arriving animals in the Gaushala should be quarantined for a minimum of 30 days. During quarantine, the cows must not have contact with healthy animals or share pastures or grazing lands.



Quarantine shed with walls up to the height of roof and windows for ventilation should be built at the entrance of a Gaushala. Buckets and other equipment for cleaning of quarantine and isolation sheds should be separate from regular use equipment.

Quarantine sheds should be located at the entrance of the Gaushala. A quarantine shed in a large Gaushala (accepting an average of 2-3 new animals for the Gaushala on daily basis) should have three animal sheds sufficient to accommodate about 40 adult animals (20 males and 20 females) and about 20 calves.

Along with the animal accommodation, there should be a provision of cattle crush (trevis) (details discussed in equipment chapter on page 41) for restraint of animals in order to facilitate medical procedures. The trevis should be installed under a shed (30 feet x 15 feet). The shed should also have a working rack and sink with water supply.

All other construction protocols used for the main Gaushala shed can be followed for the quarantine sheds.

G. Isolation sheds

Isolation sheds are meant for animals suffering from highly contagious diseases. They need to be constructed in the same manner as sheds for sick and old animals, and the only reason for separate construction is to minimize the spread of diseases.

10 isolation sheds is an optimal number for a Gaushala with 1000 animals. These sheds can be used for regular purposes of housing sick or sensitive animals if there are no instances of highly contagious disease in a facility at that point of time.

H. Stores

Stores will be required for storing concentrate feed, dry fodder and equipment.

1. Roof

Mono-pitched/sloping roofs should be used for stores and should not exceed a span of 10 metres. 12 degrees is the ideal pitch for the roof of the store. This minimizes cost and is adequate to prevent stagnation of rain water. At no cost should the roof construction allow for seepage of water into the store.

The materials used can be same as those used for construction of the main Gaushala shed. Corrugated aluminium or white galvanized iron (GI) sheets have comparatively higher rate of heat rejection and are best suited for open hay stores, manure pits, tractor sheds etc.

2. Floor

The floors of the store should be cemented or cement concrete. They should be smooth to prevent accumulation of waste and water and do not require grooves.

3. Walls

The walls of a store should be built keeping in view, the preservation and security of stored materials. The walls should be leak proof and construction practices can be the same as the main Gaushala shed.

The store should be closed on all sides, and present no opportunity for the ingress of pests through gaps, holes, etc. Measures for waterproofing (in areas which are susceptible to the problem of water seepage) should be carried out as food stock exposed to moisture will develop aflatoxins. Food tainted with such toxins can cause grievous sickness in animals. For this purpose the stores should be built on a higher ground also.

4. Gates

For feed stores it is better to have shutter gates with 8-10 feet width allowing tractor-trolley to enter and leave the building from same gate.

5. Electrical Fittings

The only electrical fittings required are those for artificial lighting. These can be energy saving CFLs/LEDs and can be powered through solar panels, if possible.

H. Silage unit

Good-quality silage is an excellent feed for cattle and an ideal Gaushala should have its own silage-making unit. Silage is a fermented product resulting from the fermentation of green fodder crops in a controlled environment and the absence of oxygen. This is a method of green fodder preservation and can be easily done in Gaushalas.

Construction

The silage-unit comprises of a silo pit which can be of any shape, but a rectangular shape



Galvanised rolling shutter gates for stores.

is preferable. The depth and width are generally kept equal (say 8 feet). The depth should not be less than 8 feet and the length can be kept twice or thrice the width or depth.

The corners must be rounded off and sides of pit must be made smooth so that the exclusion of air may be easy and the compression of the fodder is not interfered with. Put a plastic sheet on the floor and sides of the pit.

A cubic foot of space can hold around 18 kg of green fodder at the time of filling. Taking the shrinkage into consideration, one cubic feet of packed space will give around 12 kg silage at the time of feeding.

As per this calculation, a pit measuring 8 feet deep X 8 feet wide X 10 feet long can give 640 cubic feet which can hold approximately 11,520 kg of green fodder at the time of filling.

Such a silo is expected to feed a unit of 100 cattle for about seven to ten days during fodder scarcity. It is advantageous to have several pits rather than one single very large pit.

I. Hospital

All Gaushalas should have a dedicated space for veterinary care. The veterinary facility should have space for animal examination, along with an operating room.

1. Animal examination area

Since, restraining is the first step of any treatment administered to any animal. Cattle requires a special equipment to restrain them known as trevis or crush, made up of very strong iron (detail on page 41).

Approximately three trevis need to be installed in a Gaushala with 1000 cattle that also provides medical assistance for non-residential animals.

Since, sick and wounded animals kept in their designated sheds require to be examined and administered treatment regularly, these and the animal examination area should be built in close proximity.



Construction details of animal examination area.

There should be a separate space allocated within this area for recumbent animals (animals that cannot stand up). It should have a dry, padded floor to prevent sores. To help the animals stand, a sling mechanism should also be installed (discussed in detail on page 42).

Construction

The roof should be 10 feet high supported by pillars. The wall should be of 5 feet wide height and 9 inches' thickness, and an iron gate measuring a minimum of 10 feet should be built. Construction methods and materials used for the main Gaushala can be followed for this area as well.

2. Operation Theatre

The operation theatre should be large enough to allow movement of 6-8 people to carry the animal in and out. Construction materials used for the primary shed in the Gaushala can be used in the construction of the OT, except wherever mentioned ahead.

Roof

The roof of the OT should be constructed with concrete and have a false ceiling for better temperature control. The edges should be rounded off wherever possible in order to prevent accumulation of dust and cobwebs.

Floor

Operation theatre should have smooth cemented floor, for ease in cleaning and maintaining sterile conditions. Ceramic tile may also be installed on the floor and walls to the ceiling in the operation theatre. Tiled floors resist moisture and handle scrubbing much more readily than a cement floor.

Electrical Fittings

To keep animals undergoing procedures in OT comfortable, they should be protected from extremes of temperature, by installing fans, air conditioners and heaters, whenever required. A large number of electric plug points should be installed to power electrical instruments used for surgeries. There should also be provision for adequate lighting, and an overhead light on top of the operating area.

Ideally an operation table made of painted galvanized iron (covered with a washable rubber mat), measuring 4 feet x 8 feet, fitted with a hydraulic or manual mechanism for adjusting its height should be installed. A cost effective solution can be created by installing a large washable mattress (measuring 4 feet x 8 feet) on the floor only.

There should also be provision of a large trolley to move the diseased or injured animal to the operating area. The operation theatre should be spacious with wide gates, to allow movement of trolley in and out of operation theatre.

Operation theatre should have provision for as much natural light from windows as possible so that electricity failure does not create complications during surgery.



Large animal operation theatre with a large operation table and a small operation table, fitted with overhead lights and having appropriate facilities of oxygen cylinder and an anaesthetic machine.

J. Office

1. Location

The office of the Gaushala should be located at the entrance and at an elevated area. Ideally it should be a double storeyed building with the office at the top floor. The cattle sheds and other buildings should be so arranged that most of them can be easily seen

from the office.

Having the office at the centre facilitates efficient supervision of all the surrounding area while having office at the entrance provides a barrier check for people and animals entering/or leaving the premises. A double storeyed office at the entrance serves both purposes.

2. Space requirements

An office room (10 feet x 15 feet) for supervisor along with a store-cum-change room (20 feet x 15 feet) for storage of equipment etc. should be constructed side by side.

3. Roof

Flat roof of concrete supported by walls is ideal for office. Roof for office in very hot areas requires false ceiling for thermal comfort. Corrugated asbestos roof painted with white colour on the inside may also be used.

4. Floor

Of the materials commonly used for the flooring, cement concrete is undoubtedly the best flooring material for offices. It is most economical and durable flooring material. However, if budget is not the constraint, ceramic tiles may also be used for flooring of offices.

5. Walls

The wall should be finished with smooth plaster cement covering making the surface hard and free from moisture. The walls may also be covered with glazed tiles up to a height of 5 feet. to prevent accumulation of dirt and dust. The corners of the walls should be rounded off to minimize occurrence of cobwebs.



An office with a cement concrete floor and roof painted with white colour on the inside. The picture also shows an almirah kept for record keeping and other requirements of supervisor.

6. Gates

The wall should have hinged aluminum door of 4 feet width and 6.5 feet height opening on both sides for entry of staff and visitors with ease.

7. Lighting and Ventilation

The office walls should have 4 feet X 3 feet of windows fitted with glass to allow natural light and air inside. Apart from this overhead lighting system in the roof should be fitted to supplement natural light.

8. Electrical Fittings

Office should be electrically wired for powering various lights, fan and ventilation equipment. Electric plug points should be installed to power computer, CCTV connections and other electrical instruments used in office.

K. Staff Facilities

1. Location

The location of staff quarters should be on the windward side (from where wind is coming) of the Gaushala, to prevent flies and smell from the manure heap being blown towards them. The staff quarters should also be located as near as possible to the sick and old animal sheds to provide immediate emergency services.

It is better that houses are north facing. In winter, south-facing windows let in sunlight that converts to heat. Planting trees against these windows will keep the house cooler.

2. Construction of staff quarters

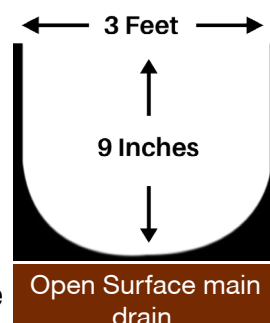
Staff quarters for labour and employees constructed and located in the premises of Gaushala, should be made available at nominal rent or even free of cost to encourage them for 24 hours availability. These may also act as rest rooms for workers to take rest during the intervals between shifts or in rest periods. Quarters for labourers should be a minimum of a room and kitchen. Common bathrooms and latrines be in one place. These should be multiple storied to save space. The quarters should have low-maintenance exterior. There should be a manager and doctor/para vet accommodation as well.

L. Waste Management System

Liquid manure from each shed should be connected to an open surface main drain (Dimensions of drain: 3 feet wide on top and 9 inches wide at bottom with a depth of 1 feet from top to bottom). The slope of the drain should be 1 feet for every 250 feet length of the drain towards the liquid manure storage tank.

Liquid manure storage system:

Liquid manure from each shed should be connected to an open surface main drain (Dimensions of drain: 3 feet wide on top and 9 inches wide at bottom with a depth of 1 feet from top to bottom). The slope of the drain should be 1 feet for every 250 feet length of the drain towards the liquid manure storage tank.



The inspection chamber, the settling chamber and liquid manure storage tank should be constructed using 9-inch-thick brick walls or 4.5-inch-thick reinforced cement concrete (RCC).

Size of liquid manure tank

The process for collecting and depositing solid manure has been discussed (Page 63). The manure that is washed with water pipes is called liquid manure and this can go into a liquid manure tank. The slope of floor should be 1:40 towards the drain which leads to the tank. The liquid manure tank is to be located underground. Drains leading to it should be sloped at 1:100 and should be continuous.



Once the drain goes outside the shed it is to be connected to a drain which has a slight slope of 1:250 leading to the liquid manure tank. This will facilitate urine and liquid faeces collection. The liquid manure tank should have 3 chambers: inspection chamber, settling chamber and manure storage chamber. The dimensions should be 1 metre x 1 metre x 1 metre, 3 metre x 3 metre x 3 metre and 4 metre x 4 metre x 4 metre respectively. CI (cast iron) pipes with a diameter of 6 inches should be used for carrying the liquid manure from inspection chamber to settling chamber and then into the storage tank.

The production of liquid manure is presumed to be 0.5 cubic feet (14 litres) per cow per day in winters and 0.25 cubic feet (7 litres) per cow per day in summer. During summer season, the quantity of urine voided by animals is less and the urine gets evaporated within a short time after voiding due to high temperature. In addition to this an adult animal voids 25-30 kg of faecal material.

Presuming that on an average 50 litres of liquid manure will be produced per adult cow per day a liquid manure storage tank of 4 metre x 4 metre x 4 metre (length x width x depth) can accommodate liquid manure produced by about 1000 adult cows provided the tank is emptied every day in winter and every alternate day in summer. This can be emptied using a motor and sent to agricultural fields.

Construction of solid manure pits

Manure pits should be located far off from the animal sheds, as fresh manure lying near animal sheds is an ideal breeding ground for insects and flies. For reason of hygiene, the manure pits should be located at a minimum distance of 10 metre from wells, rivers and tanks.

In Gaushalas it will be better to construct a number of small sized manure pits rather than one big manure pit. For ease of dumping and lifting of manure from the pit, the depth of the pit (height of retaining walls) should not be more than 7 feet (4 feet underground and 3 feet over ground). The width of the pit may be at least 15 feet in order to allow tractor trolley to enter inside for unloading and loading purposes with a ramp at the entrance.

The walls should be made of bricks or cement concrete and should have a thickness of 22.5 cm. The bottom of the pit should not be left earthen to prevent excess water to seep into the soil.

M. Gobar gas plant/Biogas plant

If the land is large enough, a biogas plant based on the conversion of dung should be built. This turns the dung into gas which can be used for lighting, cooking and be sold to farmers. The minimum land necessary for a biogas unit ranges from 10 metre X 10 metre for 50 animals to 15 metre X 15 metre for 1000 animals.

1. Selection of construction site

The selection of construction site for biogas plant is mainly governed by the following factors:

- The site should be on a slightly higher elevation than the surrounding. This helps in avoiding water logging. This also ensures free flow of slurry from overflow outlet to the composting pit.
- For effective functioning of bio-digesters, right temperature (20-35°C) has to be

maintained inside the digester. Therefore, it is better to avoid damp and cool place while sunny site is preferable.

- To make plant easier to operate and avoid wastage of raw materials, especially the dung, plant must be as close as possible to the cattle shed.
- To mix dung and water or flush manure to the digester, considerable quantity of water is required. If water source is far, the burden of fetching water becomes more. So, site should have a permanent water source.
- The selected site should also ensure easy operation and maintenance activities like feeding of plant, use of main gas valve, composting and use of slurry, checking of gas leakage, draining condensed water from pipeline etc.
- The site should be at a sufficient distance from trees to avoid damage to bio digester from the roots.
- The well or groundwater source should be at least 10 metre away from the bio digester especially the slurry pit to avoid the ground water pollution.
- If long gas pipes are used, the cost of production of biogas will be increased as the conveyance system becomes costly. Furthermore, longer pipeline increases the risk of gas leakage. The main gas valve which is fitted just above the gas holder should be opened and closed before and after the use of biogas. Therefore, the plant should be as near to the point of application as possible.
- Type of soil should have enough bearing capacity to avoid the possibility of sinking of biogas structure.

2. Location of biogas plant

A biogas plant should not be located further than 5 metres from the field. The digester chamber must be in an open area and should not be near to any natural or artificial water source as animal excrement may seep into underground water. The plant should also be situated on an elevated area and not on low land to avoid the danger of floods. The excess manure should flow into the agricultural field or the storage tank and not into natural water bodies such as rivers to avoid the risk of pollution.

3. Size of biogas plant

The size of the biogas plant in Gaushalas is based on three parameters

- Daily input of cattle dung
- Retention time of cattle dung till biogas is produced
- Volume of digester

Capacity of the plant should be designed based on the availability of raw materials. The capacity of the plant determines the quantity of gas produced in a day. One kg of cow dung along with equal quantity of water (1:1) under



Biogas plant at Govind Godham Gaushala near Hambran Road, Punjab meeting half of the power needs of the Gaushala.

anaerobic conditions in a day produces 0.04 m^3 or 40 litres of biogas.

When a biogas plant is underfed, the gas production will be low. In this case, the pressure of the gas might not be sufficient to fully displace the slurry into the outlet chamber. If too much material is fed into the digester and the volume of gas is consumed, the slurry may enter the gas pipe and reach up to the appliances.

The size of the digester i.e. the digester volume is determined by the length of the retention time and by the amount of fermentation slurry supplied daily. The amount of fermentation slurry consists of the feed material (e.g. cattle dung) and the mixing water.

Example: 25 kg of cow dung + 25 litre water = 50 litre fermentation slurry

The digester volume is calculated by the formula

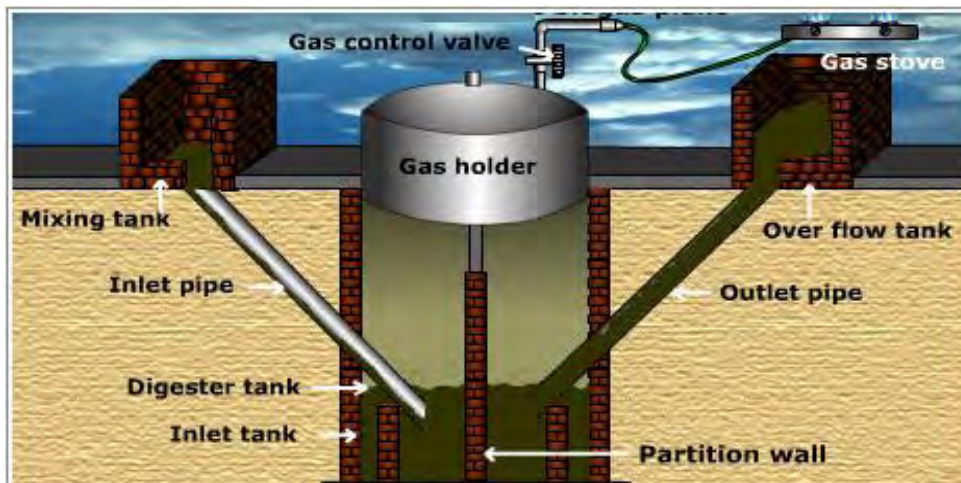
Digester volume (litre) = Daily feed (litre/day) x Retention time (days)

Assuming the retention time to be 40 days, then the digester volume can be calculated by:

Digester volume = 50 (litre/day) x 40 (days) = 2000 litre or 2 m^3

4. Biogas generator

A biogas generator is a reactor or chemical processing machine designed to organically breakdown biological source materials into gases such as methane and hydrogen that can then be combined with oxygen for use as source of fuel.



A biogas generator is a sealed container with inlet for organic waste infusion with anaerobic bacteria. The bacteria break down the waste in the absence of oxygen into a gas mixture of about 60% methane and 40% carbon dioxide, which is siphoned off into another container. Industrial level systems are simply larger scale versions of the same process. They have an elevated waste-feeding chamber that channels the material into a reactor chamber filled with digesting slurry. The biogas generator pipes transport gas out of the top of the chamber and treated slurry to the outside of the container.

Methane from a biogas generator is the main component of the natural gas, which can be used to heat homes and for other uses such as cooking and hot water production. The slurry after drying acts as good organic manure

It is easier to get a professional company to make the unit rather than attempting it on

your own. Companies have been listed on page 311.

N. Vermi-compost and bio-pesticide unit

Vermi means earthworm. Vermi-compost is an organic fertilizer produced by earthworm species and microorganisms, which grow on animal and farm waste. It involves a simple process of decomposition used to enhance the process of waste conversion into manure.

Vermicomposting is environment friendly and cost effective technique for solid waste management.

1. Construction of Vermi-pits

Vermi-composting should be done in a pit dug in the soil. For greater efficiency, cement brick tanks are used. The tank is constructed on raised land, that is, above ground to avoid water logging. The floor is higher in the center and slopes on sides. The specifications for construction of pit are:

Length	=	3 metre
Height	=	1 metre
Width	=	1.6 metre
Volume	=	4.8 metre ³

Adequate numbers of holes (8 cm x 5 cm diameter) are dug at the bottom for draining of water. Bed is 5 cm to 10 cm thick constructed of broken bricks or sawdust.

Beds/rows of vermi-compost

To avoid permanent construction of cemented pits, plastic sheets may be placed on ground, which prevents both earthworm and vermi-wash from going into the ground. Beds/rows are made of partially decomposed cow dung (1 metre wide and 75 cm high) with a distance of 75 cm between the two rows, so that people can walk in between the rows and collect the vermicompost.

2. Shed for Vermi-compost

Walls

The shed walls should be made up of galvanized steel pipes (8 feet in height placed at equidistance of 8 feet) covered with green coloured agro net to protect earthworms from sunlight. The width of the shed should be 20 feet and length could be variable according to the production capacity of Gaushala.

Roof

The roof of the shed should be rounded or barrelled and covered with green coloured agro net. An additional plastic sheet is required during rainy season to prevent seepage of water.

A thatched roof with slope of 20° supported by wooden pillars of 8 feet height would be cheap



Vermicompost unit with rounded green coloured agro net roof and walls.

and may be provided for cover over vermi-pit from above if budget is the constraint.

Gate

There should be 2 gates in vermicompost sheds. The gates of vermicompost shed should be at least 8 feet of width on both sides of shed to allow entry and exit of tractor-trolleys. The gates should be made up of galvanized steel pipes fitted with agro net.

O. Network of roads

Pathways/roads must connect buildings of hospital, office, residential quarters, cow houses and stores. Roads must be well gravelled for quick transport and as far as possible roads must be straight for easy transport. If constructing bituminous/asphalt roads is not possible, slab stone roads and concrete roads connecting various buildings within the Gaushala should be built. The width of two intersecting roads should be 4 metres and 5 metres, to facilitate the turning of tractor and other heavy machinery easily.



Network of concrete roads outside the cattle shed providing proper connectivity of various sites.

Improving the Existing Sheds

There are many ways by which the housing of animals can be improved without spending a lot of money. For example, using economical materials for construction like corrugated asbestos sheets as roofing material and brick lined floors instead of cement-concrete floors.

Before spending money on improving existing facilities in Gaushala, a simple question should be addressed. How much is to be spent on improving existing infrastructure? If the current status is very poor and our desired level of improvement is very high, the most appropriate step would be to go for new infrastructure in Gaushala in stepwise manner.

The changes should be gradually applied and by using locally available materials. If the money is surplus and management can afford to spend money to modify existing sheds to modern cattle sheds, some of the suggested alterations for improving the existing cattle sheds are as follows:

1. The surface of the floor in the shed should be made even by levelling off and filling up of pits. The surface can be made cement concrete, paved with bricks or at least made hard by good ramming.
2. The cattle sheds may be having a roof made of straw or mixed with mud or galvanised iron (GI) sheets or asbestos sheets. Straw and mud roofs may be leaky and harbour insects and pests. In rainy season, the roof may leak wetting the feed in the mangers thereby making animals prone to diseases. Corrugated asbestos sheets are best suited in almost all parts of the country. These have a self-life of 35-40 years and require minimum maintenance.
3. In traditional Gaushala cattle sheds, the height of roof is kept very low. It makes the shed dark inside and prevents proper air movement. To make it better the roof should be raised to proper height, which is at least 10 feet at eaves of the shed.
4. Over-crowding is another problem in traditional Gaushalas sheds. Care should be

taken to ensure that there is at least about 40 square feet of area per cow available in the cattle sheds. This makes the animals existence much more comfortable. Apart from this, sheds housing large number of animals (more than 80) should be partitioned using galvanised iron (GI) posts with gates for exchange of animals. This compartmentalization results in keeping animal number less than 80 in any case so that animals maintain their social order.



3 | MACHINERY AND EQUIPMENT

Machinery and equipment are essential such as the trevis/crush/chute for restraining cattle, ramp for loading and unloading of animals, chaff cutter machine, milking pails, milk cans and other implements for handling and grooming of cows.

A list of machines and equipment is presented below which is necessary for the handling, restraining, treatment and overall management of cattle in Gaushala. These equipment have a direct impact on the welfare of the animals and in turn also make Gaushala management less labour intensive.

1. Ramp for loading and unloading of animals

Loading and unloading cattle onto or off a vehicle can be the most stressful part of their transportation. It is important that loading and unloading be performed in a quiet and competent manner.

Loading and unloading facilities need to be compatible with a range of vehicles. This will mean that same premises may need to have more than one ramp according to the height of vehicles.

Location/placement of ramp in Gaushala

The unloading area should be secure and provide a wide, clear, straight path from the vehicle to the quarantine shed where the animals are to be kept. There should only be one clear and obvious route for the animals to travel down, which should be kept free of non-essential personnel and other distractions.

It is further advisable to have the loading ramp slightly away from the entrance towards open ground. This provides area to slow the animals down as they come down so they are less likely to injure themselves or others.

A permanent ramp consists of a raised flat concrete space to provide a relatively level surface where the tailgate of vehicle is dropped prior to unloading of the animals. Since animals need to walk down a slope from the raised flat area to ground level, the slope of angle should be around 10°. If the space for ramp construction is less, slope can be increased after putting grooves on the ramp to prevent slipping of the animals. Under no condition, should the slope of the ramp be more than 20°.

Although, concrete ramp has the advantage of durability, it has disadvantages like •

- Concrete ramps are suitable for specific height vehicles only. For vehicles with nonadjustable height of tailgates, loading and unloading becomes difficult affair.
- Sick and old animals might be injured by the hard concrete surface and develop abrasions, contusions, etc.

Therefore, a special height adjustable ramp makes a perfect link between the levels of the truck and the Gaushala ground surface, making loading and unloading quick and easy. The ramp may be fitted with a motor for adjustment of height. Manual adjustment of height is also possible with locks at multiple levels to adjust height according to the

level of vehicle.



Permanent ramp made of concrete for loading and unloading of animals.

The width of the ramp should be equal or greater than the width of vehicle to avoid tripping of the animals. However, 8-10 feet ramp width is sufficient for all the most commonly used transport vehicles. The ramp may have a variable length of 4-6 metre. The sides of a height adjustable ramp should be solid. Standing space should also be provided at the sides of the passage for the attendants to assist and direct old and sick animals.

The floor of the ramp should be made from checkered iron sheets to prevent slipping of the animals.

Depending on the needs of Gaushala, these special ramps can be made in different lengths and with different loading capacities.



Checkered iron sheets.



Height adjustable ramp fitted with motor compatible with all transporting vehicles of varying height.

2. Crush/Trevis/Chute

A cattle crush, also known as a squeeze chute or trevis, should be a strongly built stall to hold cattle safely while they are examined, marked for identification, or given veterinary treatment. It should be so designed to keep the animal still in order to reduce the risk of injury to the animals or the attendant while the animal is handled.



Veterinarian handling a cow in Gaushala outside the crush. Chances of injury increase when animals are handled outside the crush.

Cattle crushes should be made using standard heavy steel/pipe. This increases the durability of the equipment and reduces the risk of harm.

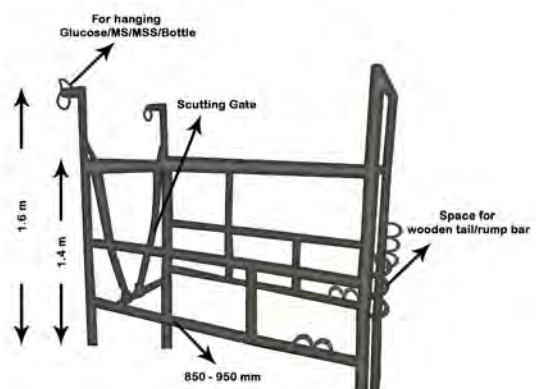
The length of cattle crush should be an approximate of 1.6 metre. The width should vary between 850-950 mm to suit type and size of cattle to be handled. The height of the crush is approximately 1.4 metre above floor level.

A sculling gate at the front end of the crush is provided to restrict the movement of neck. The sculling gate has a greater opening width when the animal is entering the crush to minimize cases of animal refusing to enter. When the animal is driven forward the gate closes on the neck. The two heavy adjustable steel pipes in sculling gate are squeezed and fitted at one of the multiple locking position on the horizontal bars fixed at a height of 1.4 metre. After administering the treatment, sculling gate is opened after releasing the steel pipes to remove the animal easily.

A space for wooden tail bar or rump bar should be there at the rear end of the crush. The use of wooden bar is primarily to reduce the occurrence of injury to the animal in case animal tries to move back or kicks at



Crush with open sculling gate at the front end.



Cattle crush for handling and restraining of cows in Gaushala.

the bar. Use of padded wooden bars further reduces the risk of injury to the animals. However, sliding or hinged gate may also be installed as an alternative for ease in operation.

At the front end of the crush, there should also be provision for hanging the Glucose/NSS drip bottles at a height.

The floor of the area where crush is installed should be made of concrete slabs finished with non-slippery diagonal grooves at 100 mm intervals to prevent animals slipping.

3. Cow sling for lifting cows

Cow sling fitted with hydraulic motor or manually operated by operators should be available in Gaushala that lifts and supports sick/old/recumbent/infirm cows humanely and safely. The main purpose of a cow sling is to encourage blood circulation, feeding and assisting the cow to become fully mobile again.

It should be such designed to support a downed cow over a large body area to reduce pressure points which may further injure the animal. It should be manufactured from long life materials like tarpaulin sheets, etc.



Buffalo getting treatment administered calmly in a specially designed cattle crush.



Cow sling for lifting and supporting sick/old/recumbent/infirm cows.



For making a sling, a large cloth sheet or tarpaulin sheet may be used. Fold to a length of 5 feet and width of 3 feet (length may vary according to the length of animal). Holes should be made for the legs and the udder to fit into them. Tie a thick cotton rope to the corner of each side and tie the other end of the ropes to the hooks on the frame as shown in pictures below. The rope is passed over the pulley fixed at the top of iron post at least 7 feet in height and then through a pulley at the top on the side of frame. The rope then leads downward towards the pulley at 3 feet height on the sides attached with a handle

for manually pulling the cow upwards or motor for automatic lifting. Tractor may also be used to pull the ropes. While helping the animal to stand with the help of slings one must ensure gentle handling and avoid jerky/quick movements.

The cattle load that needs to be lifted would be around 600-800 kg.

4. Refrigerator

Gaushala should have a refrigerator for storing vaccines, hormones, medicines and other items that have manufacturers' requirements for storage at a temperature lower than room temperature.

Apart from this, ice application, which at times forms the core of treatment, can only be made available within the Gaushala via means of refrigerator of appropriate size.



Refrigerator of appropriate size according to the requirement of Gaushala should be installed at the Gaushala.



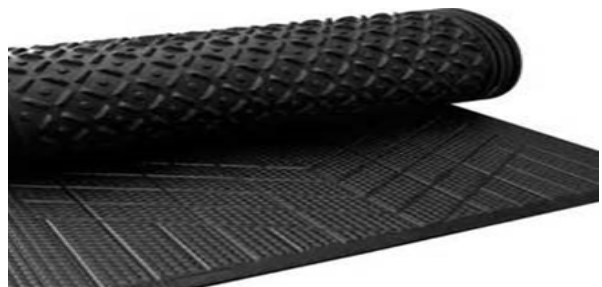
Portable refrigerator for transporting medicines, vaccines, hormones, etc. to attend calls.

A portable refrigerator with battery backup should also be available for storage and transport of items that require storage at low temperature.

5. Cow mattresses

Mattresses for cows should be easily washable, waterproof, non-slippery, durable and cost-effective; along with providing a comfortable and supportive bedding surface.

Rubber mattress with minimum of 20 mm thickness and easy to roll must be purchased. Guaranty period of mattress is also critical while purchasing and 5-year conditional warranty should be insisted on.



One-piece roll out rubber mattress for cows.

6. Curtain for sheds

To protect cattle at places where weather conditions are often harsh, the right curtain system can provide comfort and improve the ease of operation. These curtains require to be placed on the side of the sheds adjoining the manger. These curtains should be manufactured using tarpaulin sheets or other durable and water proof material.



Green coloured curtains manufactured using tarpaulin sheets are best for a Gaushala.

Sick and old animals shed and calf sheds must have provision of these curtains to provide additional comfort and protection.

7. Gum boots

While rearing and maintaining cattle in a Gaushala, the care takers/attendants require to do heavy duty work and at times damage their feet and lower limbs. If correct footwear is provided to them with a cushioned sole and foot bed that supports the arch of the foot, chances of injury become lower.

Care takers/attendants of cows work throughout the day on the concrete floor that, at the time of manure clearing, also involves risk of slipping. Gumboots with proper grooves on the sole must be made available to them. Gumboots prevent damage and infection to their feet.



Gumboots for Gaushala workers.

8. Floor groove cleaners

Floor Groove cleaners for cleaning the grooves of cement concrete floors of cattle sheds should be made available in each shed and to each employee of Gaushala involved in cleaning activity. The cleaner should have a comfortable handle for easy cleaning. It should have three or more pointed prongs made up of iron, for digging the faecal material from the grooves of floor. These prongs may be adjusted according to the width of grooves.



Floor groove cleaner for cattle sheds of Gaushala.

9. Bull leader

Gaushalas today have a large number of bulls. Training of bulls at younger stages of life requires specialised equipment called bull leader, the distal end of which fits into the hole of the nasal septum of the bull and allows the trainer to take the lead. Bulls can be easily controlled with the use of bull leader and every Gaushala where large numbers of bulls are housed should procure this equipment for easy handling and training of bulls.



Bull leader for effective handling and training of bulls in Gaushala.

10. Mouth gag

Occasionally, the need arises to visually or physically examine the inside of the mouth of cattle to check for injury to the tongue, gums, teeth, etc. For drenching the animals also, mouth gags are required.

Basically, a mouth gag is made of cast aluminium or cast iron. It consists of two wedges, one for each side of the mouth, which are pushed up between the upper and lower molars. The reflex clamping of the jaws ensures that they are



Mouth gag for drenching and examination of cattle in Gaushala..

retained open and access is made for drenching or evaluation.

11. Bull holder

Bull holder is a necessary instrument for rendering care to bulls and calves. This stainless steel, cast aluminium or polished alloy instrument is placed on the nasal septum of the animals, making them easy to handle. It only creates pressure on the nasal septum without leaving any incision. These are also called as bull pliers or bull nose and may also be used for ease of drenching sick and old animals.

Many variants of bull holder are available in the market like bull holder with spring, bull holder with rope and bull holder with chain.



Bull holder with spring, rope and chain for handling/controlling bulls and calves.

12. Bull nose punch

Bull nose punch is used to perforate the fleshy part of the nasal septum prior to insertion of a nose ring, reducing stress, risk of accidents and making the job more animal friendly. The bull nose punch is made up of stainless steel, cast aluminium or polished alloy.



Bull nose punch used for ringing the bull calves as well as the bulls.

13. Bull nose ring

Bull nose ring made of stainless steel, copper, brass and even nickel plated are available in the market in different size (40 mm, 60 mm and 70 mm in diameter). Bull nose ring is inserted and fixed into the nasal septum of animal after puncturing with bull nose puncher. This eases the handling, controlling and restraining of bulls.



Bull nose ring and ring applicator.

Although, bull nose ring can be manually applied to the animal, a specialised applicator is also available for easing the application of bull nose ring.

14. Bull nose string

After the application of bull nose ring, one end of nose string is passed through the hold and tied a knot, with other end of string behind the horn. It may be made up of cotton or synthetic material. Cotton rope is most preferred because it is strong, safe and easy to use when making knots. Rough, hard ropes like coir should not be used since they can cause abrasions.



Bull nose string passed directly through the nasal septum of the animal for controlling it.

15. Cattle neck plate

Cattle neck plates made up of galvanised aluminium or plastic may be used for identification of animals. The advantage of using neck plates is that they do not require piercing of body parts and hence do not cause any pain in the name of animal identification.



Cattle neck plate made up of iron used for identification of animals.



Cattle neck plate made up of plastic in different colours. Numbers are used for identification of animals.

16. Electric dehorner

Electric dehorners are powerful instruments allowing safe removal of horns in cattle. It is important to dehorn livestock because of the potential damage the horns can cause. It is better to dehorn livestock at a young age because it minimizes stress and bleeding.

Dehorning of cattle over the age of 12 months should be done only with help of anaesthesia.



Electric dehorner with an electric wire supply for dehorning in Gaushala.

17. Weighing machines

ISI marked weighing machines of different grades should be available in the Gaushala for weighing cows, purchased items like concentrate, gur, etc. and milk before sale.

Weighing machines required in Gaushala are of three types: Heavy duty weighing bridge, hanging weight balance and platform weight balance.



Heavy duty platform weight balance for measuring weights of animals at regular intervals to assess their health and well being.



Hanging weight balance for weighing items of regular use in Gaushala.



Platform weight balances are easy to handle as compared to hanging weight balance.

18. Manual grooming equipment

A variety of manual groomers should be available in the Gaushala for grooming, washing and comfort of the animals.



6" Rice root body brush for rough grooming of cattle.



Plastic grooming brush or curry comb for washing livestock



Grooming brush with rubber bristles.



Body brush with handle

19. Hoof cutter for cattle

The main reason for large number of lame cows in Gaushalas is the unmanaged hooves of animals.

A heavy duty hoof cutter simplifies the task of keeping cattle hooves neatly trimmed in order to prevent sore, ill-shaped or quarter cracked hooves. The long handle provides additional safety to the handler from kick of animals.



Plastic halter

20. Plastic halter

An all-cotton or nylon like plastic rope made halter that does not rot or swell is required for handling and controlling animals in Gaushala. Durable, well-finished halter with adjustable lead can best manipulate the movements of animals.



Hoof cutter for cattle.

21. Drenching gun

Drenching gun or cattle drencher allows safe and easy administration of fluids to cattle. The probe is inserted into the side of the mouth to encourage and enable swallowing. Easy-grip handle for one handed use should also be the feature of drenching gun used in Gaushalas.



Drenching Gun/cattle drencher.

22. Tag applicator

Light weight ear tag applicators made of aluminium, finished with long lasting paint and fitted with deep jaw ensuring correct ear tag placement could be used in the Gaushala for identification purpose of the animals.



Ear tag applicator for cattle in Gaushala.

23. Plastic ear tag

Flag shaped yellow coloured ear tags, easily visible from a distance and made of durable plastic could be used for identification of cattle in Gaushala. The plastic ear tags should fit the ear tagging applicator.



Plastic ear tag for identification of animals in Gaushalas.

24. Chaff cutter

Chaff cutters are efficient in uniform cutting of green as well as dry fodder. They are also useful for silage preparation.

Electric chaff cutter instead of manual chaff cutter minimizes the requirement of daily wage workers and also helps in uniform chopping of fodder for cattle in Gaushalas.



Manual chaff cutter.



Motorised chaff cutter.

25. Grain grinder

Grain grinders are required in Gaushala for reducing the particle size of cereal grains. Although it involves additional cost, yet some processing is needed for improving the digestibility of the grain. Reducing the particle size increases the microbial activity in the rumen and enzyme action in the small intestine. It improves palatability and makes grain more digestible.



Automatic grain grinder

26. Spray tank

Pressure spray tank of plastic should be made available in the Gaushala, necessary for disinfecting the premises. It should have a smooth pumping action, and attached with comfortable and easy to attach backpack straps. It should also be light weight, reasonably compact, easy to use, clean, transport and store.



Sprayer tank for disinfecting Gaushalas.

27. Milk pail

A milk pail is a tall, conical or cylindrical container for the collection and transportation of milk. It is originally a lidded bucket with a handle and made up of aluminium or steel. Milk pails are available in different quantities; the most commonly used milk pail is of 45 litres.



Milk pail of different sizes for storing milk before sale or processing.

28. Milk measures

Milk measures made up of stainless steel or aluminium available in 50 ml to 2 litre capacities should be available in the Gaushala.



Milk measures.

29. Large trolley

A large trolley to carry the diseased or injured animal from one shed to the other or from shed to the hospital or from the hospital into the operating theatre should be available.

The width of the trolley should be such to allow movement of trolley in and out of the gates.

A trolley made of painted galvanized iron fitted with four wheels and measuring 4 feet wide and 8 feet long would be ideal for carrying animals. It should be covered with a washable rubber mat for comfort of the sick/diseased animals. Iron rings should be fitted to the sides of the trolley for supporting the animal by tying while transferring. An iron flap at one end for supporting the head of extra long animals should also be there.



Trolley for carrying animals.

30. Calf feeding bottle/Nipple pail

2 to 3 litre calf feeding bottle made up of plastic and fitted with nipple is required for feeding orphan and abandoned calves. A plastic pail fitted with one or more nipples may also be employed for feeding them milk. These pails should be flattened on both sides for ease of drinking by calves and fitted with strong wire handle. It has an advantage of easy cleaning. While purchasing pails/bottle it must be ensured that food grade plastic is used for manufacturing to avoid contamination of milk.



Milk feeding bottle.



Milk pails with single and multiple nipples.

31. Asbestos cement sheets

Properties like heat and fire resistance, excellent strength and durability have made asbestos cement as the perfect roofing material for cattle sheds in Gaushalas. Cheap and easy availability further makes it more desirable for roofing. There are many companies manufacturing such sheets, one of which has been mentioned in the list of companies for purchase of equipments (page 291).



Asbestos cement sheets

4 | MANAGEMENT OF GAUSHALA

The management of Gaushala is an art of combining ideas, facilities, processes, materials and labour for the well-being of cows in most economical way. It involves decision making, examining major constraints and determining methods of minimising these constraints while managing different units of the Gaushala.

A manager is an organiser and decision maker who is well informed about the minutest details and affecting animals.

Behaviour of cattle

It is important for the management of Gaushala to understand the behavior of cows for their proper care and management. Here are some insights:

- Sight of cows is most developed of the five senses. In order to get the best vision, cows lower their heads and face the person or object head on. Therefore, the best way to approach a cow is from the side, moving at a slow pace. This will not surprise or alarm the animal. The area behind the cow's tail is blind spot. If the animal is approached from there, it will upset the cow and lead to unpredictable behavior.
- Cows always prefer well lit areas and move towards them. They will avoid moving from well-lit to dark areas.
- Cows are very sensitive to high frequency sounds and have a much wider range of hearing than humans. High pitched noises, whistling, clanging of metal and shouting is very stressful for the cows.
- Cows have a very well developed sense of smell. They will avoid places containing the urine and nasal discharge of stressed animals- such as cattle crushes. The feeding area should therefore be kept clean and free of dung and saliva.
- Cows can sense four primary tastes: sweetness, saltiness, bitterness and acidity. They are more sensitive than humans to tastes and are apprehensive about unfamiliar tastes and smells.
- Cows are intrinsically afraid of unfamiliar situations, smells, sudden movements and noises. They either freeze or baulk at unfamiliar sounds and objects. Baulking is when the animal flinches and resists doing what it is being led to do.
- Cattle fear novelty but accept routines easily. They have good memories and remember handlers who have been rough with them. Calm animals are easier to handle. Fearful animals stick together making handling more difficult. If they become frightened it takes 20 minutes to calm down. Shouting or attempting to force an animal to do what it doesn't want to do will cause the animal to become confused and disoriented. Fear responses make cows more prone to slipping, falling and injuries (pelvic and hip injuries due to falling and hoof injuries due to slipping).
- It is important to let cows move at their own pace because hurrying makes them

nervous. Cows generally walk in some order of rank and do not overtake each other. When they are calm they keep their heads down. They only lift their heads when they become nervous. Allow routines to develop and then rigidly stick to these routines.

- Cattle rarely express pain openly. The indications of pain are very subtle. Therefore all handlers should be taught the signs of animal ill health. Common behavioral indicators of pain are:
 - a) Abnormal stance and gait: Stances indicating pain may include a tucked abdomen and tail, hunched back or standing still for extended periods of time. Abnormal gaits can include walking backwards or limping.
 - b) Abnormal resting behavior: Cows lying with legs in an unusual position, hesitating to rise when lying and trying to keep the painful parts of body off the ground (dog sitting).
 - c) Vocalizations: Fear, isolation, pain and stress situations may induce a cow to make stress calls. These also act as a warning to other cows to avoid a similar painful situation.
 - d) Kicking and tail swishing: Both may be performed in response to acute pain and may be directed towards the painful stimulus.
 - e) Teeth grinding, reduced food intake and an absence of rumination.
- If the cow is frustrated or unwell or the Gaushala is too overcrowded not allowing for natural behavior, the cow will indulge in stereotypical behavior which is repetitive and pointless. Tongue rolling, bar chewing, extreme aggression towards humans and mounting other animals are some of the stereotypical behaviors.
- If the cow is overfed and bored, some of the actions will be dropping feed, throwing feed and lapping water. Feed tossing behavior is exaggerated by the presence of flies in summer. Also cows prefer to eat at ground level where feed tossing is rarely observed as compared to elevated mangers.
- Tail of cows is an important signaling tool. It will be held horizontal during defecations and urination. If together with the head it is elevated it indicates that the animal is investigating its surroundings. Tails are also elevated during heat display, fighting, threats, greeting and suckling. When the tail is held between the legs it indicates the animal is cold or fearful. Lateral movement of the tail is used for fly removal or for when the cow is irritated.
- When cows ruminate they appear relaxed with their head down and eyelids lowered. Resting cows prefer to lie on their chest facing slightly upwards.
- Within the herd there is a dominance hierarchy. The hierarchy usually depends on the temperament of the animal, her age and size. Aggressive or agonistic behaviors are one of the ways in which the hierarchy is established. Introducing new animals into the herd leads to hierarchies having to be reestablished which is done within 24-72 hours. Changes in the group structure may cause enough disruption to actually reduce food intake. It is important to give cattle enough space so subordinate individuals can avoid confrontation.

- Cows are much more intelligent than we think. They are slow movers but quick learners. They have remarkable emotional sensitivity and are deeply affected by emotional and physical pain like early separation of their young ones, dehorning, etc.
- The memory or ability to remember things is well displayed by the dominance-submission relationships in cattle. Cattle recognize each other and even good and bad behaviour of individual humans.
- Cows and their calves communicate using calls. These calls are low frequency when they are close and high frequency when they are separated by a distance. If the calf dies or gets separated from its mother, the cows mourns her baby.
- Cows sleep for approximately 4-5 hours per day only. But rests a lot while sitting and chewing the cud for hours.
- Cows are easy to manage if they are kept in groups from the start of their life. They learn things quickly when they are in a friends' zone.
- Social factors and physical condition of animals influence the quantity of feed consumed by them. Calves reared individually consume less feed as compared to those reared in groups due to visual reinforcement. As compared to healthy animal, sick and old animals will show a reduced appetite. Off-feed and reduced feed intake is one of the earliest symptoms of disease in a cow.
- Welfare manuals use 20 terms to describe cow behavior in welfare assessment manuals. These are listed below in decreasing order of positive emotional state:
 1. Happy
 2. Content
 3. Positively occupied
 4. Friendly
 5. Relaxed
 6. Calm
 7. Active
 8. Sociable
 9. Playful
 10. Lively
 11. Inquisitive
 12. Uneasy
 13. Bored
 14. Indifferent
 15. Fearful

16. Apathetic
17. Frustrated
18. Agitated
19. Distressed
20. Irritable

The behavior of the handler has a great impact on cow behavior. If the handler has a negative behavior towards the animals, they will become fearful and tend to jerk and behave aggressively. If he is calm, considerate and positive the cows will be relaxed and be easier to manage.

Negative behaviors such as hitting, slapping, tail twisting, quick or sudden actions and shouting produce more fearful cows. Even less obvious negative behavior like mild slaps and pushes can heighten fear making the behavior of cow unpredictable. Positive interaction and good handler behaviors include slow and gentle movements, rubbing or resting the hand on the cow's back or flank and gentle vocal communication will lead to a relaxed herd of cows, better health of the herd and easier handling.

Educating Gaushala handlers on the best ways to handle cattle will help improve cow welfare. Poorly designed facilities can make cattle more difficult to move leading to frustrations in the staff. But, if they cannot change the poor housing facilities, every attempt should be made to change the attitude of the handler.

- Keep herd handling routines (eg. milking, veterinary treatment, etc.) consistent and calm
- Allow time for cows to learn any change in routine
- Use positive interactions such as a stroke or a rub or resting the hand on the cow's back
- Scratch the cow or give her feed as a reward after a bad experience, such as restraint or vaccination
- Reduce excessive noise, such as banging gates and shouting
- Avoid staring at a cow directly for long periods
- Avoid painful procedures in the milking parlor
- Move cattle in groups rather than individuality

The handler should have exact knowledge regarding the individual behavior of every animal in one's charge and ability to recognize small changes in the behavior of any animal or all the animals collectively. People with good cowpersonship are perceptive to the conditions from the animals' point of view, in other words, they 'think like a cow'. They can use these skills to detect any changes in the health, comfort and welfare of stock and relate them to ongoing cow performance.

In order to manage cattle, we must understand that they are sentient beings. In Gaushalas, confinement also interferes with the habitat of the cows and their social organisation.

For effectively managing a Gaushala, its manager should also have knowledge of the

animal's behaviour individually and in groups, besides other skills of management. One such training programme is run by Gaushala Kalpvriksha, 8, Apsara Complex, Indrapuri A-Sector, Near J.K.Road, Bhopal- 462 021, Phone : +91-8839228679, 8109045954.

Knowledge of behavioural factors such as social companionship, dominance by other animals, regular feeding and resting behaviour and the rhythms of other activities such as sleeping and breeding further helps in improving the status of cows in Gaushala.

a) Imprinting

Imprinting is when a newborn animal is able to recognize its mother from among other individuals of the same species. This process helps to ensure that the young will not become separated from their parents, even among large herds of similar animals. The best-known form of imprinting is mental imprinting, in which a young animal acquires its behavioral characteristics from its parent. Imprinting is believed to be especially important in hoofed mammals which tend to congregate in large herds in which a young animal could easily be separated from its mother. New born calves can easily be imprinted to interact comfortably with humans.



Calf after its birth with developed maternal imprinting is able to recognise its mother from a group of individual animals of same species.

b) Memory

Memory is the ability to remember and capacity to retain or recall things that are learned or experienced. Animals also learn by watching others and imitating them.

The existence of dominance-submission relation in cattle is evidence that cattle do remember or recognize each other. Apart from this, feeding, drinking and even sexual behaviour in cows is learned and improved by imitation.

c) Stress and strain

Change in behaviour is the most common and identifiable evidence of stress in cows. Many environmental factors like unfavourable temperature, rearing conditions, food supply, stocking density, space allocation and confinement are agents of stress.

These stress conditions can produce deviations in existing normal behaviour or even result in the generation of new behaviour patterns like reduced intake of feed, absence of feeding, self-isolation, etc.

d) Digestive behaviour of cattle

Rumination

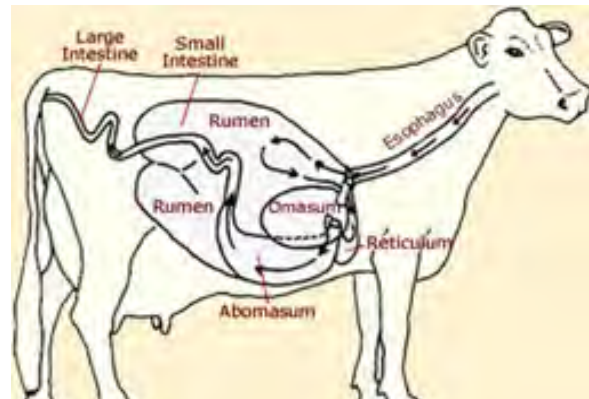
Cows quickly consume large volumes of green forage. This habit developed during evolution of the animal, when grazing in the open was only alternative for feeding, where they were exposed to predators and inclement weather. After ingesting large

volumes, they move to sheltered areas, relax and ruminate leisurely. Rumination involves regurgitation of consumed feed, proper mastication and re-swallowing food, which they have previously ingested.

Cattle are ruminant animals; this means their stomach contains four compartments:

1. Rumen
2. Reticulum
3. Omasum
4. Abomasum

When a cow first takes a bite, it chews just enough to moisten the food. Once swallowed, the food goes into the first and largest part of stomach, the rumen, where it mixes with other acidic digestive liquids and is softened. The softened food is called cud, small balls of food.



Digestive system of cattle.

Next, the rumen muscles send the cud back up to the cow's mouth, where it is re-chewed (also called chewing the cud) and swallowed again. She brings a mouthful at a time up from the rumen through the esophagus and into her mouth where it mixes with saliva, a natural antacid for her, and she chews it completely and swallows.

This time the cud goes to the Omasum section of stomach after flowing through the second compartment in order to squeeze out all of the moisture.

Finally, the food enters the last part, Abomasum (true stomach) where it mixes with digestive juices completely digesting the food.

Cud chewing is often used as an indicator of a healthy and comfortable herd. A happy, healthy animal will produce more milk or have a higher production of muscle.

Cows prefer to sit down and chew the cud roughly for 4 to 9 hours daily, under any housing conditions. But, if the floor is wet or exposed to rain, they may ruminate standing or walking slowly. Throughout the day, cattle ruminate 15 to 20 times the period of which varies from a few minutes to more than one hour. When the green fodder consumed is soft and of good quality, the rumination time will be short. The peak activity for rumination is immediately after night-fall.

Animals who do not chew their cud properly may be scared or have digestive issues such as twisted stomachs or a displaced abomasum, their fourth section of stomach. Feeding high quality forages will help to ensure the cows are digesting and chewing their cud properly. Cud chewing is also necessary because the foods ruminant animals eat are difficult to digest and it takes extra effort to get all of the nutrients from the food.

Grazing

A cow when allowed to graze naturally can cover an average distance of 4 km per day, which increases if the weather is hot and they are troubled by flies. During summers, shift from a day-time grazing to a night-time grazing must be made, if animals are not fed in their sheds only.

Cattle are also not equipped to graze very close to the ground and snap grass at a height more than one cm from the ground.

They avoid foliage contaminated by urine and dung. Taste is the major factor in deciding which plant to eat, although smell, sight and touch also play a role. If a choice between hay and silage (preserved green fodder) is given, cows spend roughly 2/3rd of their eating time with silage and 1/3rd with hay.

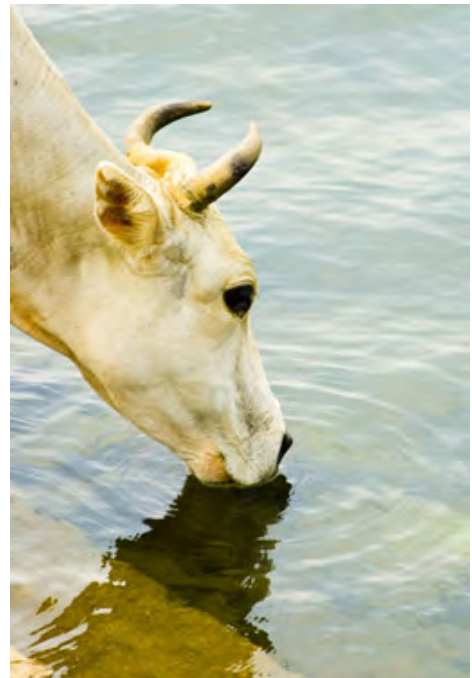


Herd of cattle grazing in the open grasslands.

Drinking

Cattle drink using their muzzles keeping the nostrils above the surface of water. An adult cow usually drinks water one to four times per day, but consumes a daily average of 40-50 litres of water in normal conditions. The frequency of drinking water increases in hot weather. There may be deviation in water consumption by the animals depending on the following factors.

1. **Body size of the animal-** A large sized animal will have higher water requirement and will consume more water.
2. **Condition of the animal-** Lactating animals will require more water depending on the milk yield of the animal.
3. **Season-** Water consumption increases during hot weather and cows consume 20-25 per cent more water.
4. **Nature of feed-** Animals receiving predominantly dry feeds require more water than those getting succulent green fodder.



Cow drinking water from its mouth keeping the nostrils above water.

e) Aggressive behaviour

This is the type of behaviour which results when cattle are kept together artificially. When two animals from different background meet for the first time, fighting will not occur if one or both shows a submissive or evasive response. If the animal threatened is slow to submit, it may be butted usually at the rump or side. If the attacking animal has horns, they may cause serious injury.

A subordinate animal quickly retreats when butted. If not, fighting between cows can cause physical injury along with submissive and meek cows not getting sufficient opportunities to feed properly when group-fed. However cows (females) are less confrontational than bulls (males). There is no aggressiveness in bullocks.

Aggressive posture by the animal being threatened is an indication that it accepts the

challenge. Aggressive posture includes lowering of head, horns pointed on the other animal and eyes crossed towards it. The tight posture of cows is similar to the 'fight or flight' posture of bulls. Bull paws the ground, rubs its head and neck on the ground and ploughs up earth with its horns. The animals may stand one or two metres away from each other displaying aggressive posture for some time presumably playing a 'war-of-nerve' with each other.

f) Sexual behaviour

For proper and effective management of a Gaushala the knowledge of sexual behaviour and nature of sex drives/ characteristics in males and females is a must.

Bulls

Young bulls are inexperienced and approach cows hesitantly. When exposed to unfamiliar surroundings, expression of sexual behaviour is further reduced in young bulls.



Agonistic behaviour of two bulls engaged in a fight for dominance.

However, in a natural environment, a bull will detect a cow in heat 2 days before it is actually receptive to mating and will remain in its vicinity as guarding behaviour.

Once the cow comes in heat, the bull, while following the cow, will lick and smell the external genitalia while curling its upper lip exposing the gums. The head is held horizontal, neck is kept extended, nostrils are widened and tail is held up.

If there are 2 or more males, they will display confrontational behaviour between them.

While grazing together, bull butts the hindquarter of cow nudging her to move forward. The female showing positive response stands firm while shifting some weight backwards. The bull stands behind the cow placing his chin and neck on the rump. Non-responsive cows move away from the bulls. After mounting and mating, bull continues to follow/ accompany the cow for some more time.

After attaining puberty (at one and half years of age), sex drive in males gradually increases and it requires the management of Gaushala to castrate the breed bulls to prevent unnecessary mating.

Cows

Cow mate only when in heat. After attaining puberty (1.5-2.0 years of age), when cows come in heat, normal behaviour and routine gets disturbed. A reproductive healthy cow comes in heat after every 18-24 days. On successful mating (conceiving) the cow stops coming in heat till it gives birth to young one and again comes in heat after 60 days of giving birth. It should not be mated before 60-90 days because the uterus is healing. If not mated, a cow will come in heat 10-12 times per year.

While the most essential characteristic for identification of heat is mounting of male, there are often visible signs of heat like bellowing, mounting other same sex cattle, swelling and reddening of vulva and clear discharge from the vulva.

Normal feeding, rumination and resting pattern becomes affected. The heat period lasts for 24 hours approximately.

Management of Behaviour of Animals in Gaushala

Following means can be implemented to manage their behaviour.

1. While following a routine procedure in Gaushala like feeding, watering, milking, weighing etc., cows can be trained to control their behaviour. On repetition of a routine, cows start to recognize and follow these procedures. Conditioned reflex can be developed easily eg. Sound of tractor to assemble for feeding, whistles and calls for assembling etc.
2. Control by force using varied variety of ropes is another method of managing behaviour of cattle in Gaushala. Vaccination, drenching, blood collection, ear tagging, tattooing, A.I., pregnancy diagnosis, dehorning etc. requires restraining and handling of animals. While manipulating their behaviour for complete restraining, trevis (discussed in detail on page 41) should be employed to immobilise the animal.
3. Chemicals may also be used at times to control animal behaviour. Ferocious animals, which are difficult to handle, can be restrained by this method. As use of excessive force would result in a permanent state of panic, chemical agents of varied nature and intensity may be used for such animals to alter the behaviour of animals by depressing their nervous system eg. Xylazine and Ketamine. The effect will last for only 30 minutes.

Routine Gaushala operations

Management of Gaushala means taking care of all the animals and, this care includes common practices like feeding, health cover, grooming, etc. Special management practices for individual classes of animals, like milch cows, dry cows, etc. are also covered under these operations.

There are some activities that are routinely required to be carried out in Gaushalas. If properly executed, these operations help in effectively managing a Gaushala.

a) Identification

Proper identification or marking of cows in Gaushala is the first pre-requisite for accurate record keeping.

Most commonly used methods for identifying cattle in Gaushala are tattooing, ear tagging and neck chain. Of these methods of identification, the most acceptable technique is application of tags.

Tattooing

It consists of piercing outlines of desired numbers or letters on to the skin inside the ears of the animal. A black tattooing pigment is incorporated into these punctures after piercing the outer skin for identification.



Picture of tattoo on the ear of calf.

Tattooing sets comprising a tattooing forceps, tattooing ink and series of letters and figures are available in market. Tattooing should be done on the inner side of the ear avoiding ear veins.

The part of the ear to be tattooed should be thoroughly scrubbed with soap and water, wiped dry and swabbed with methylated spirit to remove dust and other infection causing agents. Tattooing ink (black or green) is liberally applied over the letters or figures. The desired number of figures, fixed to the tattooing forceps, is then imprinted over the part of the ear by pressing the jaws of the forceps firmly. Some more ink is also rubbed into the tattooed punctures with the bulb of the thumb after removing the forceps. Identification mark is primarily because of steel points carrying small amount of coloured ink into the subcutaneous tissues and cartilage of ear.

While this procedure is less painful than tagging it is not practical as it requires close physical inspection.

Tagging

Tags or labels for identification of cattle are made of strong plastic with numbers stamped on them. Tags are fixed generally to the ear with a special tagging forceps. Antiseptic solution should be applied to the wound after tagging to encourage healing and prevent infection.



Cow with an ear tag for proper identification of the animal.

Tags should be applied in the upper edge of the ear as close to the head as possible. This should be far enough from edge so that it is less likely to fall off or tear off from the ear lobe due to free swinging, or during fighting between animals. After the death of animal, the tag number can be reused but after 5-6 years to avoid confusion in the records of animals.

b) Castration

Castration is the removal of testicles or glands that produce male sperm cells. Males are rendered docile at an age of 1 year. The older the calf becomes, the more it suffers at the time of castration. Castration should also be avoided in rainy seasons for fear of fly menace.

Vasectomisation of bulls can also be performed, where the vas deferens is destroyed leaving nervous and blood supply intact. These bulls show normal sexual activity, but their semen do not contain sperms. Hence, they cannot impregnate cows and are used as teaser bulls to detect heat.

c) Dehorning

The removal of horns is called as dehorning. Since, horns serve as no useful purpose for the animals in Gaushala, they should be removed as early as possible (4-10 days only).

In young calves dehorning is performed by arresting horn growth when root of horn is in the form of bud. Although, this method of disbudding causes pain to the animal, it is for the overall good of all. Specially designed hot iron rod either electric or not is applied to the horn buds. It is a bloodless method of dehorning and can be performed in any season of the year. However local anaesthesia and pain killers should be used.



Dehorning using an electric dehorner in a young calf.

Chemicals like caustic potash or caustic soda can also be used for disbudding. These are applied on the horn buds after surrounding the area with heavy grease/vaseline to protect the eyes of the animal.

In adult cattle, the horns are hard and difficult to cut. Saw and clippers should be used carefully avoiding any injury while dehorning the animals.

d) Bedding

Management of bedding in Gaushalas is very essential as cows generally spend 10 or more hours per day resting on the ground. Comfortable resting surface encourages resting behaviour in cows. The reverse brings about abnormal behaviour in cows.



Paddy straw over concrete floor as a bedding material to increase the comfort of cows.

Comfortable bedding negates the hardness of floors thereby minimizing the possibility of injury to animals. It reduces hock and knee abrasion as well as hock and knee swelling. A soft, dry, comfortable surface for cows to rest on in order to be healthy and more comfortable should be ensured in their sheds. However, bedding materials will only be effective on the floors under the roofed area.



6-8 inches of sand on firm even natural earth. Because of inorganic nature of sand, it absorbs the urine and dung of cow quickly keeping the floors clean, thereby curtailing infections.

If bedding is not given (continuous housing on concrete) the cattle are inclined to develop abnormal postures, lesions on carpal joints of front legs and tails due to a continuous state of discomfort. Non-maintenance of bedding also results in an accumulation of dung and urine over it, which might result in slipping and animals getting injured.

Various kinds of bedding materials can be provided however, each having its advantages and disadvantages. Some choices of bedding material include clean sand, straw of various kinds, wood shavings or mattresses manufactured specially for cattle comfort.



Rubber mattresses for the comfort of animals.

Of the beddings available locally, sand is the best bedding material for Gaushala cattle. It induces increased lying time, decreased injuries and reduced need for hoof trimming. The depth of sand should be 6-8 inches over a hard floor. Sand covered area of 40 feet² (8' x 5') per cow would be appropriate for an adult to rest comfortably.

An earth bed (kuttcha floor) also provides some cushioning for cows resting and provides good footing. However, there is requirement for bedding to be used over it for enhancing cow comfort.

Although, earth bed and sand bedding has several advantages, it requires a significant amount of regular management to be employed for cow comfort. Both of these require a lot of maintenance and replacements because along with providing bedding, maintenance of proper sanitation and hygiene of the floors need to be ensured.

If paddy straw or other locally available dry crop residues are used as bedding material over concrete floors, 6 inches thick bedding should be provided.

Other options of bedding materials for cattle in Gaushala include mattresses or rubber mats (discussed in detail on page 43). These are specially designed for the comfort of cows by various manufacturing companies.

e) Grooming

Grooming is of considerable importance to cows. It is actually a social activity and acts as a way to cope with stressful situations. The animal may groom itself or socialise for grooming. Self-grooming of cattle includes licking, scratching with hind hoof, scratching with horn, shaking, rubbing, pawing, etc.

One function of grooming behaviour is merely cleansing of the coat while another function is related to the establishment and maintenance of the social structure in the herd. In Gaushalas, grooming posts (where an animal can rub its body) are not easily available or accessed as they would be in pasture systems. Therefore, grooming should be applied as an environmental enrichment of cattle, enhancing their physical or social environment.

The most basic form of grooming that can be undertaken in Gaushalas comprises of brushing the hair coat of animals. It can be performed for cleanliness and appearance of animals. It stimulates the cutaneous blood and lymph circulation, removes waste

products like skin secretion and loose hair, and removes lice and other skin parasites from the hair coat. Vigorous brushing also keeps skin in loose and pliable condition and brings out the natural oil in the hair giving the animals a healthy look.

Dandy or body brush made of stiff bristle fibres should be used for grooming. The brush is held in the left hand for left side and right hand for right side for the safety of the groomer. Face should never be brushed but wiped with a clean khadi or flannel cloth.

Stationary brush, rotating brush or swinging brush may also be installed which also helps to lowers stress level in animals. However, motorized brushes require a higher investment. Additional power and wiring is required for these brushes and may require more money than just the cost of the brush.

A single brush should be installed per 60 cows. If the animals are overstocked, dominant cows may use the brushes more than subordinate cows.



Of all the activities that are dear to cows, eating is the most popular but grooming runs a close second.

f) Exercising

Exercise keep the animals active and helps in maintenance of good health. It gives them exposure to sunlight providing vitamin-D. It is also necessary because too much standing at one place weakens their leg muscles, causes the hooves to overgrow and puts abnormal strain on legs and feet.

Exercise is more essential for bulls to keep them in good condition. For that purpose they should be paraded for an hour each day. Bull exerciser can be used to exercise a number of bulls simultaneously.



Bull exercise unit at LUVAS for keeping bulls in good shape should be installed at every Gaushala.

g) Weighing

Gaushala should regularly weigh animals to get stock of their general condition, growth, well-being and health. eg. Loss of weight in the animals of Gaushala is an indication of some form of subclinical disease, worm infestation or nutritional deficiency.

A weighing yard made with collecting pens, cutting gates, passages and other fittings to permit quick and efficient weighing of large number of animals are the pre-requisites for weighing.

Animals should be weighed after fasting for 12 hours; fed animals will weigh more than their actual weight.

h) Manure management

Animal waste/manure should be completely and promptly removed from the sheds so that it does not cause any disease. Cattle sheds should be cleaned of manure at least once in a day and if labour is not a problem, twice daily.

Manure should be accumulated in an open field, located as far off as possible from cattle sheds but within the premises of Gaushala after considering the labour required in transporting manure from the sheds. This is necessary as a safeguard against foul odours and fly menace, which not only affects the health of cows but also has a negative impact on the aesthetic value of Gaushala.

Then it may be applied to Gaushala lands, used in gobar-gas plants or vermi-compost units or sold.

If possible, a Gaushala should sign a contract with an outside party to remove manure and supply/sell it to local farmers, etc. The outside party can put its own labour and vehicles in to collect and load the dung.

Routine Gaushala operations

It is important that a daily routine is established and adhered to for feeding, cleaning, record keeping and other Gaushala activities. Having a daily routine set for Gaushala will ensure that essential tasks are performed properly and there are fewer chances of lapses on the part of caretakers of cows.

It should be the duty of the Gaushala manager to ensure that these routine works should be completed within the time set in daily routine.

Management of Gaushala is a full time job. There are no holidays. Duty rosters, for each category of staff i.e. caretakers and attendants should be meticulously made and duties in rotation for maintenance and care of cows should be assigned to them.

A well-planned basic daily routine should be carried out. Changes in the timings of this daily routine should not be often as cows being creatures of habit respond negatively to changes.

Draw up a daily Gaushala operations plan and assign duties to the workers according to this plan. A model of such plan is discussed below, which can be modified by the



Mass weighing and vaccination of cattle.



Woman workers removing cattle manure from a cattle shed.

Gaushala manager according to their requirements.

Most Gaushalas should not be in the business of milk as this leads to corruption and discrimination. However milk can be obtained from recently calved cows and this milk can be given to orphan or undernourished calves.

Sample weekly duty roster							
Name of the employee	4/12/17 (Monday)	5/12/17 (Tuesday)	6/12/17 (Wednesday)	7/12/17 (Thursday)	8/12/17 (Friday)	9/12/17 (Saturday)	10/12/17 (Sunday)
Ram Singh	Harvesting, chaffing and feeding of green fodder to animals	Attending injured and sick animals	Cleaning of mangers/ waterers.	Removal of farm waste	Office/store/ hospital cleaning	Duty at gate and quarantine shed	24 hour emergency duty
Sadhu Ram	24 hour emergency duty	Harvesting, chaffing and feeding of green fodder to animals	Attending injured and sick animals	Cleaning of mangers/ waterers.	Removal of farm waste	Office/store/ hospital cleaning	Duty at gate and quarantine shed
Om Vati	Duty at gate and quarantine shed	24 hour emergency duty	Harvesting, chaffing and feeding of green fodder to animals	Attending injured and sick animals	Cleaning of mangers/ waterers.	Removal of farm waste	Office/store/ hospital cleaning
Rajesh	Office/store/ hospital cleaning	Duty at gate and quarantine shed	24 hour emergency duty	Harvesting, chaffing and feeding of green fodder to animals	Attending injured and sick animals	Cleaning of mangers/ waterers.	Removal of farm waste
Suresh	Removal of farm waste	Office/store/ hospital cleaning	Duty at gate and quarantine shed	24 hour emergency duty	Harvesting, chaffing and feeding of green fodder to animals	Attending injured and sick animals	Cleaning of mangers/ waterers.
Rakesh	Cleaning of mangers/ waterers.	Removal of farm waste	Office/store/ hospital cleaning	Duty at gate and quarantine shed	24 hour emergency duty	Harvesting, chaffing and feeding of green fodder to animals	Attending injured and sick animals
Kavita	Attending injured and sick animals	Cleaning of mangers/ waterers.	Removal of farm waste	Office/store/ hospital cleaning	Duty at gate and quarantine shed	24 hour emergency duty	Harvesting, chaffing and feeding of green fodder to animals
Amit	Milking and grooming duty	Milking and grooming duty	Milking and grooming duty	Milking and grooming duty	Milking and grooming duty	Milking and grooming duty	Milking and grooming duty
Sumit	Milking and grooming duty	Milking and grooming duty	Milking and grooming duty	Milking and grooming duty	Milking and grooming duty	Milking and grooming duty	Milking and grooming duty
Kamla	Milking and grooming duty	Milking and grooming duty	Milking and grooming duty	Milking and grooming duty	Milking and grooming duty	Milking and grooming duty	Milking and grooming duty

4.00 AM - 5.30 AM

All the milk animals in the cattle shed should be milked. They should be fed half of their daily concentrate ration (Feeds containing more nutrients and less fibre Example: Cereal grains, cereal grains by products, oil seed cakes, mixture of cereals and seed cakes etc. requirement prior and during the milking.

Usually, it takes a maximum of 5-7 minutes for a milker to milk a single cow. So depending on the number of animals in milk an appropriate number of milkers should be assigned.

During milking, the milker should check for any health issues and injury to the animals.

5.30 AM - 6.00 AM

The raw milk is delivered the office and the place where milking of the animal is performed is washed and disinfected.

6.00 AM - 7.00 AM

Gaushala manager should check all the sheds and visually inspect cattle for any health issues, injuries and heat in cattle.

Segregation of sick animals and animals in heat is done.

Injured, sick and recumbent animals are attended throughout the day. But it is easier to handle the animals in the morning because of lower temperature, less external disturbance and calm nature of the animal.

5.00 AM - 8.00 AM

Another set of care takers clean the cow dung/animal waste from the sheds. The semi-solid cow dung should be lifted manually directly into the tractor trolley to be disposed of away from the shed.

The urine and residual cow dung on the ground concrete floors should then be flushed clean by using water under pressure from a hosepipe.

Specialised floor groove cleaning device should be used for cleaning the grooves and edges of floor.

8.00 AM-9.00 AM

Clear all the mangers of the left-over feed and fodder of previous day.

After cleaning the cow sheds, periodical (every week) disinfection should also be performed using antiseptic solution like phenol (THIS IS NOT PHENYLE) to kill disease-causing microorganisms.

9.00 AM - 1.00 PM

After cleaning the mangers all categories of animals should be offered concentrate mixture according to their body requirements with some dry straw before the arrival of green fodder.

Harvesting, chaffing and feeding of green fodder according to the seasonal availability and in appropriate quantities should be done during this period. Mangers in the different cowsheds should be filled up to the brim with green fodder.

1.00 PM - 2.00 PM

During this period, only emergency activities are carried out in the Gaushala. This period should be lunch cum rest time for all the workers/staff.

2.00 PM - 4.30 PM

All the periodical activities like weighing, vaccination, white washing of water troughs and feed mangers, silage making, hay making, etc. should be performed during this period.

4.30 PM - 6.30 PM

The milch animals should be milked and fed other half of daily concentrate ration.

Concentrate ration should also be provided to the non-productive animals in their



Workers performing chaff cutting of green fodder as a daily routine activity under a permanent shed.

cowsheds.

6.30 PM - 7.00 PM

The raw milk is delivered into the office and place where milking of the animal is performed is washed and disinfected.

7.00 PM - 4.00 AM

Night watchman comes on duty and keeps a vigil throughout the Gaushala. In case of any emergency (medical or non-medical), a caretaker should be kept on standby, available on telephone.

Feeding management

Cattle in Gaushalas should be given fresh green fodder, dry fodder and concentrate feed according to their body requirements.

The cattle should be fed in suitably constructed feed mangers as discussed earlier in the housing chapter. Manger space requirements per animal have also been discussed.

When the stocking density inside the sheds increase suddenly due to a massive influx of rescued animals, empty plastic drums cut longitudinally and mounted on a wooden frame should be used as portable feed mangers for that period only.

During shortage times of shortage of green fodder, animals should be fed individually by tying them to the rings fixed at the base of the manger. If animals are fed in groups, bossy cows will drive away docile ones, resulting in negative effect on health due to starvation.

Water supply management

Clean and fresh drinking water should be made available to all cows in the Gaushala round the clock in specially designed water troughs as discussed in housing chapter. An adult animal during hot weather generally drinks 5-8 times in a day and consumes about 45-65 litres of water daily.

Water requirement and frequency of drinking increases with increase in ambient temperature.

Besides requirement of water for the animals to drink, it is also required for the washing of animals and cleaning of sheds and other units of Gaushala.



Water trough with round edges to prevent injury to the animals.

Temperature of water supplied for drinking should not be too hot in summers and too cold in winters. Cows prefer drinking water at 15-25° C temperature. If the water tank supplying water trough is located in the open, provision of shade by providing appropriate roof should be made, to keep the temperature of water favourable for drinking.

Water should be devoid of any undesirable smell or taste. This can be judged by the willingness with which animals drink it.

Turbid water or water with lot of suspended matter should be avoided as such water

might have been exposed to contamination by animal excreta and other organic wastes.

Water troughs should be emptied and cleaned at 15 day intervals and a fresh coat of lime should be applied inside the trough. This will ensure proper sanitation and prevent algae growth.

It must be ensured that mineral poisons such as lead or arsenic and other contaminants do not find their way into drinking water made available to animals.

Care of Gaushala Herd

Proper care and efficient management of the herd should play a pivotal role in overall management of a Gaushala. All Gaushala operations must be planned with regard to the comfort of the animals. Care of calves, pregnant cows during and after calving, heifers, bulls, sick and old animals therefore, should receive the personal attention of the manager.

Care for the new born calf

After parturition/calving, allow the cow to lick her calf so as to make it dry as well as to ensure calf's comfortable breathing.

If the mother is not attending her calf, remove all mucus from the nose and mouth of calf by rubbing with a clean and soft towel. The sooner the calf dries the lesser are the chances of it catching cold especially in winter.

The calf will start breathing while mucous is cleared off. If the calf does not start breathing, artificial respiration should be provided by alternately compressing and relaxing the chest walls with the hands after laying the calf on its side.

Apply tincture of iodine to the navel and dust with boric acid powder. If a long cord is attached to the navel, cut it off about 2 inches from the body before applying iodine. The navel cord should not be tied but allowed to drain.

Under normal conditions, the calf will be on its feet and ready to suckle its mother within an hour. Some assistance at this stage should be provided, and much infection can be prevented if the attendant cleans the udder before the calf drinks milk from it.

Calf should be allowed to drink its first milk (colostrum) at least for 48 hours. The antibodies present in colostrum protect the calf against diseases and help the calf to pass faeces (because of the laxative action of colostrum).

Calf should be fed milk at a rate of about 10% of its body weight per day, up to a maximum of 5-6 litres per day.

New borne calves are best maintained in an individual pen or stall for the first few weeks which allows more careful attention. After 4 weeks of age, they may be group housed.

Measurement of body weight of the cow and the calf after calving should be undertaken for record maintenance. Identify the calf by ear tagging, within 5-10 days of birth.

Dehorning of calf should be done at an early age preferably within 10-15 days.

Benefits of colostrum

If a cow starts milk producing before calving, the colostrum should be freeze stored for

feeding the calf later. None of it should be wasted. The digestibility of colostrum increases when it is fed at 99-102° F temperature. The importance of colostrum is best explained below in following points:

1. The protein of colostrum consists of a much higher proportion of globulin than normal milk. This globulin is the source of antibodies, which protects the animals from many infections liable to affect the calf after birth.
2. The protein content of colostrum is 3 to 5 times as that of normal milk. It is also rich in minerals like copper, iron, magnesium and manganese.
3. Colostrum contains 5-15 times the amount of vitamin-A found in normal milk, depending upon the quality of feed ration provided to the mother during the dry period.
4. Colostrum is also superior to milk in having a considerably greater amount of several other vitamins which have been found essential in the growth of dairy calves, including riboflavin, choline, thiamine and pantothenic acid.
5. Colostrum acts as a laxative to free the digestive tract of faecal material.

Teaching the calf to drink.

When the calf is allowed to stay with its mother, its natural instinct automatically leads the calf to the udder of its mother within half-an-hour to one hour of its birth. However, calves who are weak may need a little assistance to search out the teats.

If the mother dies during calving, teaching the calf to drink becomes necessary. This is an operation that requires considerable patience, as some calves are slow in learning to take milk from a bucket. One should pour a litre of the cow's milk into a clean bucket used for feeding calves and bring the nose of the calf in contact with milk. This is best accomplished by allowing the calf to suck the finger of the feeder so that its head may be guided into the bucket and then the hand of the feeder can be gradually lowered into the bucket and submerged in the milk sufficiently deep to allow a little milk to be taken by the calf. By continuous feeding, it will learn to drink.



Bottle feeding of calves.

Nipple pail, equipped with a rubber nipple which the calf sucks may also be employed for feeding of calf. The nipple pail has the advantage that the calf takes the milk slowly, and is thus less likely to have digestive upsets.

When nipple pails are used, one should rinse them thoroughly after each feeding.

Care of young calves

Calves should be group housed in specially designed calf sheds from 4 weeks of age to 1 year of age. Housing calves in groups or individually has advantages and disadvantages. Group housed calves have more space and engage in normal inter calves social behaviour. There is also reduced labour requirement in managing one large shed instead of multiple small calf sheds.

However, early life calf mortalities are primarily caused by digestive and respiratory problems that spread by infection from shed mates. So they are often kept separate up to 4 weeks of age but in close proximity where they are able to see/hear each other. They should also be let loose in an open yard for 2-4 hours of daily exercise, play and socialization.

Calf pens should be regularly cleaned and provided with dry bedding material. The floors should provide comfort, insulation, warmth along with keeping calves dry and hygienic.

Calves are more vulnerable to cold temperatures. During winter nights, rolling tarpaulin curtain should be hung from the roof on three sides of the shed to prevent calves from cold. In severe winters, the fourth side of shed should also be covered with rolling curtain, which is rolled up during the daytime. Calves should be manually shifted in and curtains rolled down afterwards during nights of winters. Therefore, while freedom of movement is restricted during winter nights to protect calves from catching cold, they can move into the open area to have the benefit of sunshine during daytime.

Care of the pregnant cow

A cow carries her calf for an approximate period of nine months. However, the period may range from 270 to 290 days after conception. If accurate breeding records are kept in Gaushala, due date of calving can be easily calculated. Knowing expected date of calving will make it easy to undertake all future care of pregnant cows.

Advanced stage pregnant cows should be separated from rest of the animals and shifted to individual calving pens about 10-15 days prior to the expected date of calving. The calving pens should be clean, well ventilated, well bedded, disinfected and should have the provision for individual feeding and watering.

Soft bedding material should be provided to meet the increased comfort requirement of these cows. For this purpose, grooved concrete floor should be covered with rubber mats. The mats have to be replaced daily before washing and disinfecting the floors.

Most of the animals require little or no assistance in actual act of parturition provided they are in a reasonably healthy state. However, it is also advisable that someone shall be at hand to provide assistance during parturition in case an emergency arises.

Major symptoms of cows that are about to calve include swelling of the udder, swelling of the vulva, and relaxed ligaments around the base of the tail. Birth usually takes place in one or two hours.

The first sign of calving includes the front feet of the calf appearing first, then the nose. Remember that if the labour prolongs for more than four hours, abnormal presentation of foetus is probable. Immediately call the veterinarian for aid.

After parturition, the exterior of the female genitalia, the flanks and tail should be washed with warm water containing some crystals of potassium permanganate or neem leaves boiled in water. This will give a good antiseptic wash.

Keep the mother and the calf warm to prevent them from catching cold. Give the mother warm gur water to drink just after parturition.

The placenta will be expelled by the cow within 2 to 4 hours. If it is not expelled between 8 to 12 hours, administer ergot mixture (ayurvedic preparation) orally. Beyond 12 hours the

veterinarian should apply manual help. The discharged afterbirth should be immediately buried deep into the ground. All care should be undertaken to avoid licking or ingestion of placenta by the cow as the practice adversely reduce milk yield due to excessive protein intake.

Cows should be kept in the calving shed till 4-5 days' post parturition, after which they can be shifted to milch animal sheds or regular animal sheds.

Calving pens design must also provide provision for downer cow lifting. Correct equipment for lifting, moving and treating downer cows e.g. slings should also be at the disposal of calving pens. (as discussed on page 42).

Amount of concentrate fed to cow after parturition should be gradually increased keeping in view the additional requirement of nutrients for milk production.

Care of dry cows

Young males and females can be housed together in a single shed until the attainment of age of puberty and sexual maturity. These should be separated after one year of age and housed in separate sheds according to their category.

The females from the age of one year to their first calving are called heifers. Heifers should be housed in groups in separate sheds or in the sheds of dry cows. However, efforts should be made towards keeping cows in manageable groups of similar age and weight together.

The maximum number of dry animals to be housed together in a single shed shall not be more than 80. The sheds should be temporarily partitioned for limiting the maximum number of animals in direct social contact with each other.

Care of bulls

The bull calf should be separated from other calves at 1 year of age. The bulls attain sexual maturity at about 1.5-2.5 years of age.

Rubber mats or sand should be provided as bedding material for the comfort of bulls.

As discussed before, bull calves should be dehorned within a few days of birth making the bulls less dangerous. Dehorning the bulls at later stages of life is complicated.

Ring of the animal should be done at the age of 1 year, because at this time, the bull calf starts showing its strength. A smaller ring is placed at this age, which may be replaced by a bigger ring later. Direct use of bigger ring could injure the nasal septum of the animals interfering with normal grazing. Bull leaders, chain, ropes, etc. can be easily hitched to the bull nose ring and the animal can be easily controlled with minimal application of force preventing injury to the animal.

Young bulls can be easily trained for handling and leading, which is difficult later. A 4-6 month old bull should be regularly trained for commands with a rope halter on its face. While leading the attendant/trainer should never walk in front, but on the side. The lead should be kept higher than natural. If the lead drops, the bull may butt the attendant/trainer.

Growing as well as mature bulls require to be regularly exercised. This prevents them from putting on fat and keeps them in a state of health. Regular exercise also prevents

overgrowth of hooves, which hinders in walking as well as natural mating.

An adult non-castrated bull should never be allowed to mix with cows and should be housed separately. Separate feeding and watering arrangements should be made for each bull inside the bull pen.

If the bulls are not to be used for reproductive purposes, they should be castrated at 1 year of age.

If natural mating is practiced in Gaushala, a service stall where the cow in heat can be tied prior to and during the service should be provided in the bull pen.

Care of old and sick cows

Every Gaushala should have a separate housing facility for housing old/disabled/infirm/sick animals. The shelter for these animals shall have a special provision for comfortable microclimate inside the sheds and comfortable floors for rest.

The sheds should have provision of ceiling fan, exhaust fans, heating and cooling devices etc. It would be best to have a shady tree inside the open area of the house for enhanced comfort of animals.



Sick calf provided with a blanket made up of hessian cloth to protect the animal from cold.

In order to minimize stress, appropriate stocking density and grouping of animals according to their special condition should be done. Majority of cows are likely to engage in the same activity at the same time, so overstocking would be frustrating for already sick and old animals.

The floors should be covered with good dry rubber mats or mattresses for comfortable resting of these animals (as discussed in equipment chapter on page 43). Floors should also be further made comfortable by putting locally available materials like straw, saw dust etc. 6 inches thick dry and clean bedding material should be provided over concrete floors.

As animals housed in old/sick sheds are extremely vulnerable to contracting new infections, cleanliness and daily maintenance by changing the soiled bedding material and disinfecting the floors should be a very critical activity and looked after by the manager as a prime task.

For recumbent animals (cannot stand), facility should be created (Lifter cow sling) to shift their position twice or thrice a day to avoid bedsores. Apart from this, slings for supporting the animals to stand should also be made available.

Special feeding and watering arrangement of the recumbent animals as per their need should also be made in the shed. Since the animals cannot reach the manger and water trough, feed and water should also be made available at their disposal.

Further, access to sick animal sheds should only be limited to those caretakers who

carry out the necessary daily activities. These caretakers should not have access to other healthy animal sheds. This will minimize the spread of infectious diseases in the Gaushala.

The recumbent/diseased animals under treatment, housed in open yard should be fully covered on all sides by a 1-inch squared mesh/net to prevent crows and other birds from pecking at the animal under treatment.

Blind animals should be kept tied near the manger to prevent them from trampling over others or getting themselves injured by falling.

Practices to handle an injured animal after a fall

Before providing assistance to fallen cattle, immediately call for adequate manpower to help the rescue mission.

If the cattle cannot stand by itself even after external support, a hydraulic trolley with 1000 kg or more capacity, fitted with wooden planks over it should be used for lifting.

Bamboo and tarpaulin sheet can be used to make a shift stretcher. After the cow is placed on it, it can be lifted from four sides to place on the transporting vehicle.



Lifter Cow Sling for supporting sick/old/recumbent /infirm cows.

Allow the animal to recover from shock by letting it stand for 10 minutes. Then feed it some jaggery. Feeding something sweet will help pacify the animal.

Check the wounds and provide first-aid if required. Ensure check up by the veterinarian once the animal is stable, even if the animal sustains no major injury.

Buffaloes in Gaushalas

Gaushalas should readily provide shelter to buffaloes along with cows. Buffaloes are sort of like cows. These are extremely social animals and like to live in herd. These tend to stay in cohesive groups, and are happiest when surrounded by friends. The animal matures at 4 years of age and lives up to 25-30 years.

Buffaloes are hardy animals and resist many of the illness that plaque cattle eg. Thelaria. However, they need to be protected against many diseases and pests similar to cattle.

Care and management of buffaloes in a Gaushala is almost similar to cows. Although, a few differences that need to be taken care of while managing buffaloes in a Gaushala are

- Buffaloes have poor thermoregulatory system and are vulnerable to extreme climatic conditions particularly high temperatures in summers. These are more sen-

to direct solar radiation than cattle due to their black body colour, small number of sweat glands per unit area of skin and thick skin. Additional measures need to be ensured to protect buffaloes housed in Gaushalas from direct heat. These include installation of showers, providing wallowing space or additional shade from direct sunlight.

- If allowed, wallowing is widely practised by buffaloes for cooling the body and protection from insects. Wallowing behaviour is a learnt behaviour. An animal that has not wallowed from birth with other animals will not do so on its own. Teaching such an animal to wallow is almost impossible. Buffalo has to learn it from other buffaloes. But if no water or mud hole is available, they behave more like cattle. They will seek shade and graze more during the cool hours and less during the hot hours.
- Buffaloes mature at 30 months of age while cows mature early at an age of 24 months.
- Pregnancy length of buffaloes is approximately 10 months and 10 days while in case of cows is 9 months and 9 days.
- Birth weight of buffalo calf is around 30-40 kg as compared to 20-25 kg in case of cattle calf.
- Shortly before parturition the mother moves away to give birth alone. Within 30 minutes after the calf is born all members of the herd inspect the new born and touch it with their noses. This inspection seems to serve as an introduction of the newly born calf to the animals of herd. It also facilitates adoption of the calf if the mother dies. Adoptions always occur very frequently and easily among buffaloes whereas it is rarely seen in cows.
- Calf walks with its mother as soon as it can stand. This behaviour is different from cattle where the cow leaves its calf to go for grazing.
- Normal body temperature of buffaloes is 99.5-102.2° F as compared to 99.5-101.2° F in case of cows.
- Nursing of calves is common among buffaloes. Calves are left with a care-taking animal who is mostly a female. Should there be a threat to the calves, they will simply call and their mothers will come running to their aid.
- Vocal communication is important especially from calves. There are both friendly and hostile vocal communications. Buffaloes also communicate and recognize each other by smell. Smell is also used when marking or identifying a territory. Buffaloes will rub themselves against trees to leave scent and they defecate to mark their territory.

Seasonal Management Required in a Gaushala

a) Summer management

The loose housing system (as discussed in housing chapter on page 9) is most suitable and economical for climatic conditions in India. However, some structural modifications

sitive of 10-15 feet away from the walls, to avoid damage to the walls and shed.

- Ceiling fans and high-pressure sprinklers/foggers should be installed inside the covered area of shed in very hot areas.

should be made in very hot areas for lowering the temperature.

Cattle in Gaushala should be protected from direct sunlight by maximum provision of shade. Trees are an excellent source of shade. They not only effectively block solar radiation but also, the evaporation of moisture from leaf surfaces cools the surrounding air without interfering with air circulation. Therefore, good shady trees should be planted both inside the sheds and around the periphery of the Gaushala. Given the freedom of movement, cows tend to move under the shade of large trees like neem, peepal, bargad, sheesham, etc. rather than under artificial sheds. But, the trees should be planted at a minimum distance

Ceiling fans and high-pressure sprinklers/foggers should be installed inside the covered area of shed in very hot areas.

Curtains made of gunny bags soaked in water at regular intervals should be used to keep the temperature inside the sheds low.

Due to high temperature conditions the feed intake decreases. So, ample amount of green fodder should be provided to animals to nullify the effect of heat stress. Apart from this, feeding of cows should be done during cooler part of the day.

Provide ample amount of clean cool fresh water to the cows throughout the day.

Also, cows should be kept inside their sheds during peak heat hours i.e. 11 AM to 4 PM to avoid heat stress.

If a cow gets heat stroke, move it to a cool place and put an ice wet cotton cloth on its forehead. Provide cold water to drink and call the veterinarian immediately.

While transporting animals during summer season, drinking water should be made available to minimize the effects of heat stress. Animals should only be transported during the cooler hours of the day. While stopping the vehicle, park the vehicle in the shade and duration of stops should be kept to a minimum to avoid the build-up of heat due to stationary vehicle. As a general rule, cows should not be travelled in vehicles for more than 8 hours at a stretch and should be loaded off, offered feed, water and allowed rest after every 8 hours of journey.

b) Winter management

During winter season, number of animals in the shed can be slightly increased (10-15%).

In winter season, the cattle usually remain inside the sheds during night. Bedding material should be placed on the floor to make it comfortable for sitting. A jhool/covering of cloth made of gunny bags should be placed on old, weak and young animals to keep them warm during the night.

During daytime, spread bhusa in the open and change the position of recumbent cows to open shed for exposure to sunlight.

Winter is particularly difficult for young calves. At night they might need to be protected from cold stress by housing them indoors instead of in the open and by provision of

abundant bedding for protection against cold floor surfaces. Young calves should be fed adequate amount of milk. To keep them warm electric bulbs, room heaters or halogen heaters should be placed in their pen at a height and out of their reach. It must be ensured that the room temperature in calf pens should not go below 8° C, which would be detrimental to their health.

Provide simple windbreaks like bushes or curtains during cold weather to help cattle cope with cold temperatures.

Energy rich feed like gur, grains and highquality forage should be given to all animals to meet their high energy requirements during the winter.

Feed cattle in late afternoon or early evening. Heat production from feed reaches its maximum 4 to 6 hours after feed is consumed.

c) Rainy season management

Although short, the rainy season can adversely affect the wellbeing and health of the animals. So, Gaushala management should be prepared to put in extra efforts during rains.

The chances of spoilage of dry fodder increases during rainy season, which can only be prevented by proper storage in closed, covered and dry conditions.

The chances of ecto and endo parasitic infestations also increase during rains especially from drinking contaminated water and from wet floors. Deworming of the animals should be performed along with maintaining clean supply of water during this period.

There is a risk of cows slipping and falling due to slippery floors. It is important that the staff makes sure that the cattle are under the shed when it rains. Proper drainage system, must also be ensured as a result of long term planning, so that water does not collect at one place and flow towards the drain.

Planting of Trees

As discussed before, it is necessary to plant shady trees in the animal sheds and their surrounding area, to provide the animals with congenial microclimate and protect them against thermal stress. It requires a lot of patience and planning for making the sheds tree laden

Shady trees such as Banyan (*Ficus benghalensis*), Peepal (*Ficus religiosa*), Indian Fig (*Ficus racemosa*), May flower or Gulmohar (*Delonix regia*), Arjuna (*Terininalia arjuna*), Tulip poplar (*Thespesia populnea* or *paras peepal*), Neem (*Azadirachta indica*), Siris (*Albizia lebbbeck*), Jod tod (*Casurina equisetifolia*), Jeevputra (*Putranjiva roxburghii*), Sukhchain (*Pongamia pinnata*), Babul (*Acacia nilotica*), Bakul (*Mimusops elengi*), Karanj (*Pongamia pinnata*), Child-life-tree (*Putranjiva roxburghii*), Kadamba (*Anthocephalus cadamba*), Balam kheera (*Kigella pinnata*) and Rain tree/ monkey pod (*Samanea saman*) should be planted in the Gaushala, according to their growing ability and geographical presence in the area.

False Ashok (*Polyalthia longifolia*, also effective in alleviating noise pollution), Tulip poplar (*Liriodendron tulip* or *paras peepal*), Subabool (*Leucaena leucocephala*) and Eucalyptus can be planted around the buildings at a distance of 10 feet to act as a wind breaker.

The dense foliage fruit trees like Jamun/black plum (*Syzygium cumini*), Mango (*Mangifera*

indica), Star-fruit (*Averrhoa carambola*), Jackfruit (*Artocarpus heterophyllus*), Ber fruit or Indian Jujube (*Ziziphus mauritiana*) and Tamarind/Imli (*Tamarindus indica*) besides providing fruits also provide shade to the animals. These also attract birds in the Gaushala making the environment pleasant.

Mulberry (*Morus alba*), Guava (*Psidium guajava*), Litchi (*Litchi chinensis*), Chiku (*Manilkara zapota*) are some other fruit trees which provide less shade but can be planted outside cattle sheds (*connecting roads, open areas*) for their ornamental value.

Hedge after attaining a height of about 6 feet would also act as a wind break. Shrubs that are not consumed by cattle should be preferred for hedging. Some examples of hedges that can be planted in the Gaushalas are:

1. Duranta Golden
2. Schefflera
3. Alternanthera
4. Mehendi
5. Thuja
6. Cypress Golden
7. Murraya exotica (Kamini)

Surveillance of Gaushala

Close observation of Gaushala to limit any malpractice should be done by employing security measures. With CCTV cameras, security alarm and detector system, the monitoring of Gaushala while sitting in the office is very much possible.

Although, these surveillance equipment are not cheap but installing a Closed Circuit Television (CCTV) for surveillance of the premises, will help avoid theft along with monitoring the activities of staff, and making correct and fair decisions when settling disputes.

The instrument in electronic surveillance alone cannot stop a crime, manual surveillance must also be there.

Determination of Age of Cattle

In Gaushala, management may be required to assess the age of animal. This can be adjudged by the appearance of teeth in the mouth and rings in the horns. The cattle may be dehorned or horns may be worn out. However, age is indicated by time of appearance and extent of wear of temporary and permanent teeth. Age can be determined by form and location of teeth in the mouth.

Number and types of teeth in cattle

The difference between temporary and permanent teeth is that temporary teeth are smaller with distinct neck between the root and pale in color.

Sr. No.	Types of teeth	Temporary teeth		Permanent teeth	
		Lower Jaw	Upper Jaw	Lower Jaw	Upper Jaw
1	Incisors (only in lower jaw)	8	Nil	8	Nil
2	Canine	Nil	Nil	Nil	Nil
3	Premolars	6	6	6	6
4	Molars	-	-	6	6
	Total	20		32	

The number of teeth at different age of cow is mentioned below:

Age of Cow	Total Number of Teeth
0 day	2 (2 temporary)
1 month	20 (20 temporary)
6 months	24 (20 temporary + 4 permanent)
1 year 3 months	28 (20 temporary + 8 permanent)
1 year 9 months	32 (14 temporary + 18 permanent)
2 years	32 (10 temporary + 22 permanent)
2 years 6 months	32 (8 temporary + 24 permanent)
3-4 years	32 (2 temporary + 30 permanent)
5-6 years	32 (32 permanent)
7-8 years	Wearing down of 1 st pair of central incisors take place
8-9 years	Wearing down of 2 nd pair of middle incisors take place
9-10 years	Wearing down of 3 rd pair of lateral incisors take place
10-11 years	Wearing down of 4 th pair of corner incisors take place

The details regarding eruption and wearing of teeth of cows is mentioned below and taken into consideration to determine the age.

Type	Pair	Position	Total Number		Age for teeth		Eruption and wearing	
			Upper Jaw	Lower Jaw	Temporary		Eruption	Wearing
Incisors	I	Central	-	2	At birth	10 months	2 Years	7-8 Years
	II	Middle	-	2	2 nd week	15 months	3 Years	8-9 Years
	III	Lateral	-	2	3 rd week	18 months	4 Years	9-10 Years
	IV	Corner	-	2	4 th week	21 months	5 Years	10-11 Years
	Total		8					
Premolars	I	Check Teeth	2	2	2 months	6 months	18 months	-
	II		2	2	4 months	10 months	20 months	-
	III		2	2	6 months	15 months	24 months	-
	Total		12					

Molars	I	Check Teeth	2	2	-	-	6 months	-
	II		2	2	-	-	12 months	-
	III		2	2	-	-	18 months	-
Total			12					

For example: To calculate the age of a recently rescued cow, examine the mouth for its teeth. The first thing would be to check for the number of teeth. If the teeth are in good shape and less than 32 in number, then it could be assumed that the animal is less than 5 years of age (because the 4th pair of incisor/corner incisor erupts at 5 years of age). If the animal has complete set of teeth than we look for wear and tear. If the first pair of incisor is worn out, then the animal is 7-8 years of age. Similarly, age up to 11 years can be calculated from the table above.



By the age of 11 years, all the incisor teeth become smaller due to wear and tear.

By the 12th year of age, the dental tables become square instead of oval and teeth stand apart leaving space between them.

After the age of 12 years, age estimation by examining the teeth becomes practically difficult. It is very difficult to determine exact age of cattle after 12 years of age via teeth examination.

5 | GAUSHALA RECORDS AND EMPLOYEE MANAGEMENT

Record Keeping

Everything in a Gaushala should be maintained in a transparent manner and records are no exception. Record keeping helps in easing the complicated job of management of Gaushala. Without proper records, sound planning for synchronization of all inputs and outputs is impossible.

If all the facts pertaining to Gaushala are well recorded, evaluation and planning in Gaushala becomes much easier and precise. The importance of keeping accurate, detailed and up-to-date records cannot be underestimated.

Records should be clear, simple and contain only relevant points such as a daily record of the number of OPD cases treated, incoming and outgoing animals, number of pickups, earnings and expenses and any other significant happening in the Gaushala.

Why keep records?

a. Use records to avoid mistakes

Records help to correctly identify animals in Gaushalas. For this purpose, unique identification number should be provided to each animal residing in Gaushala. When the law requires to ascertain health status or well-being of a rescued animal kept in Gaushala, records play a major role.

In case of rescue ordered by court and animals kept for a specific period of time, records will only tell when the animal was received, and help prove that the animal was kept for the legal period if any question arises.

Good record keeping will further save time, by helping avoid mistakes while performing various activities at Gaushalas.

b. Use records to document your workload

Managing large number of animals in Gaushalas on a small budget is a difficult task. Accurate records of total number of animals, number of daily intakes, treatment administered to all animals and statistical analysis of morbidity and mortality will help the management allocate existing funds sensibly and work towards increasing the flow of money.

Documenting the number of animals handled in a year, will substantiate the proper utilisation of funds and the need for more funds, equipment and personnel.

With proper, accurate and detailed record of fund dispersion the chances of getting a reasonable budget from the local administration and donors increases considerably and will ultimately benefit the Gaushala in getting feed, medicine and other facilities for the cows.

c. Use records to avoid legal problems

The law requires that a certain amount of care must be taken in the handling of animals in Gaushalas. Many donors have very strong feeling towards cows. Some will surely take the Gaushala management to court if they feel animals have been mishandled by the Gaushala.

Therefore, individual records of the animal can prove that due care of the animal was observed and everything the law requires was followed.

d. Records help in improving animal productivity and health

The records are an essential guide for the feeding, breeding and healthcare of the animals. Through records, the performance of each animal can be known; the feeding and management can be further based on the individual animal.

How long to keep records?

A policy regarding how long files are kept for after an animal leaves the premises whether by death or donation should also be instituted.

Filing systems for records

A good filing system for maintaining these records is equally critical. In a Gaushala, practical application of different filing systems would tell which filing system is best suited as this depends on the size of the operation.

If records cannot be made digital, Gaushala management will have to choose between filing records numerically, chronologically, alphabetically or use a combination of all three.

Medical records can be organized alphabetically according to the medical condition of different animals or numerically by assigning each animal a number (tag number) when they enter in the Gaushala. These files could then be transferred over into a separately organized system of files arranged alphabetically by client's name when record of adoption of animal is to be maintained.

All adoption-related forms, such as adoption applications, adoption agreements, and adoption report forms would also be contained within this file along with the medical record of the animal.

Alternatively, organize the files in the same manner along with photographs of the animals. This will avoid any confusion in changing names or losing track of numbers. The best way to do this is to make sure that there is a team of qualified staff members, and a leader of this team, in charge of record keeping.

For records about medications and stores it is wise to do these chronologically, in the form of a daily ledger. When orders are placed, when items are used, when stocks are running low or date of expiry of medicines- information should be entered on a regular basis.

Different classes of information entered in different coloured pens would also ease the understanding of records.

Digitalization of Records

A computer should be used for maintaining records of Gaushalas if possible, as it can play a crucial role in record management. Given below are the formats for various performance records and various business records/registers which need to be maintained at Gaushala.

The same tables for maintain records of various aspects of Gaushalas can be developed on excel sheets with the help of computers. Digitalization eases and organises the records in a more efficient manner.

Individual Record Books in Gaushala

1. History sheet

Tag Number	Where it came from -Police -Individual rescue -Donated by farmer	In which shed is it now?	First recorded weight	Deworming (Yes/No)	Dewormed (Yes/No)	Vaccinated (Yes/No)	Pregnant (Yes/No)	Whether in milk? (Yes/No)

2. Daily livestock register

Date	Cow		Bull	Calves		Heifer	Bullocks	Total livestock	Additions during the day		Deductions during the day		Remarks
	Milch	Dry		Male	Female								

3. Financial transactions

Year_____

Date/month	Loans						Remarks
	Taken		Given		Outstanding		
	Source	Amount	Particulars	Amount	Amount	Interest	

4. Farm supplies

Year_____

Date/month	Home produce			Purchased			Remarks
	Particulars	Quantity	Value	Particulars	Quantity	Value	

5. Miscellaneous expenditure Gaushala

Year_____

Date/month	Servicing	Veterinary/ healthcare	Electricity	Water	Consumables	Total	Remarks

6. Expenditure on fodder production

Year_____

Date/month	Value of seed	Value of fertilizers/ manure	Labour charges	Expenditure on operation of tractor	Irrigation charges	Miscellaneous	Total expenditure

7. Production from Gaushala

Year_____

Date/month	Total milk		Value of dung/ manure	Total value
	Quantity	Value		

8. Sales from Gaushala

Year_____

Date/month	Particulars of produce sold	Particulars of party	Value		Remarks
			Cash	Credit	

9. Attendance register

Month_____

Sr. No.	Employee Name	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
1	Ram Singh																															
2	Sadhu Ram																															
3	Om Vati																															
4	Rajesh																															
5	Suresh																															
6	Rakesh																															
7	Kavita																															
8	Amit																															

Limitations of records

Records are useful only if they are used to assist in making decisions that improve the efficiency and profitability of Gaushalas. They are the first source of information used in troubleshooting management problems. To use records effectively, however, their limitations must be fully understood.

Records simply provide a snapshot in time of a Gaushala as a whole or an individual animal. Even sequential records or rolling records are simply a group of snapshots in time. The usefulness of the data depends on the accuracy of that snapshot.

An additional consideration is that herd records often include only those animals currently in the herd; cows that have died recently may not be included. For example, a sudden improvement in health status of animals may be due to increased deaths and removal of diseased animals rather than an improvement in management.

Evaluation of records should be only the initial step in any troubleshooting protocol. Records are of great value in helping to solve a problem, but they rarely provide a conclusive answer without supplemental investigation.

Work Force Management

Whether managing a Gaushala with limited number of paid employees or running a diversified productive Gaushala unit with hundreds of employees, the underlying principles of successful employee management would remain the same. Management is an art of accomplishing work goals through the labour and skills of others. The means of accomplishing this objective is what distinguishes an effective manager from an ineffective one.

Management skills have become more important as Gaushala is not limited to managing cattle only and requires to be transformed into a business model. To position the Gaushalas for the future, many of these managers have already explored opportunities to expand their facilities and look for unconventional/new sources of income.

Following expansion, they often find that they are no longer managing cattle but instead are primarily managing people. Despite their tremendous knowledge of cattle, managers who lack skills or more particularly emotional skills may find that they cannot extract the same level of performance from their employees.

Successful managers must study and understand the needs and reasons for the behavior of their employees with the same zeal that they studied the needs and reasons for the behavior of their cows housing. Effective managers must have the ability to establish and maintain effective relationships with employees and prospective employees.

Four major ingredients are essential to successfully run Gaushalas: good housing, good feeding, good records, and above all good management. A manager can make or break any established Gaushala via his/her management skills.

It is important that workers know to whom they are responsible and for what they are responsible. The bigger and the more complex the operation, the more important this information becomes. It should be written down in an organization chart of Gaushala.

On operations of Gaushala where multiple employees do the same jobs (cleaning, milking, feeding, etc.), it is especially crucial that every employee performs these tasks in exactly the same way. Cows thrive on routine, and any break in routine imparts stress to the cow and affects performance. The easiest way to ensure this consistency is to create written protocols or standard operating procedures for every procedure in Gaushala. In that way every employee understands exactly what is expected. These protocols should be written as simply as possible and in as much detail as possible in local language to avoid any misinterpretation or misunderstanding. Every employee should have a copy of the protocols for the job he or she might perform.

In addition, laminated copies of protocols should be pasted in areas where the jobs are actually performed. For example, milking protocols should be pasted in the parlor, and shed cleaning protocols should be pasted on entry of sheds.

Miscommunication between the manager and employee regarding job expectations is the primary cause of employee dissatisfaction, ranking well above salary issues. All communications should be discussed first in person and then followed with a written summary of the discussion. Managers and employees who rely strictly on face-to-face communications often walk away with different interpretations of their meeting or may have different memories of the discussion at a later date. Written follow-ups prevent, or at least minimize, these potential sources of job friction.

Conversely, managers who rely strictly on written communication are often perceived as distant and uncaring by their employees. A combination of communication methods is the best approach to maintaining a stress-free workplace.

Even in situations where communication is excellent, employee performance sometimes does not meet expectations. Good managers should assess the reasons for this poor performance rather than simply dismissing the employee. Occasionally, changing job responsibilities can put an employee in a better position to utilize strengths. The ability to

evaluate employees' strengths and weaknesses and to place people in situations where they are most likely to be successful is the primary trait separating good managers from poor managers.

Job satisfaction of employees depends on whether or not they feel they are valued as an asset to the Gaushala. This is more important than salary, work hours, and work conditions. Therefore, a management priority is to create a team environment where every employee has the opportunity for input. This doesn't mean that employees should be allowed to do their jobs any way they want; it simply means that they must feel that their input is valued and that the successes of the Gaushala are, in part, their successes.

Employees costs are on an average, 10-15 percent of the total Gaushala expenditure. Labourers may receive bonuses based on piecework or exemplary work. They must also get overtime pay and a few permanent employees of Gaushala should have group insurance and a retirement plan.

The labourers should have the pride of working in a Gaushala and should be provided with incentives also. Normally, we think of incentives as monetary in nature, as direct payments or bonuses for extra production or efficiency. However, there are other ways of encouraging employees to do a better job. The latter are known as indirect incentives, and they include housing allowances; the use of the farm tractor or car; utility allowances; vacation time with pay; time off, sick leave, group health insurance, job security and year-end bonus for staying all year. These indirect incentives are critical to the successful management of a Gaushala.

The effectiveness of any organization, whether profitable or not, comes directly from the quality of its employees, their knowledge of and commitment towards the organization, as well as their attitude toward co-workers and their work. Therefore, the role of the Gaushala manager and other upper members of management is also to hire the right employees to carry out all the management practices in Gaushala and effectively motivate them. First priority of the selected employees should be to serve the animals. Apart from this, employees making the Gaushala team also requires to be hardworking, punctual, intelligent and compassionate.

Ensuring Gaushala employees safety and well-being at work as they belong to a team can increase cohesion and cooperation between them.

It is also prudent to outline a policy for dismissal in advance so that in the case that someone needs to be let go, that it can remain professional and unbiased.

Responsibilities of Gaushala manager

- Supervising cleaning and sanitization of entire Gaushala.
- Ensuring all the cattle are fed at appropriate time with quality feed in appropriate quantity.
- Managing donations in kind, like food etc.
- Checking the comfort of each animal, according to weather conditions.
- Checking for repairs and maintenance of building when necessary.
- Gaining knowledge of the laws to deal with cattle rescue cases.

- Coordinating with lawyers to fight for rescued animals.
- Checking morbidity and mortality by inspecting each and every animal regularly.
- Getting volunteers to manage and organize fundraisers for the shelter.
- Using Internet services to enhance your knowledge of management of the shelter and caring and well-being of the animals.
- Making sure records are kept and protocols are followed.
- Interacting with local officials.

Personnel selection

From the very beginning, it should be made sure that everyone you employ, paid employees as well as the volunteers, have a clear idea of what their job description is. What responsibilities this job demands, and what, if any, are opportunities for promotion. Interviewing candidates and choosing an individual with the most relevant experience is necessary for engaging paid staff. With volunteers, since there is less risk and responsibility, you do not have to look as closely at qualifications. However, the intent of volunteers must be good and they must be well aware of what role they are taking on day-to-day basis, while choosing to work in a Gaushala.

Technical and supportive work force required

The work force required for undertaking all Gaushala activities shall depend on the level of mechanization and automation of routine cow management operations. However, it has been estimated that on an average one worker can look after all routine activities of 25-30 cows along with their calves excluding the work of harvesting of fodder.

Some routine activities such as milking, heat detection, care of downed calves and neonates etc. require experienced and dedicated workers. Two or three workers have to be trained for the specialized jobs such as first aid, animal identification, de-worming etc.

Besides, at large Gaushalas technically qualified persons will have to be hired such as the farm manager, veterinarian and stockmen. The estimated work force required at different sizes of Gaushalas is given as under:

Sr. No.	Name of staff position	Number of positions required at different sizes of Gaushalas		
		100 cows	500 cows	1000 cows
1	Gaushala Manager-cum-Veterinary officer	--	1	1 (1)
2	Veterinary stock assistants-cum-supervisors	1	2	3
3	Technicians for mechanical and electrical works etc.	--	1	2
4	Office clerk-cum-farm record keeper	1	1	2
5	Unskilled workers	5	15	25
6	Drivers	1	1	2
	Total	8	21	35

It is recommended to employ one Veterinarian (in-house/resident) to look after a herd of 500 cows with two Assistants and 1 worker per 30-50 cows.

If the Gaushala is growing its own fodder then either people have to be hired to till the fields or it has to be outsourced to a person who will take a percentage of the crop. If the Gaushala is making its own vermicompost, biogas then, again a decision has to be taken on whether people are to be hired directly or whether the project is to be outsourced and the money shared.

It is also prudent to have evaluations regularly, so that the manager of Gaushala knows the capabilities of the staff.

Training

The term training refers to the acquisition of knowledge and skills as a result of the teaching of vocational or practical skills and knowledge that relate to specific useful competencies. The first level of training is immediately after hiring. This training is the least rigorous. It is an induction training whereby you can introduce the employee to the organization and the organization to the employee.

A more senior member of the team can lead them through the day-to-day tasks that will be their responsibility and offer them the occasional opportunity to attempt these tasks under the supervisor's instructions.

The second level is more job specific training that should occur on a regular basis. This can be a weekly one-hour session at different times for different groups of employees to make them well versed and efficient in their work. The training of staff purely depends on their job profile and different Gaushalas can also club together for combined training and exchange of ideas.

Training for front office staff

- (a) How to keep records of visitors
- (b) How to deal with difficult visitors and social workers
- (c) How to make entries in accounts

Training for veterinary staff

- (a) How to feed cows in different situations.
- (b) How to prepare balanced rations for cows at different stages of life.
- (c) How to unload injured cows from an ambulance.
- (d) How to handle severely injured cows.
- (e) How to effectively dress wounds for quick recovery.
- (f) How to administer an intramuscular and intravenous injection.
- (g) How to deal with a cow that is known to have an infectious disease.
- (h) How to recognise a sick cow in the herd.

Training for public relation staff

- (a) How to seek-out donors and solicit funds.
- (b) How to plan an event.

- (c) How to discuss delicate issues like euthanasia and
- (d) Principles of good advertising.

Where can you train the staff?

Though there are many well managed Gaushalas, which can be contacted for assistance. Nagar Nigam Gaushala, Carterpuri/Chauma, Gurgaon managed by Vishnu Charitable Trust can be visited for training of staff. This Gaushala was established in the year 2010 with an aim to make the roads of Gurgaon city stray cattle free since these were traffic hazards leading to accidents injuring the cows as well as the humans. The Gaushala is based on Public-Private-Partnership (PPP) Model in which one partner is Nagar Nigam, Gurgaon and the other partner is Vishnu Charitable Trust, an NGO committed to the welfare of cows and its progeny. This Model is successful and recommended for Gaushalas in each district of the country.

They rescue, shelter, protect, feed, treat, care for and rehabilitate the old, weak, sick handicapped and injured cattle abandoned on the roads by their owners. While on the roads, these stray cattle feed on plastic and other rotten stuff from garbage dumps and eventually die prematurely because plastic is a non-biodegradable material.

Nagar Nigam Gaushala has been widely acknowledged as a Model Gaushala. It has been recognized by the Animal Welfare Board of India (AWBI) and is a member of FIAPO (Federation of Indian Animal Protection Organisations) and Gau Seva Ayog, Haryana. They have got a functional hospital working round the clock with one qualified Veterinary Surgeon and two Veterinary Livestock Development Assistants (VLDAs) who reside in Gaushala premises. They have two Cattle Ambulances, purchased out of funds provided by AWBI, on call at any time for rescuing cattle in Gurgaon.

They also specialize in organic manure prepared by aerobic composting microbes. This can be used for plants, flower pots, gardens, parks, kitchen garden, lawns, golf courses and organic farming.

The Gaushala staff is capable of imparting rigorous training to labour and supervisors who can then transform the non-functioning and new Gaushalas into model Gaushalas.

They have castrated more than 700 bull calves in a humane manner and distributed the bullocks to poor farmers for agriculture purposes. These are farmers who either can't afford to buy a tractor or these who don't need a tractor because of very small land holdings.

This Gaushala can be contacted at:

Nagar Nigam Gaushala, Carterpuri/Chauma

Gurgaon — 122001

Email: carterpuriGaushala@gmail.com

Website: [www. Gaushalaonline. com](http://www.Gaushalaonline.com)

Telephone: 0124-2365177

Apart from Nagar Nigam Gaushala, Gurgaon, the Gaushala workers and supervisors can also be deputed to training programmes conducted on dairy farming and welfare

of cows at other Gaushalas, State Agricultural Universities, ICAR institutes or at nearby Krishi Vigyan Kendras. These can also be requested to design and conduct training programmes on topics such as "Care and Management of Cows in Gaushalas" for the Gaushala personnel.

Management of volunteers

A robust and well monitored volunteer program is a great asset for any Gaushala. In order to make volunteer program effective, it needs to be well planned. It is a good idea to have a paid staff member whose specific job is volunteer management. This individual can be in charge of recruiting and hiring, training and evaluation, conflict resolution and scheduling of volunteers.

Depending on the size of the Gaushala, this person might have other duties as well. Another good idea is to have a system of recognition in place, so that while a volunteer's labour might go unpaid it does not go unnoticed.

Volunteer of the month' awards, or opportunities for getting hired, are both possibilities. It is also necessary to have realistic expectations about their contributions to the organization. If asking too little can cause boredom and disinterest in volunteers, asking too much will be perceived as unfair and can cause exhaustion.

Dos by volunteers

- Register your contact details in volunteer register.
- Take guidance from shelter manager in which section help is required.

Don'ts by volunteers

Do not open animal enclosures without permission as animals may escape.

Veterinary Universities/Colleges that are offering courses in Veterinary and Animal Sciences (B.V.Sc. & A.H.) should have round the year Internship (practical training on rotation basis) in nearby Gaushalas for the betterment of Gaushalas as well as developing a sense of responsibility in new veterinarians.

Gaushala management can offer to accommodate these Veterinarians to augment various managerial and treatment aspects. They will learn for free and you will have extra hands for free as well as a pool of trained personnel to take on as employees if needed later.

Areas in which volunteers can be used

- a. Managing and soliciting food from donors.
- b. Feeding and care of calves.
- c. Finding outlet for sale of Gaushala products.
- d. Supervising repairs.
- e. Helping in the feeding of recumbent cattle.
- f. Brushing and grooming cattle.

Insurance of employees

Under the Employees' State Insurance (ESI) Act, Indian workers who earn Rs. 21,000 or less per month are entitled to free medical treatment as well as cash payment in case of temporary or permanent disablement as a result of their work. Employees can avail of healthcare services at clinics and hospitals run by Employees' State Insurance Corporation by contributing 1.75% of their salaries.

Common problems and challenges at Gaushalas

It is important to understand the common problems and challenges generally faced by the Gaushalas in order to manage them properly. Here the human factor is very important. Listed below are the common shortcomings which are self-explanatory and which the management should never lose sight of:

- Lack of inspirational leadership, will and discipline.
- Lack of practical guidelines for staff and workers resulting in confusion.
- Adhoc working, uncoordinated effort and job responsibilities of all concerned with Gaushala not being well defined or understood.
- Unskilled and untrained manpower lacking interest and dedication.
- Improper utilization of funds.
- Absence of fair system for incentives/recognition/rewards and punishments for the workforce.

Most importantly, a lack of respect and empathy for the animals in whose name this institution has been set up. Bad food, bad water, bad veterinary care, all this comes from the belief that confinement is the primary duty of the Gaushala and everything else is irrelevant.



6 | PROTOCOLS OF RESCUE

Each year thousands of cows are abandoned by their owners. There are several other cows are sent to illegal slaughterhouses after their milk has gone dry or the farmer simply cannot afford to keep them anymore.

Cows are bought at “farmer melas” by butchers and despite cow slaughter being illegal in most parts of the country. Cows are killed mercilessly and brutally. Cruel treatment including extreme overcrowding and deprivation of feed and water are common visuals during transport of cows to these illegal slaughterhouses. This transportation is usually done during the night to avoid any interference by the public or police personnel and avoid punishment. The cows are beaten with wooden sticks and iron rods and sticks are inserted in their rectum to prevent their movement. Non-cooperating animals are given sedatives. They are stacked like sacks and the animals get exhausted, crushed, injured and even suffocate to death. They lie in their dung and urine. While the law is clear that

- Only specially registered trucks can carry animals.
- Not more than 4 adults and 2 calves can be carried in a large truck.

Often upto 90 animals per truck are found, most of whom are severely injured.

Therefore, when the team is set for rescue, necessary precautions and certain guidelines of Animal Transport Act 1978 must be adopted while loading, transition and unloading of the cows as there is high probability of injury during these activities. Even a little carelessness or insensitivity may leave the animal even more traumatized.



Cattle being transported in extremely overcrowded and inhumane condition.

Standard Operating Procedure during Rescuing

The following standard protocol should be followed for the rescue and pick up of any abandoned stray cattle:

- Immediately after reception of rescue/distress call, driver on duty is to be informed of all details of address, its location with a landmark and the present situation prevailing there. In case of any confusion, the manager of the Gaushala has to be intimidated of the situation and his decision will be final. Time is critical in case of rescuing cows because there might also be an animal health related emergency requiring veterinary assistance. So, a rescue team is dispatched initially on request call.
- The number from which rescue call was received is to be recorded on a paper slip and copy of which is submitted to guard at the gate of Gaushala on exit for record

and future reference.

- The driver should log destination with landmark and kilometre reading in the log book at the time of exit from the Gaushala, and also at the time of entry.
- At the place of rescue, name of the person or authority handing over cattle with address and phone number is to be recorded if available. Driver should immediately ensure if the phone number provided is correct or not. Time and number of animals is to be placed on record.
- At site of rescue, condition of animal should be examined and the person who made the rescue call is made to sign that he/she understands how seriously ill/injured the animal is. To check for the pregnancy status of cattle, a qualified veterinarian must also perform pregnancy diagnosis, prior to transporting animals to the Gaushala.

The design of a vehicle used to transport animals must be according to the standard guidelines providing safety to the animal during loading, transit and unloading, and protecting them from unnecessary suffering, injury and inclement weather.

The vehicle must be escape-proof and sufficiently strong to bear the weight of the cow. The walls, floors and side protection gates must be free of any sharp edges, protrusions, gaps, holes and spaces that are likely to cause injury. Slippery conditions on floors must be avoided. There must be ample space and free access to the animals in the vehicle to allow them to be inspected and cared for.

- Sufficient space should be provided inside the animals compartment along with ensuring that there is adequate ventilation and above all the animals should be standing in their natural position, without any hindrance to their natural movement.
- Animals should be made to stand or sit facing the direction of movement so that they can balance themselves properly and do not fall.
- If the journey is long, water should be offered during the journey and even be sprinkled over the cows in extreme hot weather conditions.
- In normal routine and non-emergency situations, the animals should be picked up in the morning as they are calm and can be easily controlled. Cows should be picked up causing minimum anxiety and panic to avoid injury to the animal as well as the attendants.
- Cattle in advanced stage of pregnancy shall not be mixed with young cattle in order to avoid stampede during transportation.
- If the location of the animal is in a crowded places like a market, bus stand, railway



Hydraulic vehicle for animal transport.

station, subzi mandi, etc. then the animal should be first gently moved to open areas and then loaded easily.

Admission of Cattle in Gaushalas

For unloading of the animal(s), a ramp at the shelter must be made irrespective of the ambulance having a hydraulic lift (Concrete or iron ramp as discussed in equipment chapter). Planks of suitable length, breadth and height must be made available so that animals do not get injured while unloading.

- Details of animal(s) picked up must be recorded at the gate and the guard must verify the details.
- Treatment of the animal(s) must also begin immediately after the entry of animal(s) into Gaushala.
- The very first step while treatment is to determine the condition of animal whether the condition is medical, surgical or infective so that animal could be grouped with other animals accordingly.
- Animal(s) should be tagged for identification immediately after their entry into the Gaushala if they are in a state of health. This will be the animal's permanent identification number or call number for record maintenance.
- The admission is completed by entering all details of rescue into the office records within the next 24 hours.

Actions to be taken when cattle arrive at Gaushala

Stray cows and bulls picked up from trucks, slaughter houses, roads are mostly in a pathetic condition. They are weak, wounded in accidents and traumatized needing urgent veterinary attention. The veterinary staff has to be there on site when they are unloaded from the vehicle. The sequence of actions thereafter is as follows:

- Each cow/bull has to be thoroughly examined for any injury, disability or disease. The details of which have to be recorded with suggested line of treatment, if needed.
- All newly admitted animals in Gaushala should be kept for at least two weeks or preferably for one month in isolation ward to observe and prevent any infection affecting the healthy herd and for better care and fast recovery.
- Emergency cases like rupture of uterus, horn injury have to be segregated and treated immediately.
- After isolation period is over, cattle requiring further treatment should be admitted to Gaushala Hospital.
- The cows which don't require further treatment should be segregated into following categories and housed in their respective cow sheds:
 - a) Milch cows
 - b) Heifers
 - c) Pregnant cows

- d) Non-pregnant and dry cows
- e) Weak/infirm/diseased/old cows.
 - The cows with dangerously curved and pointed horns which may cause injury to other animals should be housed separately and dehorning of these cows should be performed.
 - The bulls should be kept separate, away from the cowsheds, to prevent unwanted pregnancies. As the bulls are more aggressive than the cows and calves, they can cause injury and even death of the weaker animals if due attention is not paid by the staff.
 - Proper deworming and vaccination (HS & FMD, as discussed in treatment section) should be performed, since the cattle had been feeding on dirty garbage and may even have come in direct contact with infectious disease causing organisms.
 - The cows in stray conditions also feed on the non-biodegradable plastic before being brought to Gaushala. The surgical removal of plastic is required to be done via rumenotomy in aggravated conditions (as discussed in treatment section).
 - The workers should also be briefed by the veterinary staff about precautions to be taken while feeding the newly arrived cows, in order to ensure their proper health care.
 - Full details of the cattle received in the Gaushala on daily basis should be entered in the register maintained for the purpose in Manager's Office including the following:
 - a) Number of cows, bulls, bull-calves, heifers, calves (male) and calves (female) intake along with their permanent identification number.
 - b) Their main identification/external features like colour, breed, shape of horns etc.
 - c) Place from where they have been brought.
 - Weak and debilitated cattle should be kept in the least crowded shed for proper care and feeding. These also includes old, blind and lame animals.

First Aid to Injured/Disabled Animals Received/Maintained in Gaushala

The common accidents to which cows are prone include injuries, fractures, poisoning, obstetric troubles, burns and scalds and horn injuries etc. The aim of first aid is to render such skilled assistance to the affected animals that will alleviate suffering, preserve life, promote recovery or prevent aggravation of the abnormal condition until the provision of specialized treatment is made available to them.

First aid primarily focuses at arresting severe haemorrhage, if any, providing plenty of fresh air and water to the patient, provision of warmth to check fall in temperature and shock, provision of rest by changing the position of the animal into an easy posture, covering with a clean dressing of skin injuries and keeping the animal still (especially when fractures occurred) by drugging or by diverting its attention towards food.

First Aid Kit

It is wise for the Gaushala work force to be prepared ahead of time with some basic

knowledge and a first aid kit. First aid kit is very necessary and must be in place for timely control of any injury or any emergency.

The impact of animal injuries or disease can often be greatly reduced with prompt and appropriate first aid. Cuts, scrapes, and puncture wounds are some of the most common traumatic injuries suffered by cattle during transportation. At all Gaushalas a box containing the below mentioned items should be kept handy so that it can be reached quickly in case of emergencies.

First aid requisites

1. Cotton wool, bandages, surgical gauze, old cotton sheets (for injuries)
2. Rubber tubing
3. Surgical scissors- curved and made of stainless steel
4. Forceps, splints or split bamboos (for stainless steel)
5. Clinical thermometers- two or three
6. Disinfectants- Potassium Permagnate, Dettol, Sulphanilamide Power
7. Tannic Acid- Powder (for poisons) and Jelly (for burns)
8. Antibiotic eye drops
9. Epsom salts, Copper Sulphate, Glauber's salt, smelling salt
10. Turpentine oil (for bloat)
11. Coal preparation (for poisoning cases)
12. Obstetric ropes, chains and hooks
13. Tincture of iodine, tincture of Benzoin (for wounds)
14. Cotton ropes, halters (for restraint)
15. Trocar and Canula (for Bloat)
16. Pocket knife (for cutting strangulating ropes)
17. Intravenous fluid (normal saline, dextrose)
18. Immediate stress relievers like Dexamethasone
19. Pain killer drugs like Meloxicam, Ketoprofen belonging to NSAIDs (Non Steroidal Anti Inflammatory Drugs)

Disaster Preparedness and Handling of Cattle during Emergencies

Emergency situations such as floods, earthquakes, storms, cyclones, fires etc. can have a great impact on cattle in Gaushalas due to their sheer size, and special shelter and transport requirements. Emergency management of cows in Gaushala during a disaster requires plan in advance for emergency management procedures.

Cows in an emergency situation can pose a serious hazard and tend to become nervous, anxious, unpredictable and at times dangerous. So, while evacuating cattle from Gaushala

in case of a disaster “Herd Instinct” along with “Maternal Instinct” plays a primary contributor. Cattle are social animals that feel both more comfortable and safer in a group. Always try to move cattle in groups to avoid individual stress. An animal that is separated from the group will try to get back to the group. The maternal instinct is also strong in cattle. They will protect their young from perceived threats.

Cattle are very sensitive to unusual movement including sudden movements, bright colours and unusual objects. How humans behave when handling cattle can have a big effect on cattle behaviour. It is important to be calm, controlled, and exert confidence. When handling cattle, a small flag on a stick is useful for moving or sorting cattle. This stick or flag extends the length of the arm and makes the handler appear larger/wider to the cow.

Cattle respond negatively to abuse, loud noises, and other confusing situations. Keep noisy equipment away from cattle. Yelling at cattle increases the stress level of both cattle and the handler. Cattle are creatures of habit and following established daily routine will ease handling. Handle animals in groups if possible. A single animal may be hard to handle, so get it back into the group if possible. When handling cattle, all movements should be slow and deliberate.

If cattle refuse to move, look for distractions, which could include trash on the ground, something on a fence, or even other people who are trying to help. Mixing groups of cattle that have not been together before can add to their stress level. Herding cattle is an important skill to understand. Moving groups of animals safely is a prime concern during emergency settings.

Remember that your safety is



A farmer rescuing his calf in floods.



Gaushalas should conduct mock drill for emergency evacuation in case of accidental fire and review its disaster preparedness regularly.



A young boy guiding his herd towards safety in floods.

paramount and that you cannot help others including animals if you are injured or killed. When trying to move cattle in a certain direction, here are some tips to remember:

- Locate the majority of the herd and concentrate on moving this nucleus, even though there may be a few stragglers on the outside or behind the majority.
- Start making a series of wide back and forth motions on the edge of the herd.
- Move in the pattern of a giant windshield wiper blade.
- When the majority of the herd has come together into a loose bunch, start increasing the pressure on the collective flight zone to start herd movement in the desired direction.
- Repeat the zig-zag pattern and reverse at each outside edge just slightly past the point of balance for the outlying animal.
- In order to continue the herd movement in the desired direction, the handler continues to zig-zag back and forth behind the animals.

Emergency preparedness

- To be prepared for emergency situations, it is essential to determine the hazards and risks in area where Gaushala is situated.
- For effective action in case of emergency, Gaushala should maintain an inventory of the list of all animals in the Gaushala and all these animals should have a permanent identification number (e.g. ear tags, tattoos).
- Identify alternate water or power sources near Gaushalas to be utilised during and after emergency situation.
- Prepare an evacuation kit well in advance that should come in handy during emergency. It should have:
 - a) Handling equipment (e.g., halters, nose leads)
 - b) Medications, tools and supplies needed for sanitation
 - c) Cell phone, flashlights, portable radios, and batteries
 - d) Basic first aid kit
- Make evacuation arrangements well in advance. For this purpose Gaushala manager should:
 - a) Locate and prearrange evacuation sites
 - b) Determine routes to these locations
 - c) Train staff to load and transport animals (infirm/weak).
- Herd movement training to animals should be imparted via drills conducted regularly to check for preparedness for emergency situations.
 - a) Planning, handling of animals and veterinary care to be performed at the evacuation site.

- b) Arrange for feed and water delivery for the evacuation site.
- Establish escape routes to safe locations (e.g. higher elevation).
- a) Cows should be housed in loose system of housing and should not be tied. The loose cattle can escape to safety in the event of an emergency such as fire or sudden floods or earthquake etc. whereas tethered (tied) cows may be at a greater risk.
- b) Do not set up Gaushalas in unsafe locations (cow sheds in flood prone area or in poorly drained and low-lying areas)
- Establish a safe environment for animals by:
 - a) Assess the stability and safety of cowsheds and other structures.
 - b) Remove dead trees or other debris in fields or animal holding locations.
 - c) Secure any loose equipment or materials that may cause injury to animals.
 - d) Make sure electrical wiring is safe and away from flammable materials

Ambulance: Operation and Maintenance

- Every Gaushala should have an ambulance facility. A record is maintained to tally total number of animals picked and released by the ambulance. A helpline manned by a responsible person directs and monitors the pickups.
- The driver is accompanied by one helper. He carries a form to be filled up by the person calling in. It must be returned to the Gaushala. Along with this, a donation book to issue receipts to donors must also be accompanied to take donations from on the spot donors.
- The driver of the ambulance should also provide a helpline number where enquiries pertaining to the animal rescued will be answered. For this purpose, proper record of animals picked by ambulances should be maintained at the Gaushala.
- Regular cleaning and maintenance of ambulance is also essential. The floor of vehicles should be covered with soft rubber matting that can be cleaned easily.
- In addition, ambulance should also have harnesses for extra-large animals. One must ensure that the ambulance shouldn't have any sharp pointed items or corners as they might cause injury.
- I/V pump for efficiently delivering large volume infusions and patient monitoring equipment should also be available, for emergency situations.

Ambulances should have non-slippery floor (to prevent animals from slipping and injuring themselves) and hydraulic lifts to load and unload animals conveniently. Straw can also be spread on the floor up to thickness of 6 inches to avoid any injury if the animal falls down in the process.

- The driver and helper should be well trained to handle wounded and sick animals. Each ambulance should have a first aid box with painkillers, oxygen pumps and lifesaving medicines, ropes, bamboo sticks, rubber sheet, etc.
- The log book of every ambulance should be made and checked on a daily basis.

The amount of donations received per ambulance with proper record of every receipt need to be crosschecked and verified with the donors as a lot of pilferage takes place in cash donations received by the drivers.

Rules for Transportation of Cattle

1. A valid certificate from a qualified veterinary surgeon to the effect that cattle are in fit condition to travel by rail or road and not suffering from infectious contagious or parasitic disease and that they are vaccinated against FMD and HS like infectious disease and properly dewormed [Under Rule 47 of transportation]. In the absence of such a certificate, carrier shall refuse to accept the consignment for transport.
2. Permission for transportation of animals shall be given by state government veterinarian not below rank of Assistant Director/SDO/District Animal husbandry officer) [Rule 96 for transportation].
3. Veterinary first aid equipment shall accompany all batches of cattle to be transported.
4. Each consignment shall bear a label showing in bold letters the name, address and telephone number of consignor and consignee; the number and type of cattle being transported.
5. Consignee shall be informed about train or vehicle in which consignment of cattle is being sent and its arrival time.
6. Space requirement for cattle as per Rule 50:

Cattle weighing upto 200 Kg	1 Square Meter
Cattle weighing 200-300Kg.	1.20 Square Meter
Cattle weighing 300-400kg	1.40 Square Meter
Cattle weighing above 400Kg	2.00 Square Meter

7. Space requirement for Cattle while be transported in commonly sized road vehicles:

Vehicle Size Length x Width Square metre	Floor Area of the vehicle in Square metre (Sq. mtr.)	Cattle weighing upto 200 Kg (1 Sq. mtr space per cattle)	Cattle weighing 200-300 Kg (1.20 Sq. mtr space per cattle)	Cattle weighing 300-400 Kg (1.40 Sq. mtr space per cattle)	Cattle weighing above 400 Kg (2.0 Sq. mtr space per cattle)
6.9x2.4	16.56	16	14	12	8
5.6x2.3	12.88	12	10	8	6
4.16x1.9	7.904	8	6	6	4
2.9x1.89	5.481	5	4	4	2

8. The motor vehicle for carrying animals shall have permanent partition in body of vehicle so that the animals are carried individually in each partition where size of partition shall not be less than 2 metre².
9. No motor vehicle meant for carrying animals shall be permitted to carry any other goods.

10. The regional transport officer shall issue special licences for motor vehicles meant for carrying animals on the basis of vehicle modified (applicable from 01 Jan 2016).
11. Suitable rope and platform should be used for loading cattle into vehicle.
12. Cattle shall be loaded after they are properly fed and given water.
13. Cattle in advanced stage of pregnancy shall not be mixed with young cattle.
14. Watering arrangements enroute shall be made and sufficient quantity of water shall be carried for emergency. Sufficient feed and fodder with adequate reserve shall be carried to last during the journey.
15. Adequate ventilation shall be ensured.
16. Motor vehicle should be in good condition and provided with anti-slipping material such as coir matting wooden board on floor/paddy straw of minimum thickness of 6cm to avoid injury, pain and suffering.
17. No vehicle shall carry more than six cattle.
18. Each vehicle shall be provided with one attendant
19. Vehicle should have "Animal Carrier" board clearly visible in bright colour having front size of not less than 25 sq. cms per letter, in black on yellow backgrounds on both front and back side of vehicle.
20. Different class of animals are not to be mixed with other animals.
21. Suitable ramps and platforms should be there for loading and unloading of cattle.
22. Vehicle breast bars should be properly placed.
23. Vehicle should have permanent indication of the maximum number of animals/ vehicle load to be carried.
24. To prevent cattle from being frightened or injured, they should preferably face the engine.

PROFORMA FOR APPLYING FOR PERMISSION FOR ISSUE OF CERTIFICATE BEFORE TRANSPORTATION OF ANIMALS

(See rule 96 of Transport of Animals (Amendment) Rules 2011)

1. Name and address of the consignor:
2. Name and address of the consignee:
3. Name and address of the transport Authority/agency:
4. Whether Proforma for certificate of fitness to travel has been issued by Veterinary Doctor to State that
 - a) The animals are free from infectious diseases and are fit to undertake the journey
 - b) There are no animals which are unfit for transport such as new born, diseased, blind, emaciated, lame, fatigue or having given birth during the preceding 72 hours or likely to give birth during transport
 - c) Pregnant and young animals are not mixed with other animals during transport
 - d) Different classes of animals are kept separately during transport
 - e) Diseased animals are not mixed with other animals
 - f) Troublesome animals are given tranquilizers before loading
5. Purpose for which the animals are transported
6. Details of applications and certificate issues by other authorities covered in this case (copies of relevant documents to be enclosed).
7. Whether animals have required provisions of feed —fodder, water, rest and milking facilities during transportation.
8. Time and place of transport
9. Details of railway/road transport route with details of departure and arrival times at different points.
10. Place of inspection by the authorised representative of Animal Welfare Board of India (AWBI)

The particulars given above are true to my knowledge. All the relevant Central and State Act Rules and orders have been compiled with

Signature of Consignor/Applicant

CERTIFICATE

I hereby certify that I have read Rule 96 of the Transport of Animals (Amendment) Rules 2001 and the permission for transport of animals as per the above application is hereby issued.

Signature of authorized

Representative at AWBI

7 | ADOPTION POLICY OF GAUSHALAS

The tradition of Gau Daan (cow donation) in order to do Punya (good deeds) is an age-old tradition in India. However, many of these cows are sold off to dairies and later to slaughter houses giving no karmic benefit to those who donated.

A better option would be to visit a Gaushala and donate money for the regular upkeep of the cattle. Adopt a cow in a Gaushala and whenever you want to see the cow, you can make a visit to the Gaushala and see how the cow is being looked after.

To further incentivise the adoption of cows, a gau-prem award should be given each year to the person adopting maximum cows in each block. The Gaushala with the maximum adoptees should also be awarded by the state Government. Every adopter should be given a certificate of appreciation.

People in India already do gau-seva (service to cows which implies giving food to them) but gau-prem (love for cows) should also be inculcated in them. When Gaushalas are full, compassionate people who want to make a direct difference to a suffering cow should be encouraged to adopt them. This would include gau-seva at their respective homes. The cow adopted will be tagged for identification for the ease of the adopter and the Gaushala management for regular check. Since, having a cow is a long-term commitment a detailed interview need to be carried out with prospective adopters for two main reasons:

1. To ensure long-term homes for the cows in their care.
2. To facilitate good matches between prospective adopters and their adopted cows.

To assess whether they are fit to adopt a cow, the following requirements should be communicated to potential adopters.

1. Having a cow is a long-term commitment. A cow typically lives 18 to 22 years. Be sure you have the time for such a commitment, and have a substitute caretaker ready to take over during vacations and illnesses.
2. Cows need attention. They love to be groomed, scratched and petted. A bond will develop with time between adopter and the cow, but one has to be patient.
3. Be aware of their size. Although cows are gentle, they are massive. It must be ensured that the farm/house has enough room to house a cow.
4. Contact veterinarians in your area who treat cows. Locate a large-animal veterinarian in your area before bringing a cow to your farm.
5. Knowledge regarding cows' food and water needs. Cows drink up to 40-50 litres of water per day, more during summer. The holding container must be large and cleaned regularly. A healthy adult cow will require 35-40 kg of green fodder, 1-1.5 kg of concentrate and 3-4 Kg. dry fodder for their maintenance. Salt blocks should also made be available to them.
6. Evaluate your space. Cow enclosure must be no less than 80 square feet for each cow.

Their bedding should consist of clean, dry bedding, with extra bedding required in winter.

In addition to this, Gaushala management should also ensure that this adoption procedure is a selfless process. See that adopters do not opt for only heifers, pregnant or milch animals to get milk in return. Stress should be laid on to adoption of old animals that require better care and management. Seriously ill cows which are the end of their lives should not be open for adoption.

Apart from this, castrated bulls/bullock may also be adopted by farmers for agricultural purposes after receiving/taking this affidavit -



On Ten Rupees Non-Stamp Paper Affidavit

I, _____ S/O _____ of (Address) _____ Am taking _____ bullocks from _____ Gaushala for agriculture purposes, I shall abide by the following conditions:

1. I shall ensure the following freedoms for the bullocks: -
 - (A) Freedom from hunger and thirst.
 - (B) Freedom from fear and distress.
 - (C) Freedom from pain, injury and disease.
 - (D) Freedom from discomfort.
 - (E) Freedom from express normal pattern of behaviour.
2. The bullock shall be given proper and adequate feed and clean portable water drink water.
3. I shall ensure that they remain healthy by due attention and care.
4. If they fall sick, I shall get them treated by an authorised and competent Veterinary doctor/VLDA.
5. I shall ensure their periodic vaccination and deworming when due/necessary.
6. The bullock shall not be subjected to any form of cruelty, torture suffering from unnecessary pain in any manner
7. I shall provide a clean, well-protected and spacious accommodation for the bullocks.
8. The bullocks shall not be sold to anyone or abandoned on the roads/streets.
9. They shall not be butchered or sent to slaughter house.
10. My premises where I am going to keep the bullocks, are open to inspection any time by Govt. official including representatives of animal welfare board of India and NGO concerned.
11. If any of the condition mention above is violated, I know that I shall be liable for legal action.
12. In case I find at any stage that I am unable to look after the bullocks, I shall contact _____ Gaushala for their advice/guidance.

Witnesses

1. _____

(Signature, Name & Address)

2. _____

(Signature & name of the person
taking custody of bullocks)

Place:

Date:

8 | EUTHANASIA IN GAUSHALA

Euthanasia is a humane method of alleviating animal suffering in cases of incurable disease, injury or debility. Euthanasia must be performed by qualified veterinarians who have an understanding of anatomical landmarks and the equipment and drugs used for the humane euthanasia of animals.

Euthanasia should result in rapid loss of consciousness followed by cardiac or respiratory arrest and the ultimate loss of brain function. It is important that the death of the animal is confirmed after euthanasia by examining the animal for cessation of vital parameters (heart beat/respiration).

Following process may be followed for euthanasia in Gaushalas:

1. Sedate cattle using Xylazine. Humane and compassionate handling without causing any stress to the animal could be the only substitute to sedation and a qualified veterinarian can take this decision based on the mental and physical assessment of the animal and the skills of the animal handler.
2. Inject an overdose of Thiopentone sodium intravenously over a period of 10 seconds. In most cases it will stop the heart.
3. If the heart beat persists, inject intravenously one of the following drugs immediately after the animal becomes unconscious (these three solutions **MUST NOT** be administered to conscious animals):
 - Saturated Magnesium Sulphate solution till death of the animal is achieved (most preferred and economical way of euthanising)
 - 10% Potassium Chloride or Iodide solution till death of the animal is achieved
 - Chlorhexidine-cetrimide solution till death of the animal is achieved
4. It may take few seconds to minutes for the heartbeat to stop. Do not rely on loss of respiratory movements or eye reflexes as signs of death. Use a stethoscope and check for heart beat. The veterinarian should not leave until he or she is certain that the animal is dead.

Decision making for euthanising animals

The following essential considerations must be kept in mind by the Veterinarian while performing euthanasia: -

1. Veterinarians have the primary obligation to relieve an animal's incurable suffering and pain by performing euthanasia
2. A veterinarian must not cause any animal to suffer by failing to maintain adequate pain control and relief of suffering.

Decision making

The following points need considerations in the decision making to perform euthanasia of an animal: -

- a) History and seriousness of present illness and general health of the animal
- b) Thorough physical examination for evidence of intractable (hard to control) or incurable (impossible to cure) condition/ailments
- c) Prognosis (likely course of medical condition) of the case based on the above (a and b)
- d) Future life of the animal if not euthanized especially in relation to the five freedoms:
 - i) Freedom from Hunger and Thirst
 - ii) Freedom from Discomfort
 - iii) Freedom from pain
 - iv) Freedom to express normal behavior
 - v) Freedom from fear and distress

The decision to perform euthanasia is ultimately vested with the veterinarian based on the above guidelines. Subsequent to the decision, the procedure to be adopted for administering euthanasia, will be as per the guidelines/standards explained.

Animal behavioral considerations

- Minimal animal distress in handling (reduce animal fear, anxiety, nervousness)
- Careful and effective sedation prior to euthanasia

Conditions requiring euthanasia of animals

1. Old age associated with debility, poor mobility and recoverability to normal health
2. Incurable specific disease (caused by bacteria, virus, endoparasites, ectoparasites, rickettsia, fungi)
3. Incurable systematic or non-specific diseases (cancer, tumours, pneumonia, nephritis, hepatitis etc) which may cause severe pain, digestive disorders, poor mobility, lack of appetite and will not respond to treatment.
4. Natural disasters – drowning, extensive fire burn wounds, cachexia due to starvation and inability to consume food
5. Rail and road accident victims with multiple fractures, grievous injuries, extensive tear, laceration wounds that cannot be repaired, head injuries leading to shock, permanent disabilities affecting normal movement
6. Serious conditions of shock, coma and unconsciousness that cannot be treated or are irreversible
7. Animals suffering from extremely serious contagious or zoonotic diseases like rabies
8. Animals mutilated that cannot be restored to normalcy and will be in agony if permitted to survive

Prohibited methods of inducing euthanasia

- Electrocution
- Hanging
- Stunning
- Hypothermia
- Drowning
- Using household products and solvents for Euthanasia
- Formalin injection
- Neuromuscular blocking agents' injection (nicotine, magnesium, sulphate, curariform agents)
- Burning
- Rapid freezing
- Chloroform
- Strychnine injection
- Exsanguination
- Decompression
- Air embolism
- Cyanide administration
- Chloral hydrate injection

Essential principles of conducting euthanasia

- Euthanasia techniques should result in rapid loss of consciousness followed by the cardiac or respiratory arrest and the ultimate loss of brain function
- The technique chosen should minimize distress and anxiety experienced by the animal prior to loss of consciousness
- The drugs chosen should be of proven quality, cost effective and easily available
- Veterinarian conducting euthanasia must be knowledgeable on the dose and route of administration of the drug
- Veterinarian performing euthanasia must have appropriate training and experience in the techniques being used and humane restraint of the animal to be euthanized to ensure minimal pain and distress to the animal
- Selection of the most appropriate method of euthanasia in any given situation depends on the species of animal involved, available means of animal restraint, professional skill of personnel and number of animals to be euthanized
- No animal should be euthanized in the presence of other animals

Procedure of euthanasia

Sedation with Xylazine I/M and Ketamine I/V followed by 10% Thiopentone sodium

- Sedation dose (mg/kg) of Xylazine- 0.05-0.15 mg IV or 0.10-0.33 mg IM
- Sedation dose (mg/kg) of Ketamine HCl- 2.2 mg IV
- Euthanizing dose (mg/kg) of Thiopentone Sodium- 120 mg IV

NOTE

Proper carcass disposal should be ensured after euthanasia as most of the drugs used for euthanasia will have residual effect/harmful to predators and scavengers.

Veterinarian performing euthanasia must confirm the death of the animal

Confirmation of death is made from the following parameters

- a) No movement of the chest/No sign of respiration
- b) No heart beat when checked with the stethoscope
- c) No pulse on palpation
- d) Color of the mucous membranes turns blue from bright red in the animal mouth (mucous membrane of mouth is pink in a healthy animal and bright red in a sick animal. It becomes pale in anaemic animals and yellow in animals suffering from jaundice)
- e) Loss of corneal reflex and glazing of the eye

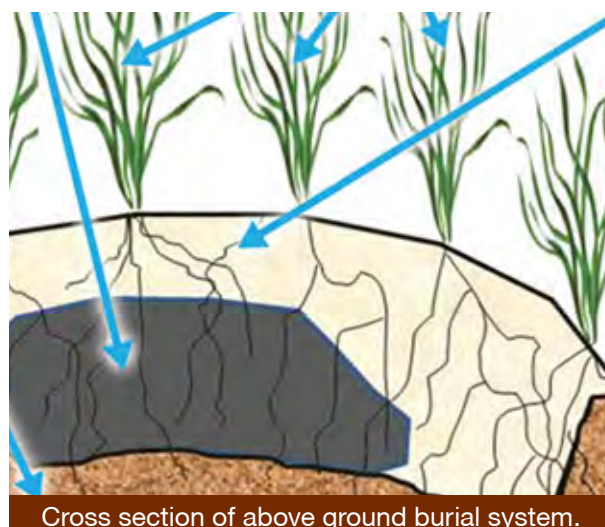
9 | DISPOSAL OF CARCASSES FROM GAUSHALAS

Dead cows in the Gaushalas must be disposed of in a manner that prevents spread of diseases to other livestock, preserves the environment, and safeguards public health. The potential negative impact on neighbouring residential property should also be given due consideration. Preparations should be made to dispose of dead cattle under both normal daily conditions and catastrophic situations.

Safe and environmentally responsible disposal of animal carcasses, is an essential consideration. Premises should be promptly cleaned in a manner that prevents any infectious or toxic health hazard to domestic or wild animals or people.

Generally, 1.5 cubic metre space is required for disposing a mature cow. There can be different methods for disposal of dead carcasses. These include:

Burial: Burial is a common method of carcass disposal to manage mortalities, but it poses a groundwater contamination risk if the burial site is not selected and managed properly. Therefore, selection and maintenance of a burial site is very important. Prompt burial will prevent nuisance problems such as smell, flies and scavengers. On-farm burial might be the quickest way to dispose of non-diseased animal mortalities.

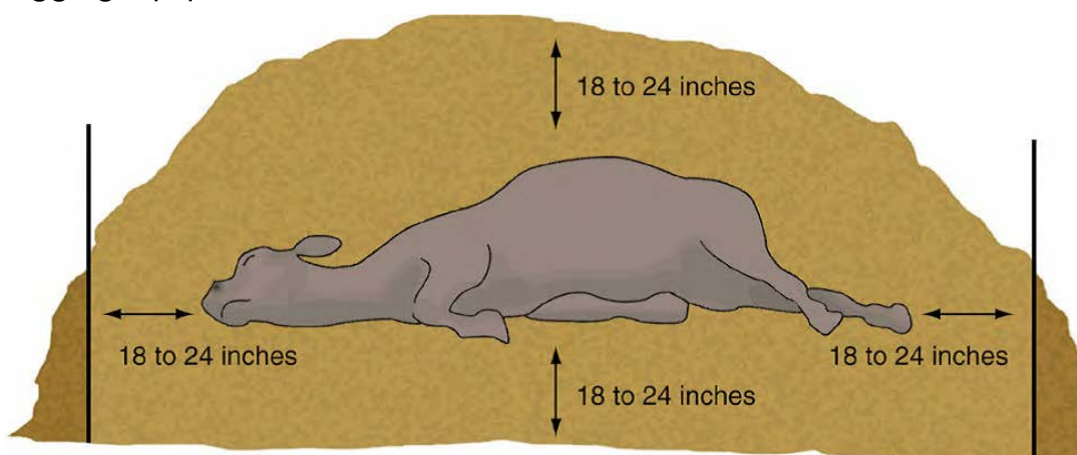


- a) **Shallow burial:** This method can be adopted for occasional disposal of carcasses. Shallow burial involves burying carcasses in soil in a single layer, about 30-45 cm deep. Some organic matter like hay, straw, dry leaves, wood chips or manure is layered into the trench and covered with soil. The area can be returned to normal use after several months.
- b) **Trench burial:** This method is adopted when a digging machinery tool like JCB machine is available to dig trenches of required size. The trench width and depth will depend on the number of carcasses to be disposed and also on the type of machinery used. The carcasses are generally piled 2.5-meter-deep in the soil and at least 1.5 meter soil is placed on the top of carcasses as a heap. In case of multiple trenches care must be taken to separate two trenches at a distance of more than 10 meters. Excessive pollutants can build up in burial sites and the leaching of nitrogen and phosphorus into water bodies will result in eutrophication.
- c) **Trench burial:** This method is adopted when digging machinery tool like JCB machine is available to dig trenches of required size. The trench width and depth will depend on the number of carcasses to be disposed and also on the type of machinery used. The carcasses are generally piled 2.5-meter-deep in the soil

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Points to be considered for selecting a burial site or establishing a composting unit for disposing carcasses

- Disposal sites should be at least 250 metres away from watercourses and surface water catchments areas like streams, rivers, creek beds, wetlands or defined depressions.
- The base of the trench should be at least two meter above the water table.
- The site should be at least 250 metres away from the nearest bore.
- The site should be at least 250 metres away from the residential building.
- The burial sites should be marked properly, preferably on a map or recorded using GPS.
- The location of burial sites should be retained by the site owner to inform future decision making.
- The burial site should be free of underground services like pipelines, power and telephone lines.
- The burial trenches and should not interfere with access to roads.
- The soils selected for deep burial must be stable enough to take the weight of digging equipment used to construct and fill trenches.



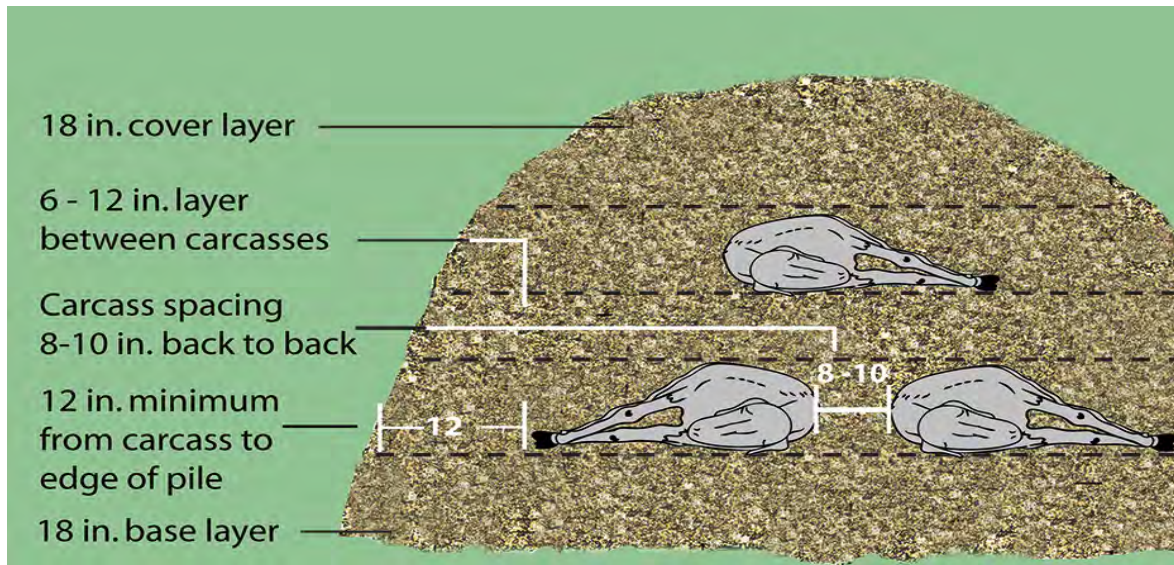
Burial standards

- Surplus soil should also be heaped over the trenches to allow for subsidence over a period of time.
- Disposal trenches should be inspected regularly after closure to check for subsidence, seepage and scavenging (if any).

Composting

This is also one of the methods for disposal of animal carcasses. This is a process of aerobic microbiological decomposition conducted in either open or closed systems.

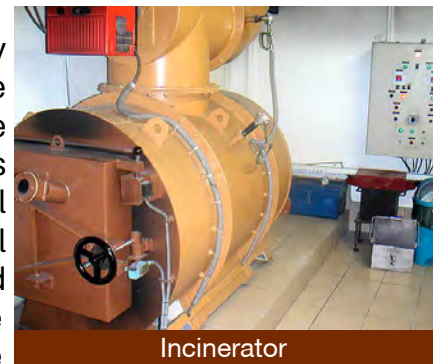
This process requires a significantly extended period of time and it is necessary to ensure a constant temperature throughout the material for the total time period and it is difficult to verify the effectiveness of pathogen inactivation. There are set norms for establishing the composting units which follows the regulations and take care of environmental protection. Consultants may be approached for establishing such units so that compost piles are constructed properly including an adequate carbon—to—nitrogen (C:N) ratio and also following regulatory norms.



Carcass spacing for composting pile.

Incineration

Incineration is the thermal destruction of carcasses by auxiliary fuel such as propane, diesel or natural gas. The modern incinerators reduce carcasses to ash and are generally considered to be bio secure. Incineration requires a great deal of energy compared with other disposal methods and is not considered a viable economic disposal option due to cost and labour. Incineration still a preferred method for managing small carcasses, but often large carcasses and/or a large number of mortalities cannot be handled due to the small incineration capacities.



Incinerator

In this method the carcasses are reduced to ashes by complete burning, which can be achieved by either fixed whole carcass incineration fuelled by natural gas in a specialized facility or by mobile air curtain whole carcass incineration which can be done on-site. In either case, the whole carcasses can be burned and reduced to ash. These methods produce effective inactivation of pathogens but need temperatures up to 1000°C.

Alternatively, Municipal corporations should be informed so that trucks can be sent to take the dead bodies to the local disposal facility.

10 | NUTRITION MANAGEMENT IN GAUSHALAS

Economical, sufficient and appropriate feeding to all the categories of cows in Gaushalas should be the key ingredient in feeding management.

As feed accounts for more than half of the total cost of maintaining cows in Gaushalas, proper planning should ensure minimum wastage and round the year availability of feed and fodder.

The quantity of food given should be optimum for maintaining health and normal behaviour and promoting the growth of young animals. It should be according to the body requirements of different categories of cows housed separately in Gaushalas.

The condition becomes more critical in Gaushalas when the availability of feed is scarce. In such situations, the feeding strategy should aim at utilizing rumen fermentation to obtain maximum nutrients from the forage (green or dry fodder) based diets and ensure most favourable balance feeding of the cows. eg: urea molasses treatment (50% molasses, 10% Calcium oxide, 5% salt and 25% wheat bran or cotton seed meal)

Feeding Systems

There are two feeding systems:

Traditional grazing

Traditional grazing can be adopted as a method of feeding in Gaushalas having significantly smaller herd sizes. It has been a very economical means of providing some or all of cow's forage needs.

However, provides inadequate nutrition and veterinary expense becomes higher.

The challenge of managing a grazing system for cows is different from managing confinement feeding. Uncontrolled or continuous grazing of the same areas should be avoided as it decreases forage quality and yield.

The practice of controlled grazing has proven to be beneficial in restoring and maintaining of grasslands. Care should be taken to provide plenty of cool, clean water prior to taking animals to grazing area. During the daylight hours of summers, if plenty of shade is not available in grazing area, cows should be returned to the Gaushala. Grazing should be practice in morning and evening hours of the day. There should be a check on the use of pesticides in grazing areas.



Pasture grazing method of feeding cattle.

Confinement feeding/Zero grazing



Zero grazing/confinement method of feeding cattle.

Confinement feeding provides no pasture to the cows and all forage provided to the residing animals is mechanically harvested (green fodder) and stored on the farm or purchased (e.g. silage and hay).

The housing system of confinement-fed cows have continuous feeding mangers and water troughs as discussed earlier. A larger percentage of Gaushalas use confinement feeding because of the large herd size and absence of grazing area.

Although confinement Gaushalas have a higher feeding expense per cow but accurate ration balancing can be practiced while feeding, leading to a healthy herd. Confinement feeding requires increased labour efficiency as feed has to be manually placed into the feeding mangers.

Gaushalas using confinement feeding have significantly lower veterinary expenses.

The management of proper nutritional resources is challenging because adequate supply of feeds and fodders throughout the year is a critical factor for feeding cows at Gaushalas. Insufficient feeds along with insufficient supply of one or more dietary essentials in the ration results in severe dietary deficiencies.

Most Gaushala management have little knowledge about the nutrient requirement of different categories of cattle being kept in various Gaushalas. Cows don't receive a fraction of the nutrition they need, and even the animals in milk or near parturition are not properly fed.

Fodder has to be grown and conserved for meeting out cow's nutritional requirements round the year.

Optimizing feeding programs is a matter of concern. Feed should be formulated using agro-industrial by-products and other non-conventional materials to avoid competition with human food and to reduce the cost of feeding.

Classification of Feeds and Fodder

The different feedstuffs that supply these nutrients to the cows can be broadly classified into two parts:

- 1) Roughages
- 2) Concentrates

Roughages are bulky feeds and possess relatively large amounts of less digestible

material i.e. crude fibre (more than 18 per cent) and low (about 60 per cent) Total Digestible Nutrients (TDN). Roughages are basically fillers to satiate hunger rather than provide complete nutrition. These roughages can be green (succulent) or dry, based on their moisture content. Green roughages include cultivated fodder crops, pasture grasses, tree leaves and silage. Dry roughages are the straws such as wheat or paddy straw; maize, sorghum or soyabean stovers (leaves and stalks of field that are commonly left in a field after harvesting the grain); hay etc. Another classification on the basis of Digestible Crude Protein (DCP) of green fodder is



Rice straw collected after harvesting.

- a) Maintenance type- Containing 3-5 percent DCP. e.g. Green maize, oat.
- b) Non-maintenance type- Containing less than 3 percent Digestible Crude Protein (DCP). Example. Straw, kadbi.
- c) Production type- Containing more than 5 percent Digestible Crude Protein (DCP). Example. Berseem, lucerne.



Square bales of wheat straw.

Concentrates are feeds, which contain relatively lesser amounts of crude fibre (less than 18 per cent on dry matter basis), have a comparatively high Total Digestible Nutrients (more than 60 per cent), and as a result have higher nutritive value e.g. cereal grains, oil cakes etc. The concentrates are further classified as:

- a) Energy Rich Concentrates- Cereal grains, cereal grain by-products, roots and tubers.
- b) Protein Rich Concentrates- Oilseed cake, pulse chuni, Brewer's grains and yeast.

Although, roughage and concentrate are sufficient to fulfil the body requirements of cows in Gaushala, feed supplements to improve the nutritional value of the feeds should be added for better health of cattle.

Green (succulent) fodder

Cows should never be deprived of green fodder as it contains lot of vitamins, minerals and water.

Young (before flowering) wheat, barley, black dal, peas, corn stalks, jowar, bajra and paddy in their green and tender state are excellent green fodder for cows. The long juicy grasses that grow among the corn, wheat and other crops also makes splendid cattle fodder. Carrots, beetroot chopped up and occasionally cabbages are very wholesome

and good food for cattle housed in Gaushalas.

In summer, green fodder has a cooling effect on the body. Due to high water content it fulfils the water requirement and increases the dry matter intake by the animal in hot summer. Along with this, green fodder is also a mild laxative, preventing constipation.



Chaffed green fodder for feeding of cows.

Pastures

Pasture refers to the land on which different type of edible grasses and other plants grow or are grown for animal grazing. Pasture was the natural and only feed of cattle when it was a feral animal.

There are many grass species suitable for different climatic areas. Guinea grass, Napier grass, Senja and Anjan grasses are familiar grasses having high yield and are particularly rich in digestible protein. Doob is the best grass for cattle.

Unfortunately, grasses cannot be made into hay and conserved for future use. So, cattle can be fed on them or allowed to graze during the season of their peak production only.

In India, well-developed pastures are not available extensively. Most of the natural grasslands have been denuded by overgrazing.

Important grasses for feeding of cows

Gaushala can grow grass for feeding near the premises or in an area available nearby (if space is available). Following are the types and description of various kinds of grasses that can be grown or availed by the Gaushala for feeding the cows:

Sewan grass

Sewan grass is a perennial grass that can live up to 20 years and is also known as the "King of grasses".

This grass is found abundantly in dry parts of Rajasthan, Haryana and Gujarat. It is sole source of survival of domestic animals as well as wild animals in the Thar Desert.

Sewan grass is a bushy plant, which grows to a height of 1.0-1.5 metre. The people of the Thar Desert are able to keep their animals alive during drought by feeding them the stored hay of Sewan. It is almost a complete feed for cows, as it is highly nutritious and palatable grass with protein



Sewan grass (*Lasiurus scindicus*)

content of 6-14% depending on the growing stage of grass.

This grass grows well in sandy loam to sandy soils in dry areas and is suitable for setting up of permanent pastures in dry areas. The ideal time for sowing of this grass is in the month of July during monsoon season. Its seeds are very light so they fly with the air and are also consumed by ants and rats leading to low germination rate of seeds.

For sowing, seeds are mixed with wet sand and compost and are sprinkled over the ground during rain or just after the rain. Shallow ploughing is done over them after broadcasting the seeds. Avoid deep ploughing as it decreases the chances of germination of seeds. For sowing 1 hectare of land 5-6 kg seed is sufficient.

Sewan grass can also be grown by planting its shoot bits with nodes and roots during the rain. Also, its seedlings can be prepared in a nursery which can later be planted in the pasture. The pasture of Sewan should be irrigated only by sprinkler systems.

From one hectare pasture of Sewan we can get 30-35 quintal dry fodder in dry areas and 50-70 quintal dry fodder in areas receiving good rains. Hence, Sewan grass can act as a major source of green fodder to Gaushalas in areas of Haryana, Rajasthan and Gujarat.

The seeds of Sewan grass can be obtained from Central Arid Zone Research Institute, Jodhpur; Central Arid Zone Research Institute, Bikaner; Agriculture Research Station, Beechwal; Bikaner and Rajasthan Agriculture University, Bikaner. Important varieties of this grass include CAZRI M-305, CAZRI-317 and CAZRI-319.

Anjan grass

Anjan is also an important grass of arid and semi-arid regions of the country. It is abundantly found in Punjab, Haryana, Rajasthan, Gujarat, Andhra Pradesh, Tamil Nadu, Karnataka, Madhya Pradesh, Western UP and foot hills of Jammu. It is the most important grass of Indian pastures.

It can be grown in almost every type of soil except water logged area. It is an extremely drought resistant grass and its roots spread up to 2.5-metre diameter and go up to 1.5 metre deep.

The pasture of Anjan in arid and semi-arid regions can act as a good source of green fodder round the year for Gaushalas. Anjan grass can also be grown along with other grasses like Dhaman or Sewan in the pasture. In North India, sowing of Anjan is done in June to July and in South India from March to September.



Anjan grass (*Cenchrus ciliaris*)

Anjan grass gives maximum production in sandy loam to loamy soils. It can also be grown by planting the seedlings brought up in the nursery and even by planting rhizomes (root) of old plants. Normally seeds are sprinkled in the field after preparing it for sowing and shallow ploughing is done over it.

Anjan is an important grass for the development of permanent pastures. From one hectare pasture of Anjan, about 150-300 quintal green fodder can be obtained during

the first year of establishment.

The protein content of Anjan grass is about 12%. Digestibility of green fodder obtained from Anjan is around 80%.

The seeds of Anjan can be obtained from Central Arid Zone Research Institute, Jodhpur; Indian Forest and Grassland Research Institute, Jhansi; Tamil Nadu Agriculture University, Coimbatore and IARI, New Delhi. Important varieties are CAZRI-357, CAZRI-358, CAZRI-1106, Marwar, Anjan, Pusa Gaint Anjan, Bundel Anjan-1, COL, Neela Kolukattai.

Dhaman grass

Dhaman grass is found in all the regions where Anjan is found but its drought resistance capability is low as compared to Anjan grass. Its root system is less developed as compared to Anjan. It can be grown in almost every type of climate but it gives maximum production in areas having rainfall more than 400 centimetres.

Dhaman grass can be an important grass for supply of green fodder to Gaushala and is highly palatable and nutritious. Its protein content is 4-11% and digestibility is around 70%. From one-hectare pasture of Dhaman, one can get 2-5 tonnes dry fodder in arid regions and 8-10 ton dry fodder in semi-arid regions.



Dhaman grass (*Cenchrus setigerus*)

Sowing is done in monsoon season in the month of June to July. The seeds are light weight so they are mixed with wet soil or compost and sprinkled in the field and shallow ploughing is done over it.

The seeds can be obtained from Central Arid Zone Research Institute, Jodhpur; Central Arid Zone Research Institute, Bikaner; Agriculture Research Station, Beechwal; Bikaner and Rajasthan Agriculture University, Bikaner; Indian Forest and Grassland Research Institute, Jhansi; Agriculture University, Coimbatore, Tamil Nadu. Black Kolukattai is an important variety developed in Tamil Nadu and is recommended for entire Southern India. Other varieties include CAZRI - 76 and Marwar Dhaman (CAZRI- 175).

Gramna grass

Gramna grass is found mostly in Rajasthan, Uttar Pradesh, Maharashtra, Karnataka and Gujarat. This grass can tolerate extreme drought and its roots spread up to 3 metres in a diameter and go up to 2-metre-deep into the soil. It grows up to 2 meters in height.

From one-hectare pasture of Gramna we can get 40-70 quintals dry fodder in dry areas and in irrigated and rainy areas we can get up to 100 quintals dry fodder from one hectare.



Gramna grass (*Panicum antidotale*)

Animals have less preference towards Gramna grass in comparison to other grasses like Sewan, Dhaman, Karad etc. It is palatable and

nutritious in early stages but in mature stages it becomes hard and animals do not like to eat it in that stage.

The oxalic acid content is also high in this grass, which is not good. Long-term consumption of this grass leads to calcium deficiency in animals. Animals consume this grass in initial stage of its growth and at that time, its digestibility is around 85%.

Important varieties of Gramna grass are CAZRI-28, CAZRI-330 and CAZRI-627.

Marvel or karad grass

Marvel or Karad grass is mostly found in the hot, dry, arid climate of Rajasthan and Gujarat to hot-humid climate of South India.

In India itself, 8 varieties of this grass are found in different agro-climatic zones and is found in all plains and up to 1500 metre height in mountains. It is adapted to different types of climates. It grows in several varieties of soils but black clay soil is best for its growth. It is a drought resistant grass and its roots go up to 1.2-metre-deep in the soil. It grows up to 1 metre in height.

Sowing is done after the first shower of monsoon and for one-hectare land 4-6 kg seeds are required. It is the most favourite grass of the animals and they eat it in all stages of its growth. The protein content is up to 7% and from one-hectare pasture, 30-70 quintal dry fodder is obtained.



Marvel grass (*Dichanthium nultatum*)

For seeds, one can contact Central Arid Zone Research Institute, Jodhpur; Indian Forest and Grassland Research Institute, Jhansi or nearest Agriculture University or Agriculture Research Station. Important varieties of Marvel or Karad grass are Marvel-7, Marvel-8, GMG-I, Marvel-93, CAZRI- 490, CAZRI- 491 and IGFRI 495-1.

Doob grass

It is found everywhere in India in the fields, gardens, parks, etc., and is also known as Bermuda grass. It is readily consumed by all categories of cattle and also used as a soil binder for the control of soil erosion. It is a nutritious grass and palatability is good but its dry fodder yield is very low. Protein content of this grass is around 8-14%.



Doob grass (*Cynodon dactylon*)

Dhawal grass

This grass is suitable for stony soil where the soil layer is shallow and there is a layer of stones below the soil. The capacity of the soil to hold water is low although it prevents soil erosion. It is a perennial grass and grows up to 1.5-2.0-metre height.

It has great capacity to tolerate drought conditions. Its improved species are Mhow and Chandigarh but the yield of Mhow is more. The protein content in this grass is between 4.6 to 5.3%. It can be grown by sowing seeds, preparing seedlings in a nursery and planting them or even by planting shoot bits with nodes and roots of old plants.

The month of July is most suitable for sowing and for one-hectare land, 6-7-kilogram seed is sufficient. From one-hectare land, 35-40 quintal dry fodder can be obtained and if fertilizers are used, 75-80 quintal dry fodder can be obtained from one hectare of land. Grass can be cut at intervals of 60 days regularly.

The areas having rainfall 300-1200 cm are most suitable for growing this grass. Southern India is more suitable for growth of this grass.

Important varieties are GAUD-1 developed at Gujarat Agriculture University, Banaskantha and is suitable for clayey type soil; 1GC-9903 or Bundel Dhawloo Grass-I-developed at Indian Forest and Grassland Research Institute, Jhansi and is recommended for growing in Madhya Pradesh, Southern U.P., North Karnataka, Rajasthan, Andhra Pradesh, and Southern Maharashtra.

Guinea grass

Guinea grass was introduced in India in 1793. It gives a high yield in hot areas having heavy rainfall, but it can also give a good yield in dry, hot and un-irrigated areas. It has the ability to produce quality fodder even under the shade of trees.

It also has the ability to grow under adverse conditions. It is a perennial grass and once it grows, it gives fodder for up to 20-25 years. It can be grown throughout India except in the mountains. In areas having hot-humid climates with heavy rainfall 8-9 cuts in a year can be achieved while in North India 4-5 cuts may be achieved.



Guinea grass (*Megathyrsus maximus*)

It can be grown in sandy soil after putting cow dung manure and compost. In various types of soils in India. In North India, under irrigated conditions, its sowing can be done from March to August but sowing during monsoon season gives better results. It can be grown both by seeds and by root planting.

After sprinkling seeds, shallow ploughing and light irrigation over it is recommended. Heavy irrigation is not good for it, so irrigate only up to germination in order to prevent development of hard dry layer of soil over the seeds. It is a very high yielding grass. It gives 320 tonne fodder in one hectare per year in 7 harvests. It is a very nutritive fodder for animals.

Important varieties of Guinea grass are Macueni, Riversdale, Hamil, PGG-9, PGG-19, PGG-14, COG-I, PGG-101, PGG-518, COG-2, PGG 616, Bundel Ginni-1 and Bundel Ginni-2.

Sen Grass

This grass is found in areas receiving 300-2000 cm rainfall. It is suitable for brown grit soil having efficient drainage of water. It is also cultivated in monsoon. It can be cultivated by both seeds and roots but it is better to cultivate by roots. Important variety is Bundel Sen Grass (1GS9901).

Dinanath grass

Dinanath grass is found in Bihar, Orissa and adjoining states. This grass grows very well

during monsoons in tropical and semi-arid areas. It grows well in fertile loamy soils but can also be grown in sandy soils after application of manure. It can tolerate both alkaline and acidic soils but cannot tolerate frost.

It is one of the fastest maturing grasses. It needs a well prepared seed bed. Sowing is done just before rainy season after receiving one or two good showers. For one-hectare land, 1-2 kg seed is required. The seed is spread or broadcasted in the field and shallow ploughing is done over it.



Dinanath grass (*Pennisetum pedicellatum*)

Five tonnes of farm compost per hectare should be applied to the pasture prior to sowing. It can be cut several times in a year for green fodder production. This grass has an ability to spread naturally by self-dispersal of seeds and thus regenerates each year.

It is good quality fodder and gives up to 45 tonnes fodder per hectare in areas receiving medium to high rainfall. It can also be grown in both irrigated and rain fed areas. It is largely a cut and carry type fodder and is best suitable for making good quality hay. The crude protein level in this grass is 7.4%.

Its seeds can be obtained from IGFRI, Jhansi. The main varieties of Dinanath grass are Pusa Dinanath Grass, Bundel-1, Bundel-2, COD-1, TNDN-1 and Jawahar Pennisetum.

Para grass

Para grass is commonly known as Buffalo grass, California grass, Giant Couch grass, Water grass or Pani wali ghaas. It is a hairy, perennial grass which spreads by surface runners and have hairy roots at nodes. This grass is a native of Brazil and it was introduced in India in 1894 in Pune.



Para grass (*Brachiaria mutica*)

It grows well in water logged areas like on the banks of rivers and canals and it can withstand prolonged flooding of water. This grass is most suitable for areas where there are problems of water logging or frequent flooding and on sewage farms. This is a grass of tropical climate and grows well in hot-humid areas receiving high rainfall. It grows better in clayey, silty, peaty, sewage and water logged soils. It is highly profitable to grow this grass on water submerged soils or low lying alkaline soils where nothing else survives.

Best time of sowing is March in irrigated conditions and monsoon season in rain fed conditions. For sowing or growing this grass, the land should be well levelled and 5 tonnes of farm compost should be applied.

Shoot bits 20 cm in height, with 2-3 nodes on it, are planted in lines at 50 cm distance. First cut can be taken after 3 months of planting and then subsequent cuts can be made at monthly intervals. It gives 130-140 tonnes of green fodder in one hectare. This grass cannot withstand heavy and close grazing. However, it can withstand moderate grazing. First grazing should be allowed only after the grass attains a height of 60 cm and becomes well established. Only controlled and light grazing should be allowed for this grass. The crude protein (CP) level of this grass is 7% with 0.76% calcium and 0.49% phosphorus.

Its shoots for planting can be obtained from IGFRl, Jhansi.

Napier or elephant grass

Napier grass grows mostly in hot and humid regions. It is the favourite grass of elephants. It can be grown in water scarce area also with drip irrigation. But due to high oxalic acid content of this grass it is not very good fodder for cows. In the absence of other green fodder source, it can be consumed in limited quantities.



Elephant grass (*Pennisetum purpureum*)

It is a perennial grass so once planted gives fodder for many years. It can be planted with roots and before planting field is well levelled and irrigation is done just after planting. It starts giving fodder after 50 days of planting.

Hybrid napier

It is a cross between Napier grass and Bajra or Jowar. It is better than Napier grass and its protein content is about 10.2 %. However, the amount of oxalic acid can be high in some varieties. It is also a perennial grass. It can be planted with roots and before planting, the field is well levelled and irrigation is done just after planting. It starts giving fodder after 50 days of planting.



Hybrid Napier Bajra Grass

Important varieties of Hybrid Napier are CO-1, CO-2, CO-3, CO-4, PBN-83, IGFRl-5, NB-21, PBN-233, KKM-1, APBN- 1, Sugna, Supriya and Sampurna.

Black spear grass

This grass is found in the coastal areas of India. Important variety is IGHC-03-4.

Cultivated fodder crops

Cultivated fodders form the major source of green fodder for the feeding of cows in most parts of the country and in almost all the Gaushalas. Fodder crops are classified into two groups - leguminous and non-leguminous.

Leguminous fodders

Leguminous fodder plants have higher nitrogen content. This can form a major source of protein to cattle. If legumes are fed liberally to cattle, there is no need for any additional supply of protein in their diet.

Among leguminous fodders, berseem (*Trifolium alexandrinum*) and lucerne (*Medicago sativa*) are the most common rabi (cropping season is from October-March) season fodder grown in India. Cowpea (*Vigna sinensis*) and cluster bean (*Cyamopsis tetragonoloba*) are the other common kharif (cropping season is from July -October) season leguminous fodders. Other legumes like soybeans (*Glycine max*), sunhemp (*Crotolariajuncea*) are also important in the feeding of cows. Leguminous green fodders are very rich in protein and calcium but excessive feeding of leguminous green fodder can also lead to frothy bloat in cows.

Berseem

It is an important green fodder crop of winter or rabi season grown in irrigated areas of India and is also known as the king of fodder.

It is rich in protein and calcium. It contains almost 12.8% digestible crude protein (DCP).

Varieties: Pusa giant, Barseem Ludhiana-1, Mescavi, Vardan, BL-10, BL-22, BL-2 and Flisar Barseem- 1.



Lucerne (Alfalfa)

Lucerne is known as the queen of fodder. It is grown in rabi season and is very nutritious and highly palatable. It is very rich in protein and calcium. Its digestible crude protein (DCP) level is almost 16.2%.

Varieties: CO-1, GAUL-1, GAUL-2, LL Composite 5, LL Composite-3, Lucerne No-92, Anand-3 and RL-88.



Cowpea (lobia)

It is a very good green fodder for cows. It is a crop of kharif season. Its digestible crude protein (DCP) level is nearly 20.3 %.

Varieties: Cowpea-74, Kohinoor, HFC-42-1, GFC-2, CO-5, UPC- 5286 and Bundel Lobia-1.



Guar

It is a crop of dry regions and areas with low rainfall. It is usually an industrial crop but can also be used as fodder when it is in 50% flowering stage. Sole feeding of green guar can lead to bloat so it should be fed mixed with dry green fodder. Its digestible crude protein (DCP) level is around 12%.

Varieties: Durgapura Safed, FS-277, HFG-I 19, HG-75, Maru guar, Bundel guar-1, Bundel guar-2 and Guar kranti.



Methi (fenugreek)

It is a very nutritious and highly palatable green fodder for cows and usually grows in winters. The leaves of fenugreek are rich in vitamin C, other vitamins and minerals. Its digestible crude protein (DCP) level is nearly 17 %.

Varieties: Lam Sel.1, RMT-1, Rajendra Kanti and



Non-leguminous fodders

Non-leguminous fodders generally contain lower percentage protein. When cattle in Gaushalas are fed on these fodders special care has to be taken to add sufficient protein rich concentrates to balance the ration.

Non-leguminous fodders include many cereal fodder crops, perennial grasses and some indigenous grasses. Important cereal crops used as fodder are maize (*Zea mays*), sorghum (*Sorghum vulgare*), oats (*Avena sativa*) and bajra (*Pennisetum typhoides*).

The protein content of these cereal fodders generally is between 8 to 10 per cent. These green fodders must be cut into pieces one inch in length before feeding. The perennial cultivated fodder grasses include hybrid napier, para grass (*Brachiaria mutica*), guinea grass (*Panicum maxicum*), napier grass (*Pennisetum purpurium*), rhodes grass (*Chioris gayana*) and sudan grass (*Sorghum sudanense*). Some indigenous grasses like anjan grass (*Cenchrus ciliaris*) doob grass (*Cynodon dactylon*) and sewan grass (*Elyonurus hirsutum*) can also be used as cattle feeds in Gaushalas. If these crops are grown under sufficient irrigation, several cuttings of excellent green fodder can be obtained. A small area of land near Gaushala should be devoted to growing these fodder crops. The palatability, digestibility and protein content of these grasses are slightly lower or almost equal to the cultivated cereal fodders. However, their annual yields are usually poorer as compared to the yield of most of cultivated fodder crops.

Jowar (Sorghum)

One of the most important green fodder crops of North India. It is very nutritive and sweet in taste. The digestible crude protein (DCP) level of jowar is 7.8%.

Jowar in its green tender state is excellent food for cattle, but great care must be ensured regarding the condition/stage of the plant, for after a certain stage it becomes poisonous. Drought affected jowar contains hydrogen cyanide poison and kills death of animals. Jowar should be cut and fed after 1 or 2 irrigations and after attaining a height up to 50-60 cm.



Sorghum forage

Varieties:

Single cut: Pusa chari 1, Hariyana Chari J5-73/53, SL-44, MP Chari and Jawahar Chari

Two cut varieties: CO-27 and Gujarat Forage Sorghum Hybrid 1

Multi-cut varieties: SSG-59-3, Jawahar chari -69, PCH 106, Punjab Sudex Chari-1, Safed Moti FSH-92079, Pant Chari -5 and Hariyana Jawar-513.

Maize (makka)

Maize is also a green fodder crop of kharif season. The amount of digestible crude protein (DCP)



Maize (*Zea mays*) green forage

content is around 6-7.4%.

Varieties: African tall, African Tall Composite, APFM-8, J-1006 and Pratap MakkaChari-6.

Oat (Jaee)

Oat is the green fodder crop of the rabi or winter season. It is very nutritious and its digestible crude protein (DCP) content is about 7-9 %.Oats are first grown for forage and then allowed to recover for grain harvest for humans.

Varieties: Algerian, Bruncker, FOS-I/29, Kent, Palampur-I, UPO-94, OS-6, OS-7, 01-9, Bundel Jai-822 and OL-125.

Indian sweet Clover (Senji)

It is a fodder crop of sugarcane and jute grown areas, cultivated in rabi season.

Varieties: FOS-I, Senji Safed-76, YSL-106 and PC-S.



Oat (*Avena sativa*) forage



Senji/Sour clover (*Melilotus indicus*) forage

Package of practices for green fodder

Fodder crops need to be cultivated and harvested for feeding the animals in the form of forage (cut green and fed fresh), silage (preserved under anaerobic conditions) and hay (dehydrated green fodder).

Fodder and feeds constitute the major part of expenditure involved in day to day management of the animals at Gaushala. The cost of animal rearing can be significantly lowered by improving feeding system based on quality green fodder. There could be several other types of fodder crops that can be grown for feeding the animals at Gaushala owned or leased land. Some of them are mentioned below.

Summarized package of practices of major Cereal fodder crops of India

Cereal fodders like maize, sorghum, pearl millet and oats provide energy-rich herbage to livestock. These have wider adaptability and variability in terms of growth, regeneration potential, yield and quality of herbage. However, herbage quality of cereal fodder and grasses starts deteriorating after flowering.

Crop	Seed rate (Kg/ha)	Sowing time	Interrow spacing (cm)	Fertilizer dose and scheduling	Irrigation interval and number	Harvesting schedule (DAS- Days After Sowing)	Green fodder yield (Tonnes/ ha)
Sorghum/ Jowar/Cheri (Single cut)	Broadcasting: 20-25; Linesowing: 12-15	June-July	30-40	60:30:30 kg N:P:K/ ha at sowing time followed by top dressing with 30 kgN/ha at one month after sowing.	Depending on rain (indry spell 10-12 days interval)	65-70 DAS	35-40

Sorghum/ Jowar/ Cheri(Multi cut)	Broadcasting: 20-25; Linesowing: 15-20	March-April	30-40	70:30:30 kg N:P :K/ ha at sowing time followed by top dressing of 50kg N/ ha after each cut.	Summer:5-6 innumber Monsoon: Dependingon rain	1st cut at 55-60 DAS Subsequent cut after 45 days	80-90
Bajra/ Pearlmillet (Singlecut)	Broadcasting: 10-12; Linesowing: 8-10	March-April	30-40	60:30:30 kg N:P :K/ ha at sowing time followed by top dressing of 50kg N/ ha after each cut	Summer:4-6 in number Monsoon: Depending on rain	1st cut at 50-55 DAS Subsequent at 35-40 days	90-100
Maize/ Makka	Broadcasting: 60-70; Linesowing: 50-60	Summer: March-April Monsoon June-July	25-30	50:40:40 kg N:P:K/ ha at sowing time followed by top dressing with 40 kgN/ha at one month after sowing or knee high stage.	Summer:7-8 in number Monsoon: Depending on rain (indry spell 8-10 daysinterval)	60-70 DAS	40-45
Jai/ Oat(Single cut)	Broadcasting: 70-80; Line sowing: 60-70	Octoberto lastweek ofNovember	25-30	80:40:40 kg N:P:K/ ha at sowing time followed by top dressing with 40 kgN/ha at one month after sowing	3-4 innumber	70-75 DAS	40-45
Jai/ Oat(Multi- cut)	Broadcasting: 70-80; Line sowing: 60-70	Octoberto lastweek of November	25-30	100:40:40 kgN: P:K/ ha at sowing time followed by top dressing with 40 kg N/ha after each cut	7-8 innumber	1st cut at 65 DAS Subsequent cut at 35-40 days	55-60

Summarized package of practices of major Leguminous fodder crops of India

Crop	Seed rate (Kg/ ha)	Sowing time	Inter row spacing (cm)	Fertilizer dose and scheduling	Irrigation interval and number	Harvesting schedule (DAS- days after sowing)	Green fodderyield (Tonnes/ ha)
Cowpea/ Lobia (Summer crop)	Broadcasting: 25- 30; Line sowing: 20-25	March-April	40-50	20 kg Nand 60 kg P2O5/ha at sowing time	6-7 in number	70-75 DAS	35-40
Cowpea/ Lobia (Rainy Season crop)	Broadcasting: 25- 30; Line sowing: 20-25	June-July	40-50	20 kg Nand 60 kg P2O5/ha at sowing time	Depending on rain (indry spell10-12 days interval)	60-65 DAS	35-40
Guar/ Gluster bean (summer crop)	Broadcasting: 30- 35; Line sowing: 25-30	March-April	30-40	20 kg Nand 60 kg P2O5/ha at sowing time	5-6 in number	70-75 DAS	30-35
Guar/ Cluster bean (Rainy season crop)	Broadcasting: 30- 35; Line sowing: 25-30	June-July	30-40	20 kg Nand 60 kg P2O5/ha at sowing time	Depending on rain (in dry spell10-12 days interval)	65-70 DAS	30-35
Ricebean/ Gaimung/ Redbean	Broadcasting: 30- 35; Line sowing: 25-30	March- Sept.	30-40	20 kg Nand 60 kgP2O5/ha at sowing time	4-5 in number during summer and rain fed during monsoon season	65-75 DAS	30-35
Berseem	Broadcasting:30- 35;Line sowing:25-30	2 nd Fortnight of October	20-25	20 kg Nand 80 kg P2O5 and 40 kg k2O/ha at sowing time	8-12 in number	1 st cut at 50-55 DAS subsequent cut at 30-35 days	100-120

Lucerne/ Rizka	Broadcasting:30-35;Line sowing:15-20	Sept.- October	30-35	20 kg Nand 70 kg P2O5 and 40 kg K2O/ha at sowing time	10-14 in number	1 st cut at 50-60-65 DAS subsequent cut at 30-35 days	80-100
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Summarized package of practices of major grasses of India

Perennial grasses provide nutritious and palatable fodder round the year. Perennial grasses grow faster and produce more herbage which is ideal for feeding as green fodder, silage and hay. These grasses grow well in high temperature and can withstand drought conditions for a fairly long spell.

Crop	Seed rate (Kg/ha)	Sowing time	Inter row spacing (cm)	Fertilizer dose and scheduling	Irrigation interval and number	Harvesting schedule (DAS-days after sowing)	Green fodder yield (Tonnes/ha)
Bajra Napier Hybrid	35,000 rooted slips or stem cutting /ha	February-August (Summer planting under irrigation)	75 cm× 50cm	60:50:40 kg N:P:K/ha at sowing time followed by top dressing with 40kg N/ha after each cut. Addition of 20-25 tonnes FYM/ha is required during land preparation	15-18 days interval during March to May and at 10-12 days interval in summer months	1st cut at 60-65 DAS Subsequent cut at 25-30 days	100-140/year
Guinea grass	40,000 rooted slips/ha and 3-4 kg seeds /ha	February- July (Summer planting under irrigation)	Rooted slip sat 50cm ×50 cm	60:50:40 kg N:P:K/ha at sowing time followed by top dressing with 40kg N/ha after each cut. Addition of 20-25 tonnes FYM/ha is required during and preparation	15-18 days interval during March to April and at 10-12 days interval in summer months	1st cut at 60-65 DAS Subsequent cut at 25-30 days	80-120/year

Perennial forage i.e. Bajra Napier Hybrid, Guinea grass, etc. can be effectively grown on the bunds of field boundaries and irrigation channels. These areas do not offer any competition with existing crops and cropping system. The land areas which are not used for any agricultural purposes can be brought under perennial forage production. In addition to these land areas, the community land may also be planned for perennial forage production.

Mixed cropping of fodder crops

Maize+Cowpea

Maize + Cowpea mixed cropping (50% seed rate of each crop) can give 41-45 % more total green fodder yield than the sole green fodder yield of fodder maize. However, time of harvesting is very important and maize+cowpea mixed crop needs to be harvested within 55 to 58 days after sowing (DAS). Delay in harvesting can cause drastic reduction in green fodder yield.

Berseem+Gobhisarson

In first cutting, the forage yield of berseem is low. In order to compensate



Growing of Bajra Napier Hybrid (CO4) on the bunds.

yield in first cutting, seed of berseem is sown mixed with 700-800 g seed of gobhisarson and mixed cropping of berseem+gobhisarson can improve the total green fodder yield to the tune of 38-42% at 1st cut. In addition to improve green fodder yield, the broad leaves of gobhisarson can suppress the growth of several weeds.

Round the year fodder production

Overlapping cropping system comprises of raising berseem, inter-planted with Bajra Napier. Hybrid/Guinea grass in spring and intercropping the inter-row spaces of the Bajra Napier Hybrid/Guinea grass with cowpea during summer after the final harvest of berseem can supply green fodder round the year. Intensive forage production systems are tailored with an objective of achieving high yield of green nutritious forage and maintaining soil fertility. Under assured irrigation multiple cropping sequences like sorghum + cowpea + berseem + gobhisarson + maize + cowpea and sorghum (multicut)+ cowpea + berseem+ gobhisarson with the planting of Bajra Napier Hybrid/Guinea grass on the bunds or non-competitive lands areas provide green fodder round the year.

Fodder from trees

There are a variety of trees, the leaves and lopped off branches of which may be sufficient for supplying fodder to Gaushala cattle. Lopping for leaf fodder is a wide-spread habit and form an important addition to grazing in the feeding of cows, especially during the scarcity of other green fodder resources. The trees, if properly lopped by rotation under control, can supply a large bulk of fodder.

Wastelands and canal banks if situated near the Gaushala may be extensively used as green fodder resource for cows. These trees are rich in protein, ranging from 10-16% crude protein. Their calcium content is also fairly high. List of fodder trees that can be used for cattle feeding:

Name	Geographical distribution
Babul (<i>Acacia nilotica</i>)	: North West India
Bael (<i>Aegle marmelos</i>)	: All over India
Jack fruit tree (<i>Artocarpus heterophyllus</i>)	: Deccan (cultivated in all parts of India)
Kachnar (<i>Bauhinia variegata</i>)	: All over India
Kumbi (<i>Careya arborea</i>)	: Hotter parts of India
Shisham (<i>Dalbergia sissoo</i>)	: Sub-Himalayan tracts
Gular (<i>Ficus racemosa</i>)	: Tropical India
Anjan (<i>Hardwickia binata</i>)	: Peninsular India.
Mulberry (<i>Morus alba</i>)	: North West Himalaya
Poplar (<i>Populus alba</i>)	: Cultivated in Punjab & N.W. Himalaya
Jhand (<i>Prosopis cineraria</i>)	: North West India
Ban (<i>Quercus leucotrichophora</i>)	: Central Himalaya
Arjun (<i>Terminalia arjuna</i>)	: All over India

Ber (<i>Ziziphus mauritiana</i>)	: All over India
Kosum (<i>Schleichera oleosa</i>)	: Northern India

Dry roughages

The left over parts of the grain crop plants which are used for animal and human feeding after separating the grains constitute bulk of dry roughages in India. These include mainly wheat straw, paddy straw, ragi straw, gram bhusa, bajra karbi, jowar karbi etc.

Dry roughages are generally of poor feeding value due to their low palatability, high lignin content and low digestibility. Wheat and paddy straw are the major dry roughages in cattle feeding. They contain about 40 to 50 per cent Total Digestible Nutrients (TDN) and negligible amount of Digestible Protein.

Though poor in feeding value, these straws are the staple feed available to the cattle in Gaushalas throughout country due to non-availability of much croplands for fodder production as well as total destruction of communal grasslands due to overgrazing.

They are important filler agents and help in satisfying hunger. Certain techniques like soaking in water, urea-ammonia treatment or impregnating with urea and molasses can improve the palatability and nutritive value of these cereal straws. Some of the pulse crop straws like gram, moong and moth bhusa are more palatable and nutritious and have more protein value but their availability for cattle feeding is limited.

Non-leguminous dry roughage

Straw

The leaves and stock of pea, beans, gram, mussoor and moong, after the grains has been threshed can be good source of fodder for Gaushala cows. The chopped up bhoosa can be mixed with other feed. Wheat and barley straw cut into pieces and fed as bhoosa are certainly the best that can be given to the cows.

Care must be taken that the bhoosa is clean and free of contamination. Most of the time it is found full of mud, dung etc. or musty and rotten which may impair their utilization and adversely affect the health of cows.

Rice straw has less nourishment, but it can be a chief article of dry fodder in scarcity time. In selecting paddy straw for cattle feeding, be careful that it is not of paddy grown in swamp or low lands because insects and fungi can attack the straw in such conditions.

Wheat straw

Wheat straw is mostly used in North Indian states like Punjab and Haryana. It is low in nutritive value but used for feeding cows and buffaloes. It contains some amount of phosphorus but low in calcium. Digestible crude protein (DCP) level is almost zero. These provide a feeling of satiety to the animals due to their rumen filling action.



Wheat straws used for feeding of cattle in Gaushala.

Rice straw

Mostly used in rice grown areas of India, especially in North-East India. It is a poor quality fodder, almost zero in nutritive value. It contains high level of indigestible fibre and potassium salts. The high level of potassium salts leads to excretion of sodium salts from body. It also contains high amount of oxalic acid which binds with the calcium in the body and makes calcium oxalate, which is excreted in the urine. So, it reduces the calcium absorption in the body and leads to calcium deficiency. It should be soaked in water for some hours before feeding. Digestible crude protein (DCP) level is almost zero.



Rice straw after harvesting of rice.

Barley straw

It is similar to wheat straw but its nutritive value is more than wheat straw. The problem with this dry fodder is that it contains a lot of spikes so sometimes it causes mouth injury. Digestible crude protein (DCP) level is 0.5%.

Oat straw (Jae ka danthal)

It is the best straw or dry fodder for feeding cows. It contains about 2.2% digestible crude protein (DCP). It is richer in protein and minerals in comparison to other straws.

Bajra kadbi or bajra straw

It is an important fodder for cows, especially in dry areas. It contains digestible crude protein (DCP) up to 0.80%.

Jowar kadbi or jowar straw

It is also used for feeding cows where jowar crops are grown. Its digestible crude protein (DCP) level is 2.4%.

Makka kadbi or maize straw

Used for feeding cows in maize grown areas. Its digestible crude protein (DCP) level is 3.4%.

Ragi bhoosa

Used for feeding cows in Southern India. Its digestible crude protein (DCP) content is 0.30%.

Note: Kadbi or kutti are leftovers (leaves, stem etc.) of crops like bajra, jowar, maize which remain after extracting the grains from these crops. All type of kadbis are better fodder for cows compared to any type of straw or bhoosa. In Indian conditions, since the nutritive value of the bhoosa and kadbi etc. is low, it is recommended to feed cows 1.0-1.5 kg of concentrates along with bhoosa daily in order to fulfil the nutritive requirement for body maintenance of cows in Gaushalas.

Hay

Difference between Hay and Straw

Hay is made by drying after harvesting of green fodders while straw is by product of the grain harvest.

Leguminous dry roughage/hay

All leguminous dry roughages are better fodder than non-leguminous dry roughages. They are more palatable and nutritious. They are rich in calcium and protein but their availability is limited due to low production.

Chana bhoosa (Gram straw)

It is very nutritious and tasty. It is salty in taste so improves the water intake and palatability of the feed. Its crude protein content is 0.6-1.0%. Instead of feeding alone, it should be fed after mixing with other non-leguminous dry fodder. The chana bhoosa obtained from modern mechanical thrashing is of poor quality and can lead to digestive upsets due to presence of sand; so should be fed cautiously. The chana bhoosa harvested by manual thrashing by traditional methods is of better quality.

Moong bhoosa and Moth bhoosa

Both moong and moth bhoosa are excellent dry fodder for cows in Gaushalas because of their highly nutritious and palatable nature. The digestible crude protein content is 3.96%.

Guar bhoosa

Usually not used to feed cows but can be fed in times of scarcity after mixing with wheat and rice straw in some amount. Excessive feeding of guar bhoosa can lead to bloat and digestive upsets.

Groundnut straw (moongfali bhoosa)

Groundnut straw is also very nutritive, palatable and rich in protein. In Bikaner region, it is also used as an alternative to green fodder. It is also a very good fodder for cows. Groundnut straw is very leafy with tender branches and retains its green colour.

Soyabean bhoosa

It is also an important dry leguminous fodder for cows which is rich in protein and available in soyabean growing areas. Its digestible crude protein level is around 1.64%.

Arhar bhoosa

Its digestible crude protein level (DCP) is 3.81%.

Urad bhoosa

Its digestible crude protein (DCP) content is 3.89%.

Concentrates

Concentrates are energy and protein rich feed stuffs that need to be added to the roughage to meet out the nutrient requirement of cows. They supply the primary nutrients (energy, protein, minerals and vitamins) but contain less than 18 per cent crude fibre with low moisture content.

The feeding of concentrates is of paramount importance to cows specially to producing cows as production cannot be sustained beyond a certain level on the feeding of roughages alone. In addition, young calves cannot consume a large amount of roughage and hence require concentrates.

Concentrates can be classified into:

- a) Cereal grains, legumes and tubers- Energy rich concentrates (less than 18% protein).
- b) Oil-cakes- Protein rich concentrates (more than 18% protein).
- c) Agricultural by-products- they are mid- protein and mid-energy value feeds.

Energy rich concentrates

Energy rich concentrates include all the grains and some of their by-products. They are rich in carbohydrates and therefore used in the ration of cattle as sources of energy. The cereal grains are rich in starch and there is only a little fibre. The total digestible nutrients are supplied in plenty and therefore, bulk energy may be obtained out of them.

These are highly palatable feeds. Rice, maize, wheat, barley etc. are consumed with pleasure and the cattle are capable of ingesting more roughages if a part of these palatable material is given to them with the roughages.

Maize (*Zea mays*), oats (*Avena sativa*), barley (*Hordeum vulgare*), jowar (*Sorghum vulgare*) and bajra (*Pennisetum typhoides*) are the most important for the feeding of cattle. Poor quality wheat (*Triticum aestivum*) or wheat grains unfit for human consumption can also be used as cattle feed. The crude protein content of these cereal grains varies between 8 to 12 per cent and the total digestible nutrients can be as high as 75 to 80 per cent.

Use of the cereal grains in feed of cows is very limited, obviously for the reason that they fulfil the human requirement: The cows in Gaushalas have to depend very largely on treated straws and other roughages for their energy requirement.

Protein rich concentrates

Protein rich concentrates have a greater proportion of protein as a constituent. Certain pulses such as bengal gram, black gram, soyabean and their by-products form an important group of protein rich concentrates. Their utility as animal feed is limited as most of these are required for human consumption.

Oilseed cakes (the residue after removing the seeds) constitute the principle high protein concentrate feeds available for feeding cattle. Their protein content varies from 25 to 50 per cent and they also have reasonably high energy content.

They can be of expeller type or solvent extracted type based on the method of processing. The expeller cakes have more energy as they retain some oil. The solvent extracted types are richer in protein and contain minimum amount of oil (less than 1%). The most popular oilseed cakes for feeding of cattle include the mustard oilcake, groundnut oilcake, cottonseed oilcake, sunflower oilcake, linseed oilcake, sesame oilcake, rapeseed oilcake and coconut oilcake. The extractions of these oilcakes are also available in the market known as Groundnut Extraction (GNE), Mustard Extraction, Deoiled Soyabean Cake, Deoiled Sunflower Cake or Sunflower Extraction. These are rich in protein but lower in energy than oilseed cakes.

Important concentrates include the following:

Grains (anaj)

Grains are rich in carbohydrates (starch) and low in fibre. They are an important source of energy. In grains, the amount of calcium is low but phosphorus and potassium is found in sufficient quantity. Grains are an important source of vitamin B-complex. Mostly wheat, jowar, bajra, barley, oats, maize and guar grains are used to feed cows. Grains should be soaked in water before feeding. Although uneconomical it will be better if they are fed after cooking.



Variety of grains for feeding of cattle in Gaushalas.

Choories

These are by-products of daal mills. These are rich in protein and minerals and fed to cattle for increasing the milk production. In India, chana choori, moong choori, moth choori, arhar choori, urad choori and masoor choori are commonly used to feed cows.

Oil cakes or khal

These are by-products of oil mills left over after extraction of oil from seeds. These are usually rich in protein and fat but calcium level is low. In North India, cotton seed cake (Binola khal) is most commonly used to feed cows. Other oil cakes used to feed cows are: groundnut cake (Moongfali ki khal), mustard cake (Sarson ki khal), til cake, linseed cake (Alsi ki khal), soyabean cake and coconut cake (Nariyal ki khal). The oil cakes should be soaked in water for some time before feeding to increase the palatability.



Oil cake or khal

Agricultural by-products

By-products of grain processing industry like bran, grain screenings, polishings and meals are also used as animal feeds. These by-products are comparatively cheaper components of concentrate mixture. These are medium in energy and protein values.

Brans are the outer coats of grains separated during processing. Rice bran and the wheat bran are the two most extensively used by products in animal feed. These brans are the rich source of minerals especially phosphorus and vitamin B complex. The rice polish is the by-product of rice milling consisting of a fine residue that accumulates during polishing of rice kernels after initial removal of hulls and bran. It is an excellent source of energy and vitamin B complex.

Wheat bran is the most used bran to feed animals. It is highly palatable and has a laxative action on intestine. The crude protein level is around 13%. Rice bran is other mostly commonly used commercial cattle feeds and its crude protein level is around 12%. It is less palatable and nutritious than wheat bran.

Non-Conventional feed sources

Keeping in view the scarcity of conventional feedstuffs, some unconventional feed

materials have been tried as cattle feeds and found useful for feeding cattle in Gaushalas. These include mango seed kernels, mahua cake, babool pods, rubber seed cake, guar meal, sun hemp seeds, soyabean bhusa and certain tree leaves and agricultural by products. These can be added to a certain level in cattle feeds during scarcity periods.

What are non-conventional feeds?

Non-conventional feeds are the by products of agriculture and they are also known as scarcity fodders and these can be added to normal feeds to some extent only. Their main advantage is that they reduce the cost of feeding, along with helping cattle to strive through scarcity period.



Wheat bran

Characteristics of non-conventional feed resources

Some non-conventional feeds cannot be fed alone. They can only be after mixing with normal feed in limited amount as some non-conventional feeds can be dangerous for cows if fed alone.

Different non-conventional feeds and fodders for feeding cattle

Sugarcane tops and leaves

These are abundantly available in the sugarcane fields and sugarcane mills during the harvesting season. The top portions of sugarcane are cut and left unused, which can be used to feed cows. These are palatable and nutritious.



Sugarcane tops and leaves for feeding cows.

Sugarcane bagasse

It is the leftover after extraction of juice from sugarcane. It is available in abundance in juice shops and sugar mills. It contains some amount of sugar, which acts as source of energy. It can be chaffed and mixed in bhoosa upto 30% and can be fed to cows after mixing. The bagasse obtained from kolhu or normal juice shops is better than that obtained from sugar mills, because of higher amount of sugar in it.



Sugarcane bagasse.

Fruit pulp

These are available in juice shops and jam/juice factories. It is highly nutritious and can be fed to cows in Gaushalas.

Vegetable waste

The crop residue of vegetable crops, peelings, leaves etc. can also be used to feed cows

in Gaushalas.

Mango, jamun and Imli seed kernels

Mango seeds are produced in abundance in India. These can be collected from juice shops, factories and pickle factories. The kernel can be ground and fed to cows after mixing with normal concentrate. Dried mango kernels and peel make a high class energy food for cattle and cakes left after the extraction of kernel oil could even substitute for wheat and maize flour in animal feed as it is a good source of many essential amino acids. It is also very rich in protein. Similarly seeds of jamun and imli can also be used to feed cows after grinding.

Mango seed kernels can be added up to 10% in normal concentrate ration of cows and imli seed can be added up to 20 % level in normal concentrate ration of cows. Imli seeds should be soaked in water for few hours prior to feeding.

Cassava waste

It is the waste left over after making sabudana from cassava roots. It can also be used to feed cows in Gaushalas.

Dry tree leaves

Dry tree leaves can also be collected from areas having dense forests and transported to the Gaushalas situated in the vicinity.

Babul (*Acacia nilotica*) pods (Babool ki faliyan)

Babul seeds separated from pods are available as babul seed chuni. These are rich in protein. They can be dried and used to feed cows after grinding and mixing with normal ration up to 15-20% level.



Babul (*Acacia nilotica*) pods along with tree leaves.

Groundnut hulls (Moongfali ka chilka)

These are available at factories making products of groundnut. These can be mixed with bhoosa and can be used to feed cows.



Groundnut hulls

Corn cobs

The cobs left after harvesting corn grains can be shredded and mixed with bhoosa to feed cows in Gaushalas.

Rice husk

The husk left after extracting rice grain can be used to feed cows in Gaushalas after mixing with bhoosa.

Different cakes (khal)

Ambadi cake, neem cake, karanj cake, mahua cake, watermelon cake and sunflower cake can be fed to cows after mixing upto 15-20% level with normal ration in Gaushalas.



Maize cobs after harvesting corn grains.

Brewery waste

The malt left after making beer from barley grains is highly nutritious and can be fed to cows after drying.

Potato peelings

Potato peeling, which is the waste of chips factories is a rich source of carbohydrate and is a highly nutritious feed for cows in Gaushalas.

Sunflower straw

Sunflower straw can also be used to feed cows in times of scarcity.

Whey and pulses water

The whey left over after making paneer from milk is highly nutritious and is a rich source of vitamins. It can be used to feed calves and cows. The water which is left over after washing rice or pulses is a rich source of carbohydrate and protein; it is available in community kitchens and gurudwaras in abundance and is an excellent feed for cows.

Tree leaves

The leaves of trees like Peepal (*Ficus religiosa*), Bargad/banyan tree (*Ficus benghalensis*), neem (*Azadirachta indica*), sheesam (*Dalbergia sissoo*), khejri (*Prosopis cineraria*), subabul (*Leucaena leucocephala*), bamboo (*Tribe Olyreae*), jharberi (*Ziziphus mauritiana*), ardu (*Ailanthus excelsa*), gular/Indian fig tree (*Ficus racemosa*), banana (*Musa sapientum*), pilkhan (*Ficus virens*) and khajoor/date palm (*Arecaceae*) can be used to feed cows in times of scarcity.

Forage Preservation

The stalks of cereal crops after separating from the grains may be stored for use in periods of fodder scarcity. The fodder with tender stems are dried and then preserved as hay. The green fodder with thick stem and rich in carbohydrates, for example maize, jowar etc. can be preserved in the form of silage and can be used as moist succulent fodder during scarcity. In area where the water level rises every rainy season or during inundation e.g. East Bengal, artificial mounds can be created by the excavation of tanks.

Why preservation of green fodder is essential?

The agriculture system of India is monsoon based. Green fodder is abundantly available only during a limited period during monsoons and the rest of the year remains a lean period. So in order to provide green fodder during the rest of the year we have to preserve the green fodder during monsoon, when it grows in abundance.

Methods of green fodder preservation

Hay Making

Hay refers to the grasses or green fodders that are harvested, dried and contain about 85-90% dry matter and 10-15% moisture. It is green in colour, leafy and free from mustiness.

The principle of hay making is to dry the water content of the plant in sun light so that all activities of plant cells and microbes stop and the fodder can be preserved without any loss of nutritive value.

Crops like lucerne, cowpea, berseem, oats and grasses are best suitable for hay making

as they are leafier and have tender stems. However, hay of thick stem crops like jowar and bajra, etc. can also be made after chaffing them into small pieces.

Qualities of good hay

- It should be leafy as leaves are rich in protein, vitamins and minerals.
- The crop used for hay making should be cut at 15% flowering stage or near maturity when it has the maximum nutrients.
- It should retain its green colour as much as possible.
- The crop should be tender, soft and pliable.
- It should be free from weeds, moulds and dust.
- The moisture content of hay should not exceed 15% as, if there is high moisture in the hay. Heat will be produced due to fermentation while in storage and the hay can catch fire.

Types of hay

Legume hay: Made from leguminous crop like Rizka (lucerne), Lobia (Cow Pea) and it is high in protein.

Non Legume hay: Made from non-leguminous crops like Jayi (oats) and other grasses.

Mixed hay: Made from both leguminous and non-leguminous crops.

Method of hay making

One method is to cut the crop in the pre flowering stage and spread the crop in field, floor or roofs in loose and small bundles. These bundles should be turned 2-3 times day till it dries completely (sun drying method). The bundles of crop can also be hung on fences, walls, etc. for drying. We should keep in mind that there should be minimum loss of leaves during turning or handling the crop while drying.

Another method is to chaff the crop into small pieces with the help of a chaff cutter and spread it in a thin layer not exceeding more than 6 inch in thickness on the roof or floor over a plastic sheet or concrete floor and then turn or stir the mass 2-3 times a day until dried. This method is suitable for crops like jowar, bajra, maize etc.

The advantage of hay making is that it is the easiest, economical and most suitable method for conserving green fodder in Gaushalas where we get ample sunlight and an open area.

Silage making

Silage is a fermented product resulting from the fermentation of green fodder crops in a controlled environment (absence of oxygen). This is method of green fodder preservation and can be easily employed in Gaushalas.

For silage making, green fodder crops with thick stems and rich in carbohydrate content like Jowar, Bajra and Maize are most suitable. For silage making the crop should have 65-70% water and 30-35% dry matter in it. The crop is chopped into pieces before making silage with the help of a chaff cutter.

Principle of silage making

The main principle behind silage making is the anaerobic fermentation of the crop in the absence of air. When chopped green crop is stored in a compact mass, anaerobic fermentation leads to production of organic acids like lactic acid, propionic acid, acetic acid, butyric acid and formic acid by the bacteria. These acids preserve the green fodder and prevent it from decomposing.

Method of silage making

First the crop is cut when it is at 20-25% flowering stage. The crop should be cut when its grains are in the milky stage (during the milky stage the plants are still greenish in colour; the bottoms of the stems turn yellow, and the lower leaves of grains are yellow or dried out). A pit/trench already been made of suitable size according to the amount of silage required in Gaushalas. The pit can be made of bricks and concrete or if it is kept kutcha then a plastic sheet is placed on the lower surface to prevent seepage.

The crop is then chopped into small pieces with the help of a chaff cutter. For the ensilage of very succulent or immature feed stuff, it is recommended to put a mixture of dry stuff like hay, straw or stalks of wheat, jowar or bajra alternatively to the green fodder.

If the moisture content of the crop is too high, then the crop can be dried a little and if the moisture content is too low then little jaggery water can be added.

The pit is filled layer by layer, a layer of chopped crop is placed in the pit then it is pressed by 2-3 people by their legs and in big silo pits by a tractor. This is done to expel maximum possible air out of pit.

Finally, after filling, the silo pit is made airtight by covering with mud or a plastic sheet. In 65-70 days the silage becomes ready to be fed to animals and the pit is opened partially from a side. Never feed silage to calves below 6 months of age. The silage on which fungus has grown should never be fed to animals. Silage can be made in any kind of weather and the organic acids produced are similar to those produced in the rumen of cows, so can be utilized in the same manner.

Another easy method of silage making is by making it in propylene bags. The green fodder crop is chopped and filled in these bags. 1-2 people stand on the bag to press the mass with their feet. The bag is filled layer by layer and these layers are pressed simultaneously. When the bag is completely filled, it is closed and stored at a proper place and opened after 65-70 days for feeding. The advantage of making silage in these bags is that they are convenient to handle and can be moved from one place to another and stored. The capacity of one bag is around 500 kg.

Characteristics of good silage

- Good quality silage is green or golden-brown coloured having pleasant vinegar type smell, and pH in between 3.5-4.2.
- It should be palatable and slightly laxative.
- Although there is a little loss of carotene during silage making but no loss of leaves should take place
- Leguminous crops like berseem, lucerne, cow pea, etc. are not good for silage making.

- The silo pit or bag should be closed again after extracting required silage from it.

Salt Supplements

Salt helps in maintaining digestion and keeping the cows in healthy condition. On not getting sufficient salt and a little sulphur in the feed, the cow will pick up dry bones and other unwanted things. The tendency to lick earth or drink the urine of other cows will increase.

Salt licks

Minerals are an essential component of animal nutritional requirement. Cattle in Gaushalas may face various mineral deficiencies as our feeds and fodders are deficient in these minerals. Mineral deficiencies are manifested by abnormal licking or chewing of wood, soil and sweat of other animals. It is also accompanied by a decline in growth rate and milk production of animals.

Stones of rock salt should always be kept in the manger so that cow can lick them, etc. These salt licks prevent mineral deficiencies in cattle and decrease summer stress.

Common salt (sodium chloride) is an essential constituent of animal diet. Because many Indian pastures are deficient in sodium some form of supplementation is necessary. Lactating cows requires a daily minimum of 20 gm of sodium chloride while dry cattle requires a minimum of 10 gm. The reason for the high requirement of sodium in cattle is that it is routinely expelled from the body in milk, urine, faeces, sweat and saliva. Therefore, sodium should be made available every day and at all times round the year.

One most common symptom indicating sodium deficiency includes suppression of appetite.

The salt requirement of cows significantly increases when they are producing milk, as large amounts of sodium is excreted in milk. Young calves in rapid growth need sodium for new tissue formation for their mothers's milk. For adult cows, one block of salt lick is sufficient for 10 cows.

All blocks contain Sodium chloride. Mentioned below are the blocks of different colours containing different minerals:

- White salt block contains nothing more than NaCl or table salt.
- Yellow salt block contains sulphur.
- Red salt block contains iron and iodine.
- Blue salt block contains cobalt and iodine.
- Brown salt block contains cobalt, iodine, iron, zinc, copper, molybdenum, and



Picture of salt licks for animals that may be hung in the shed or may be placed in the manger for the cattle to lick.

manganese. Some brown blocks may also contain potassium and magnesium.

- Black blocks contain everything found in the brown blocks plus selenium

Some companies which supply salt bricks

- i) Leon Health Care Services; 1061 New Street, Yelahanka, Karnataka- 60064, India
Mobile: +91-8904022237
- ii) S. R. Industry (HO.); 121, First Floor, Trade Square, Opp. Rokadiya Hanuman Mandir, Khokhara Circle, Khokhara, Ahmedabad- 380008, Gujarat, INDIA., Tel: +91-9913608677 Cell: +91-9377544466
- iii) Saltech Formulations Pvt. Ltd. 404, Khushi Avenue, G- 1, Sector - 29, Gandhinagar 382030 (Gujarat) India, Tel.: +91 - 79-2324096 7 Mobile: + 91 9924107991.

Feeding Practices for Cattle in Gaushalas

Good feeding is necessary for maintaining health, production and welfare of cattle in Gaushalas.

Different combinations of available feeds and fodders can be made for meeting the nutrient requirements. Find the cheapest combination that meets all the animal requirements and at the same time, is wholesome and palatable. In the computation of ration for cattle, the first step is to ascertain the total requirement of cattle in terms of Dry Matter (DM), Digestible Crude Protein (DCP) and energy (TDN) for 24 hours from the cattle nutrient requirement (as per ICAR feeding standards).

The total requirement is arrived at by adding requirements like milk produced, growth, etc. to that required for maintenance. Cows need extra nutrients during the last quarter of gestation for the growth of the foetus and building body reserves for the next lactation.

Requirement of dry matter (DM)

The dry matter requirement depends on the body weight of the animal. Indigenous cows generally require 2.0 to 2.5 per cent dry matter of their body weight. All the animal's nutrient requirements with respect to carbohydrates, proteins, fats, minerals and vitamins shall be met within the dry matter requirement of animals.

In Gaushalas it should be kept in mind, that two-third of the dry matter shall be supplied through feeding of roughages (both dry and green fodder) and the rest one-third shall come from feeding of concentrates.

Two-third of the roughages (or three-fourth if sufficient green fodder is available) should be supplied through the feeding of green roughages and the remaining one-third through dry roughages. In general, the dry matter from roughages should not exceed 2 per cent of the cow's live weight nor should it be less than 1 per cent.

The requirement of DCP and TDN are obtained from feeding dry fodder, green fodder and concentrate separately for different physiological needs of the different categories of animals. It depends on whether the animal is just to maintain itself or is in milk production or in advance stage of pregnancy.

Thumb rule of feeding cattle

Knowledge of the body weight of the animal is essential for the computation of ration

for cattle. This is the main reason for housing animals of the same size and stage of life together.

The routine feeding of cattle can be simplified by following a thumb rule of feeding based on practical experience.

Straw and concentrate forms the basis of feeding by thumb rule method as these are the principle feed ingredients available for feeding of cattle in most parts of India and the availability of green fodder is limited.

The amount of concentrate mixture, straw and green fodder that fulfil daily requirement of cattle by thumb rule are given below:

Sr. No.	Category of Gaushala animal	Green fodder (kg/day)	Dry fodder (kg/day)	Concentrate mixture (kg/day)
1	Young calves (up to 6 months)	5.0	1.0	0.5-1.0
2	Old calves (6-12 months)	10.0	2.0	1.0-1.5
3	Heifers	15-20	2.0-3.0	2.0-3.0
4	Dry and pregnant cows	20-25	4.0-5.0	2.0-3.0
5	Milking cows (Indigenous breed)	20-30	4.0	2.0-3.0
6	Milking cows (Crossbred breed)	30-40	4.0-5.0	5.0-6.0
7	Bullocks	30-40	4.0-5.0	4.0-5.0
8	Breeding bulls	40-50	4.0-5.0	4.0-5.0
9	Old cows and bullocks	20-25	2.0-3.0	1.0-2.0
10	Old bulls	30-40	2.0-3.0	2.0-3.0

It is of utmost importance that the various feed stuff at Gaushala should be kept clean and tidy. Presence of dust in feed results in bloat in cows.

From the above table, minimum daily green fodder, dry fodder and concentrate requirement for 100 cattle (consisting of 30 calves, 5 dry cows, 5 milking cows, 10 young bullocks and 50 adult cows and bullocks) is calculated below:

Sr. No.	Category of Gaushala animal	Number of animals	Green fodder (kg/day)	Dry fodder (kg/day)	Concentrate mixture (kg/day)
1	Young calves (up to 6 months)	15	75	15	7.5
2	Old calves (6-12 months)	15	150	30	15
3	Dry cows	5	100	20	10
4	Milking cows	5	100	20	10
5	Bullocks	10	300	40	40
6	Adult cows and bullocks	50	1000	100	50
	TOTAL	100	1725	225	132.5

Monthly requirement for 100 cows can be calculated by multiplying with a factor of 30. Minimum of 550 Quintal green fodder (1 Quintal=100Kg), 70 Quintal dry fodder and 40 Quintal concentrate is required for their balanced feeding.

Formulation of Total Mixed Ration (TMR)

The ration should preferably be offered in the form of Total Mixed Ration (TMR). In TMR mix concentrate mixture with wheat straw and green fodders before feeding. One third of concentrate is mixed with two third of roughage. The roughage inturn should consist of one third green fodder and two third of dry fodder. This will result in higher nutrient utilization and higher animal productivity.

The composition of an ideal concentrate mixture per quintal is given below.

Concentrate ingredient	Parts (in kg)
Maize grains	33
Groundnut cake (expeller)	21
Mustard cake (expeller)	12
Wheat bran	20
Deoiled rice polish	11
Mineral mixture	02
Common salt	01

Along with the concentrate mixture the ration shall also include dry fodder such as wheat straw, paddy straw etc. The green fodder added to TMR shall include both leguminous and non-leguminous seasonal fodders.

Lactating cows should be provided with 400-gram concentrate mixture for every one kg milk produced along with 1.5 kilogram of additional concentrate mixture for meeting the requirements of maintenance.

Practices for feeding of new-born calves and growing calves

Feeding of calves (0 to 4 days)

Although the stomach of cow is four-chambered, only one chamber is present in calves at birth. The other three chambers of stomach develop later by the age of 3-6 months. Therefore, atearly age, a calf cannot digest fibrous food like bhoosa and remains dependent on mother's milk.

The first milk of the mother is known as colostrum and is a rich source of proteins, minerals, vitamins and antibodies. It has a laxative action on the intestine of the calf, which helps it to pass the first faeces (dung) called meconium. So it is important to feed colostrum during the first week of life. It also helps in developing the immune system.

The calf should be fed colostrum (khees) half an hour after birth. The calf can be fed 2.5 to 3 litres of colostrum in two or three divided doses (@1/10 of the body weight of the calf) in a day during the first few days of life.

If colostrum is not available, then a suitable substitute should be given to the calf within 24 hours of birth.

The young calf showed not be separated from the mother and allowed to suckle from her, ensuring that the calf is getting the required quantity of milk. (10% of body weight)

Calves must have free access to drinking water sufficient for their needs. Troughs should

be cleaned and maintained regularly. Water should be potable and free of foul odours.

Feeding of calves (5 days to 4 months)

After colostrum feeding the calves should be fed as per following feeding schedule. (* Figure in brackets show the total requirement of milk in kg)

Age of calf	Milk (kg/day)
6-30 days	3.50
31-60 days	2.50
61-90 days	1.50
91-120 days	1.00

A special type of concentrate containing 16-20% crude protein known as "calf starter" is fed to calves at 15 days of age to promote development of rumen. Initially, 125-gram calf starter should be fed per day and the amount can be increased up to 500 grams per day up to the end of third month. Along with this, a small amount of good quality green fodder should also be fed.

Ingredients of calf starters 1

Ingredient	Parts
Crushed barley	50
Ground nut cake	30
Wheat bran	08
Dried skimmed milk	10
Mineral mixture	02

Ingredients of calf starters 2

Ingredient	Parts
Crushed maize	35
Cotton seed cake	10
Wheat bran	35
Crushed barley	17
Mineral mixture	02
Salt	01

Feeding of calves (4 months to 6 months)

At this age, a calf should be fed about 1-2 kg bhoosa, 2 kg green fodder and around 1 kg of concentrate mixture daily. The amount of milk fed is reduced to negligible at this stage.

Feeding of calves (6 months to 1 year)

At this stage, rumen of the calves develops completely and they can now digest fibrous food easily. A calf at this age can consume 2-3 kg bhoosa, 8-10 kg green fodder and 1-1.5 kg concentrate mixture daily. After 1 year of age male and female calves should be separated and housed separately.

Feeding of heifers

The female animals between 1 year of age to first calving are known as heifers. It is a very crucial age for a cow, as feeding at this stage will determine its future and green fodder is essential.

A pregnant heifer may consume 3-4 kg bhoosa, 15-20 green fodder and 1-1.5 kg concentrate. Along with this maintenance ration, 1 kg of concentrate mixture is fed daily in the last trimester of pregnancy to support the foetal growth.

Feeding of cows

A cow should be fed 5-6 kg bhoosa and 10-15 kg green fodder daily. To a dry cow, 1-1.5 kg concentrate mixture is given as maintenance ration for maintaining body condition.

To lactating or milking cows along with this maintenance ration, 1 kg of extra concentrate mixture is provided for each 2.5 litre of milk production.

Feeding of cows just after calving

Warm drinking water should be given to the cow just after calving. A concentrate mixture containing 1 kg wheat bran, 1.0-1.5 kg cooked grains, 0.5 kg gur and 20-25 gm salt should be given to the cow after calving. This concentrate mixture should be continued up to 3-4 days after calving and then gradually normal ration should be introduced in the diet of the cow.

Composition of concentrate mixture 1

Ingredients	Parts
Crushed grains (wheat, bajra, barley, maize etc.)	30
Wheat bran	30
Choori (chana choori, moong choori, arhar choori, urad choori etc.)	20
Oil cakes/khal (cotton seed cake, mustard cake, groundnut cake, til cake, etc.)	17
Mineral mixture	02
Salt	01

Composition of concentrate mixture 2

Ingredients	Parts
Crushed grains (wheat, bajra, barley, maize etc.)	30
Wheat bran	30

Oil cakes/khal (cotton seed cake, mustard cake, groundnut cake, til cake, etc.)	30
Mollases	06
Mineral mixture	02
Salt	01

Practices for feeding of heifers and cows

- Ensure that all feed components used in the ration are of good quality and free of spoilage.
- Where a change of feed is required it should be introduced gradually, e.g. over a period of 7 - 10 days. Abrupt changes in diet should be avoided.
- While increasing concentrates also, it should be done gradually (0.5 to 0.7 kg per head per day) according to appetite of the animal.
- Provide fresh feed to the cows daily, along with maintaining a consistent feeding schedule. Provide adequate feed manger access time to animals. Also ensure continuous access of feed by regular presence of feed in the feed manger.
- It must also be ensured that feed surfaces of manger are smooth and not more than 4-6 inches higher than the standing area. Feed served at ground level is better than at elevated levels.
- Provide adequate linear feeding space (minimum of 60 cm per cow) to ensure that dominant cows cannot restrict access to feeding areas of submissive cows.
- The feeding activity in cows is enhanced and in majority of cases occurs at the time of fresh feed delivery or when cows return from milking.

Feeding of sick animals

Sick animals may be offered lush green fodders and they should be provided water throughout the day. Small amount of balanced concentrate mixture may also be offered. Under diarrheal condition sufficient amount of electrolytes (salt and sugar) may be provided through water.

Key Points to Remember while Feeding in Gaushalas

1. Cattle in Gaushalas should be provided balanced ration containing all nutrients in adequate quantity to fulfil all nutrient requirements throughout the day. Grains are a source of carbohydrates; oil cakes are a source of protein and fat; brans and choories are source of minerals and protein. So these should not be fed singularly, rather all grains, oil cakes, brans and choories should be included in the ration in proper proportion as discussed before to make it palatable and nutritious.
2. Cows should be fed at least twice a day and there should be a gap of 6-8 hours between two meals.
3. An adult unit of cattle usually consumes 4-6 kg of dry fodder in a day and young calf consumes 3 kg of dry fodder in a day. However, in case of sand adulterated

bhoosa even the small amount of bhoosa may weigh more and consumption may be lower. Therefore, it should be ensured that dry fodder for cattle should be free from dust, sand and other adulterants. Avoid feeding rotten, wet bhoosa or bhoosa, which contains high amounts of sand in it as it leads to digestive upsets.

4. Try to provide as much green fodder to the cows as it is very essential for them. Green fodder is a rich source of vitamin A, which is essential for the foetus and reproductive functions and also have a cooling effect in summer. In absence of green fodder, the amount of concentrate and bhoosa should be increased and vitamin A should be supplemented in concentrate fed to them by adding vitamin supplements.
5. It is a general practice to mix bhoosa with green fodder, concentrate and leftover buttermilk. This is known as "Saani making". It is a good practice to feed cows this concentrate mixture rather than feeding all ingredients separately.
6. Grains should be fed only after grinding and it is better to soak grains, oil cakes, brans, choori etc. in water for some time prior to feeding to the cows in order to increase the palatability and digestibility.
7. Bhoosa, kadbi or green fodder should be fed after chaffing to increase dry matter intake and digestibility of feed.
8. Excessive feeding of leguminous green like berseem, lucerne, guar etc. can lead to frothy bloat and sometimes become cause of death of cows. So it is better to feed it after mixing some amount of dry bhoosa in it. If condition of bloat occurs 500-1000 ml of sweet oil like mustard oil or 100 ml of herbal preparation like Tyril or Bloatosil should be administered as a first aid measure.
9. The jowar which is drought affected contains hydrogen cyanide (HCN) and is fatal for animals so such type of green jowar should not be fed to cows. Jowar should be cut and fed after 1-2 irrigation and after attaining a height of at least 60 cm.
10. Excessive feeding of grains can lead to ruminal acidosis, which leads to death of cows. Stray cows commonly become victims of this as they feed on leftover poories, boiled rice etc. after religious ceremonies or other functions, which leads to rapid development of ruminal acidosis and death of cows. In this condition, withhold the water for 6-8 hours and give oral sodium bicarbonate or Buff zone powder as first aid measure and call the veterinarian immediately for fluid therapy and necessary treatment.
11. Excessive feeding of protein-rich substances like daal, soyabean etc. can lead to ruminal alkalosis and leads to death of the animal. In this condition, 500 ml of vinegar should be fed to the cow as first aid measure and call the vet immediately for treatment.
12. Groundnut cakes and concentrate ingredients sometimes have aflatoxins due to fungal growth due to storage in damp wet places which is dangerous for animals. All feed ingredients and concentrate mixture should be stored in dry well covered places
13. Excessive feeding of rice straw, especially in winters, leads to Degnala disease in which dry gangrene of extremities of body like ears, tail, etc. occurs.

14. Feeding of urea-treated straw to cows

A simplified procedure where available dry fodder materials (like thresher chaffed wheat/rice straw) should be used for feeding of cattle in Gaushala post urea treatment. 8% urea solution (4.0 kg urea + 50 litres water) is sprayed on 100 kg wheat/rice straw and properly mixed with it. Treated straw is stacked and covered with more straw over it.

The stack of treated straw should be opened after a minimum of 7 days, except during winter when its need prolonged treatment time of about 2 weeks.

The urea treated straw component of the diet may be offered 2-3 times a day to ensure at least some refusals (5-10% of straw offered) next morning. The amount of supplements fed to lactating cows may be reduced to 25% as compared to untreated straw fed cows. However, a minimum of 1-2 kg green foliage or leaves should also be offered daily to avert vitamin A deficiency.

15. Drinking Water

Drinking-water in Gaushalas should also be given due attention. Ample supply of clean water is as absolutely necessary as good and sufficient food. If they do not get pure water, at least four times a day, animals will drink whatever comes in their way, which will affect their health.



Visitors should be encouraged to feed green fodder instead of puris/chappatis/daal etc. that may upset the digestion.

11 | VETERINARY MEDICINE IN GAUSHALA

1. Infrastructure

1.1 Establishment of veterinary care unit

Poor housing and management is one of the greatest shortcoming observed in Gaushalas and has a substantially negative impact on both health and well being of the animals. The Gaushalas must provide an environment that is conducive for maintaining animal health. Facilities must be appropriate for the cow and its progeny. Proper veterinary care is to be provided during the expected length of stay in order to ensure optimum health and well being of the animals. It is also important to prevent disease transmission. Effective management requires a proper plan for intentionally managing each animal in the Gaushalas.

The basic infrastructure includes a dispensary with

- a. Chute/ trevis/crate
- b. Sand bed 20 cm thick layer of sand in a pit at ground level
- c. 8' X 8' foam /coir mattress padded GI pipe (2 inches diameter) metal bed/table or foot operated hydraulic table,
- d. Animal lifting device/Forklift
- e. Slings or hiplifter
- f. Tube inflation devices
- g. Ropes
- h. X-ray unit: fixed 1000 mA and portable 300 mA
- i. Ultrasound unit with Portable ultrasound
- j. Minor OT for contaminated operations
- k. Major OT for sterile surgery
- l. Large animal operation table
- m. Electrocautry
- n. Cryo-surgery
- o. Electric Hoist
- p. Auto-clave and Hot air oven
- q. Centrifuge machine and Hematocrit centrifuge
- r. Microscope

- s. Refrigerator
- t. General Surgical Instrument Kit
- u. Laparoscope
- v. Dystocia set
- w. Fetotomy kit

1.2 Veterinary dispensary

Veterinary dispensary is an important facility for effective health care services of animals in any Gaushala. A standard veterinary dispensary should have following minimum components:

- a) Veterinary consultant room with sufficient seating arrangement and proper ventilation and adequate light source.
- b) Clean and hygienic consulting room with good environment.
- c) Clean water supply facility.
- d) Covered space with animal examination table and proper Crate /Trevis for animal immobilization.
- e) Clinical examination equipments viz. thermometer, stethoscope, probang, otoscope, ophthalmoscope, examination gloves, lubricant etc
- f) Weighing balance.
- g) Small operating room for wound dressing, abscess drainage and dental work etc.
- h) Routine medicines should be kept alphabetically in glass almirah.
- i) Record keeping facility with detailed case history sheet.
- j) There must be a written guideline for dealing with infectious cases.
- k) Display system for vaccination and deworming schedule for large animals.
- l) Prescription slip and test advice slip. Name plate for doctors on duty.
- m) Few standard text books with drug index and electronic access facility.
- n) Refrigerator, LN₂ tank, autoclave
- o) Disposal of cadavers with proper hygiene and measures.

1.3 Animal examination room / hall / shelter with service crate

A provision of animal examination room/hall must exist adjacent to Veterinary dispensary. The size of room/hall should be atleast 30 feet x 30 feet. The floor should be made of concrete that could be easily cleaned. The space should be well ventilated with proper lighting and exhaust fan. The cattle crush should be installed in the room; it should also contain a large size table.

1.4 Veterinary diagnostic laboratory

- Veterinary diagnostic laboratory is required to perform rapid and accurate routine clinical pathology, bacteriology, parasitological and toxicological tests.
- The diagnostic laboratory should have a well ventilated room, sufficient light source, work table and laboratory furniture that can be easily sanitized/disinfected with regular water supply, electricity and waste disposal facility. The diagnostic clinic shall have rooms/areas where animals can be handled with minimal stress to them.
- There should be sufficient number of sample collection tubes and storage vials for processing of bio-samples.
- Routine urine analysis and blood smear examination facility must be available.
- Proper marking and labeling of stain, reagents, chemicals and diagnostic kits are essential.
- Veterinary diagnostic laboratory should have following minimum equipments: Binocular microscope, Incubators, Hot air oven, Autoclave, Water bath, biosafety cabinet, Centrifuge machines, PCR machine, Electrophoresis apparatus, serum biochemistry analyzer, automated hematology analyzer, Glucometre, Analytical Balance, Computer with Internet connectivity and Printer, Refrigerator, Deep freezer, pH Metre, Telephone and fax facilities.
- Diagnostic laboratory attached to a Veterinary dispensary of Gaushala should have facilities to analyze: Urine (qualitative: pH, albumin, glucose, bile pigment, sediment), Fecal sample (Parasitic and protozoan ova/cyst), Skin scrapings (mange or mites), Milk sample (for clinical and sub-clinical mastitis by CMT), Blood (Protozoa, microfilaria), complete blood count, PCV and CSF.
- Manpower set up: One registered veterinary practitioner with knowledge of Veterinary Pathology, one laboratory technician, two laboratory attendants, one animal attendant, and one sweeper.

1.5 Diagnostic imaging room

The diagnosing imaging room size should be 20 feet x 20 feet. There should be a provision of power supply of 100 kw for high frequency of X-ray machines. The walls and door of the room should be constructed as per the guidelines of AERB to minimize the radiation hazards.

1.6 Isolation ward

1.6.1 Isolation shed for large animals

Animals suffering from infectious disease must be segregated soon from the rest of the herd. Loose boxes of about 150 sq. feet are very suitable for this purpose. They should be situated at some distance from the other barns and should never be higher than the other sheds. Every isolation box should be self contained and should have separate connection to the drainage disposal system.

The entire shed should be surrounded by a boundary wall of 5 inches height from three side and manger etc., on one side.

The inside floor of the barn should be of some impervious material which can be easily kept clean and dry and is not slippery. Paving with bricks can also serve the purpose. Grooved cement concrete floor is still better. The surface of the cowshed should be laid with a gradient of 1 inches to 1.14 inches from manger to excreta channel. An overall floor space of 65 to 70 sq. feet per adult cow should be satisfactory.

A height of 8 feet at the sides and 15 feet at the ridge will be sufficient to give the necessary air space to the cows.

1.6.2 Foot bath

Footbath is important for protecting the animals from contagious disease. The foot bath is a tank measuring 6 metre x 3 metre at the bottom 12 metre x 4 metre on top and 0.3 metre deep and constructed near entrance. The tank is filled with a germicidal solution.

The floor of the baths should be studded with hard stones set into the concrete to provide grip, and to splay the hoofs apart to loosen any mud between them.

The footbaths should be arranged in a cascade, so that clean water added continuously at the end near the dip, overflows from each bath into the one before it, with an overflow outlet to the side near the collecting pen. Floor level outlet pipes from each bath can be opened for cleaning.

1.7 Quarantine ward

A quarantine area should be created to achieve the following objectives:

- Provide an air space, water source, and feed source separate from the rest of the livestock.
- Prevent direct contact with the rest of the livestock.
- Provide a clean, dry, comfortable resting space for the animal(s).
- Provide transition to a new ration.
- Provide adequate restraint facilities for examinations and administration of treatments.
- Allow equipment storage in that area (e.g., shovels, halters, buckets, etc.) for use only in the isolation area.
- Prevent the movement of equipment and manure from the isolation area to other locations with livestock.
- Ensure workers clean hands and boots and change clothes before going to other areas.

1.8 Medicine store

Veterinary medical store should be situated near the veterinary dispensary. The medical store should have all kinds of veterinary medicines (routine and emergency) including vaccines, fluids and surgical items. Medicines may be arranged alphabetically or medicines used according to body system affection.

The following items should be kept in an ideal medicine store:

- a) Vaccines
- b) Emergency medicines (Dexamethasone, hemostate, antihistaminic, antidotes of poisons etc)
- c) Antibiotics
- d) Fluids and plasma extender
- e) Surgical items

1.9 General health examination kit:

Apron, gloves, face mask, thermometer and Infra Red Thermometer, stethoscope, mouth gag, probang, percussion hammer and pleximetre, trocar and canula, teat siphon, rumen puncture needle and rumen fluid collection tube, scissors and knife, forceps, blade with scalpel, syringe, needle, bandage material, cotton, slides-cover slip, sample collection tubes for fecal-milk-urine-blood, torch, etc.

Proper collection, preservation and dispatch of samples play utmost role in diagnosis of diseases. Samples sent to the laboratory for analysis must be properly sealed and sealed bottle should again be packed properly with proper identification markings in wooden or thermocol box having enough packing material (with ice if needed) so as to check damage during transit. The parcel should contain label showing the description of the contents and authorized seals. Alcohol and common salt are the routinely used preservatives for biological samples. Blood samples can be collected with commercially available anticoagulant coated tubes. The following are the minimum quantities of the specimen to be sent for laboratory examination:

S.No.	Sample	Minimum Quantity
1.	Blood/Serum	EDTA coated vials / serum collection tubes (around 5 ml)
2.	Fecal	1 or 2 sterile fecal swabs
3.	Urine	All available
4.	Stomach content:	0.5 to 1 Kg
5.	Liver, Kidney	0.5 to 1 Kg
6.	Hair	5 to 10 g
7.	Fat	200 g

1.10 Post mortem kit:

Apron, gloves, face mask, knife, scissor, scalpel with blade, axe, specimen collection bottle, formalin(10%), slides with cover slip, specimen marker, gum boot, etc.

1.11 Essential and emergency medicines

1.11.1 Dressing Material

Povidone iodine, hydrogen peroxide, turpentine oil, Magnesium Sulphate, Glycerine, Potassium Permanganate, Spirit, Surgical absorbent Cotton, Cotton Gauge Bandage 6 inches and 4 inches, Flyrepellant, Herbal Skin Ointment and Spray, Acriflavine Powder,

Tincture Ferriperchloride, Zinc, Copper, FerriSulphate, DMSO.

1.11.2 Emergency Drugs

Ethamsylate Inj., Doxapram Hcl, Atropine Sulphate, Dexamethasone/Betamethasone/prednisolone/ Hydrocortisone, Nikethamide, Deriphyllin, Mannitol, PAM, BAL, 1% Alkaline Methylene Blue, Oxygen Cylinder, ET Tubes, Butler's Gag, Cardiac Defibrillator

1.11.3 Common Drugs

Painkillers/NSAIDs- Tolfenamic acid, Nimesulide, Meloxicam, Ketoprofen, Piroxicam, Phenyl butazone and Salicylic acid, Flunixin meglumine.

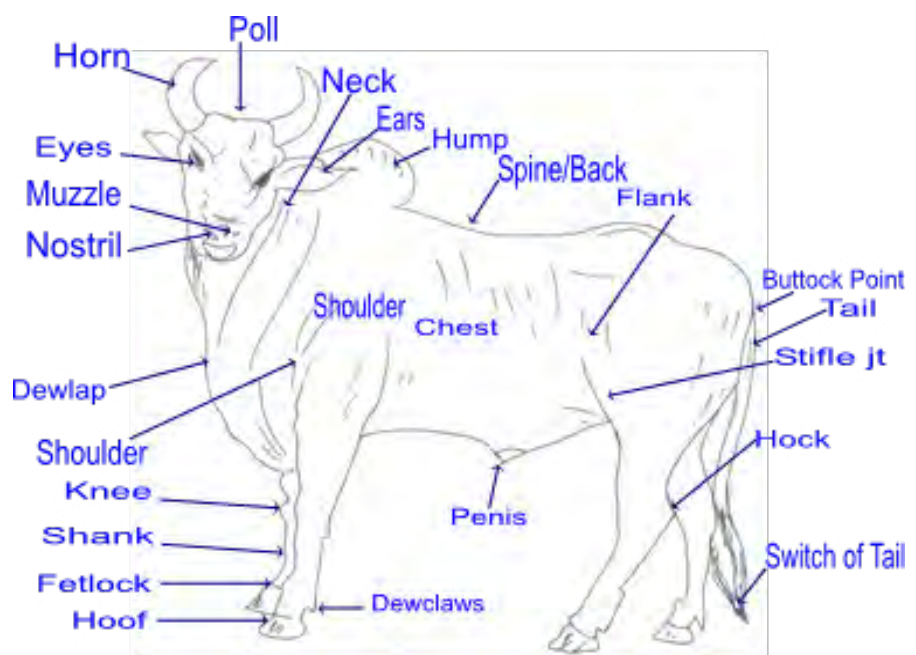
2. Animal Health Management

The goal of animal health management is to ensure the optimal care and well-being of dairy cattle and to reduce losses in productivity caused by disease and management errors. The structure of health management programs is unique to each farm but is typically keyed to the scheduled veterinary herd visits that combine routine reproductive examinations, review of selected herd performance records, and decisions and actions related to specific herd management issues.

Animal health management poses one of the greatest challenges for veterinarians in the livestock and in particular to the ganshalas. The aim of managing animal health is to minimize the negative effects of animal diseases on animal production and welfare, trade in livestock and livestock



Body Points of the Cow



Body Points of the Bull / Bullock

products, and human health. It involves preventing outbreaks of epidemic diseases and managing endemic diseases in cost-effective ways that minimize their impact on production, trade, livelihoods and human health and prevent their spread to areas where they are not endemic. The ability of animal health service providers in both the public and private sector to effectively manage animal health depends on knowledge of the diseases involved and access to information and tools as required. This chapter provides broad concepts and principles of some of the tools that are available for animal health management.

2.1 Preventive medicine

2.1.1 Animal Health Card and record keeping

Maximum animals in any Gaushala are stray, unwanted, homeless and the animals surrendered by owners. Hence, their identification and health status remain lacking. For effective health care service, maintenance of veterinary medical record is very essential. Although, the past records of the stray animals are completely unknown, however, some records can be obtained for those animals which are left by owners to the Gaushala. Gaushala must maintain the documents related to veterinary health care rendered to each animal. Records include date of entry of animal to Gaushala, source, identification information, results of all diagnostic tests for screening of diseases, history of mastitis, reproductive abnormalities, vaccination status, deworming status, treatments (including medications) etc. Records of each individual animal can be maintained in following two forms:

- **Animal health card (written form):** The animal health card must include the records like date of entry to Gaushala, species, breed, age, sex, date of various vaccinations, date of deworming, disease record if any and treatment history, results of laboratory investigation, date of major surgery and finally overall estimated cost of health care etc. A prototype of a standard animal health card is detailed below.
- **Computerized data recording system:** A software based data storage system where all the data mentioned in animal health card and past history, if any, can be maintained in computer and the data can be retrieved any time.

ANIMAL HEALTH CARD (Name of the Gaushala:-----)				
Species	Breed	Date of entry to Gaushala	Sex	Brand No
Date	Clinical observations	Tentative diagnosis	Treatment	
Deworming	Date	Name of dewormer	Date	Name of dewormer
Vaccination	FMD vaccination	HS vaccination	BQ vaccination	Brucella vaccination

Others/Investigations				
Date	Investigation of bio-samples	Result		
Date of major surgery, if any				
Cost of treatment				

2.1.2 Vaccination against common infectious diseases

Name of Disease	Age at first dose	Subsequent dose	Remark
Foot and Mouth Disease (FMD)	4 months and above	Six monthly (Preferable Feb-March and Aug-Sept.)	Before vaccination, deworming should be done
Haemorrhagic Septicaemia (HS)	6 months and above	Once in a year in endemic areas	
Black Quarter (BQ)	6 months and above	Once in a year in endemic areas	
Brucellosis	4-8 months of age (Only female calves)	Once in a lifetime	
Rabies (Post bite therapy only)	Immediately after suspected bite.	0, 7 th , 14 th , 28 th and 90 th (optional) days after first dose.	

2.1.3 Vaccination Calendar

Month	Name of Disease	Age	M/F	Booster
January	Foot and Mouth Disease (FMD)			
February	Foot and Mouth Disease (FMD)			
March	Brucellosis		Female calf only	
April	Black Quarter (BQ)			
May	Anthrax			
June	Haemorrhagic Septicaemia (HS)			
July	Foot and Mouth Disease (FMD)			
August	Foot and Mouth Disease (FMD)			
September	Brucellosis			
October	---			
November	---			
December	---			

Vaccination schedule may vary as per the endemic nature of disease, environmental conditions and prevalent disease pattern in the area; # Immunization as per disease occurrence in Rabies, Tetanus, Snake bite etc.

Before any vaccination deworming should be compulsory to get better results; @ Dose of vaccine may vary as per manufacturer's detail.

2.2 Deworming schedule for different endo parasitic diseases

Type of worm	Deworming Schedule	Recommended drugs	Remarks
Roundworms	First dose at 10 days of age and thereafter at monthly interval up to 6 months Thrice a year in animals above 6 months of age	Fenbendazole @ 7.5 mg/kg bwt Piperazine hydrate (56.3% w/v) @ 3-6 ml per 10 kg body weight.	Rotational changing of anthelmintic drug is recommended to avoid resistance
Liver flukes	Twice in a year in endemic areas (before and after monsoon)	Triclabendazole @ 10-12 mg/lg bwt Oxyclozanide @ 18.7 mg/kg bwt (2 doses required at 2 days apart) Niclosamide @ 160mg mg/kg bwt (2 doses required at 3 days apart)	
Tapeworm	Twice in a year	Praziquantel @ 3.75 mg/kg bwt	

2.2.1 Anthelmintic Medication Schedule for Gaushalas

	First	Second	Third
Calves (upto 3 months)	15 days of Age (Fenbendazole/ Albendazole)	After 1 month of 1 st dose (Fenbendazole/ Albendazole)	After 1 month of last dose (Fenbendazole/ Albendazole)
Calves (3 months to 1 year)	06 months of Age (Fenbendazole/ Albendazole)	12 months of Age (Fenbendazole/ Albendazole)	----
Cow (Above 1 year)	In the month of May-June every year (Fenbendazole+ Oxyclozanide)	----	November-December of every year (Fenbendazole+ Oxyclozanide)

2.2.2 Acaricide Spray Schedule for Gaushalas

Acaricide Spray	
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Animal Shed	First in the month of April and then once in every month upto August (Organophosphate Acaricide)
Animal Treatment	First in the month of April and then as per need with spray of cypermethrin.

2.3 Clinical Veterinary Care

2.3.1 Examination of Patient in Gaushalas

2.3.1.1 Restraining the animal

Restraints can be necessary for safely completing some tasks involved in daily operations. The restraint tools must quickly and easily restrain cattle without injury. These tools must also be safe for the handler and should allow secure restraint and quick and easy release. Depending on their purpose, restraints can include ropes or mechanical devices. The use of mechanical devices, such as manual or hydraulic squeeze chutes, depends on the size and number of animals to be handled. Cattle tend to rush when they exit a squeeze chute, so a slip-resistant surface should be used to prevent injury. Regardless of the type of restraint tool, it should only be used by a trained and experienced handler who knows how to prevent injury.

The principles of low stress restraint are:

1. Solid sides or barriers around cattle prevent them from seeing people deep inside their flight zone. This is especially important for wild or excitable cattle.
2. Provide non-slip flooring
3. Slow steady motion of a restraint device is calming, while sudden jerky motion excites.
4. Use the concept of optimal pressure. Sufficient pressure must be applied to provide the feeling of restraint, but excessive pressure that causes pain or discomfort must be avoided.
5. Livestock will remain calm if they can see other animals close to them.
6. Select equipment to minimize noise.
7. Restraint devices must be designed to avoid uncomfortable pressure points on the animal's body.
8. Restrain livestock in an upright position.



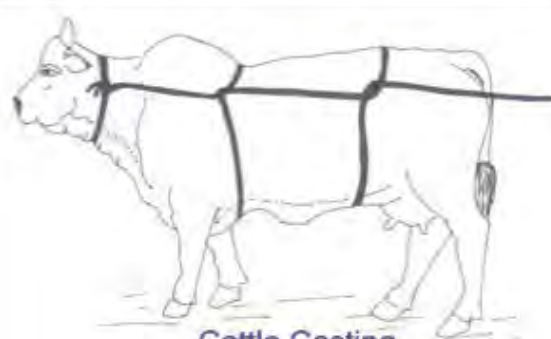
Bull Ringing



Bull Tethering Chain



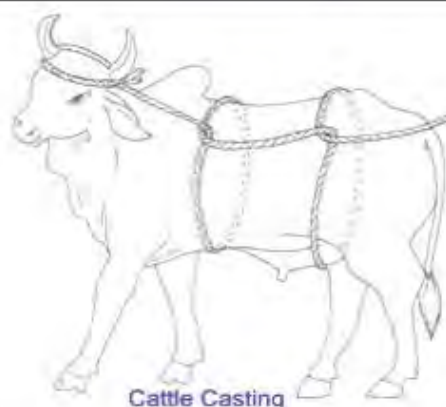
Nose String for Bullock



Cattle Casting



Cattle Casting



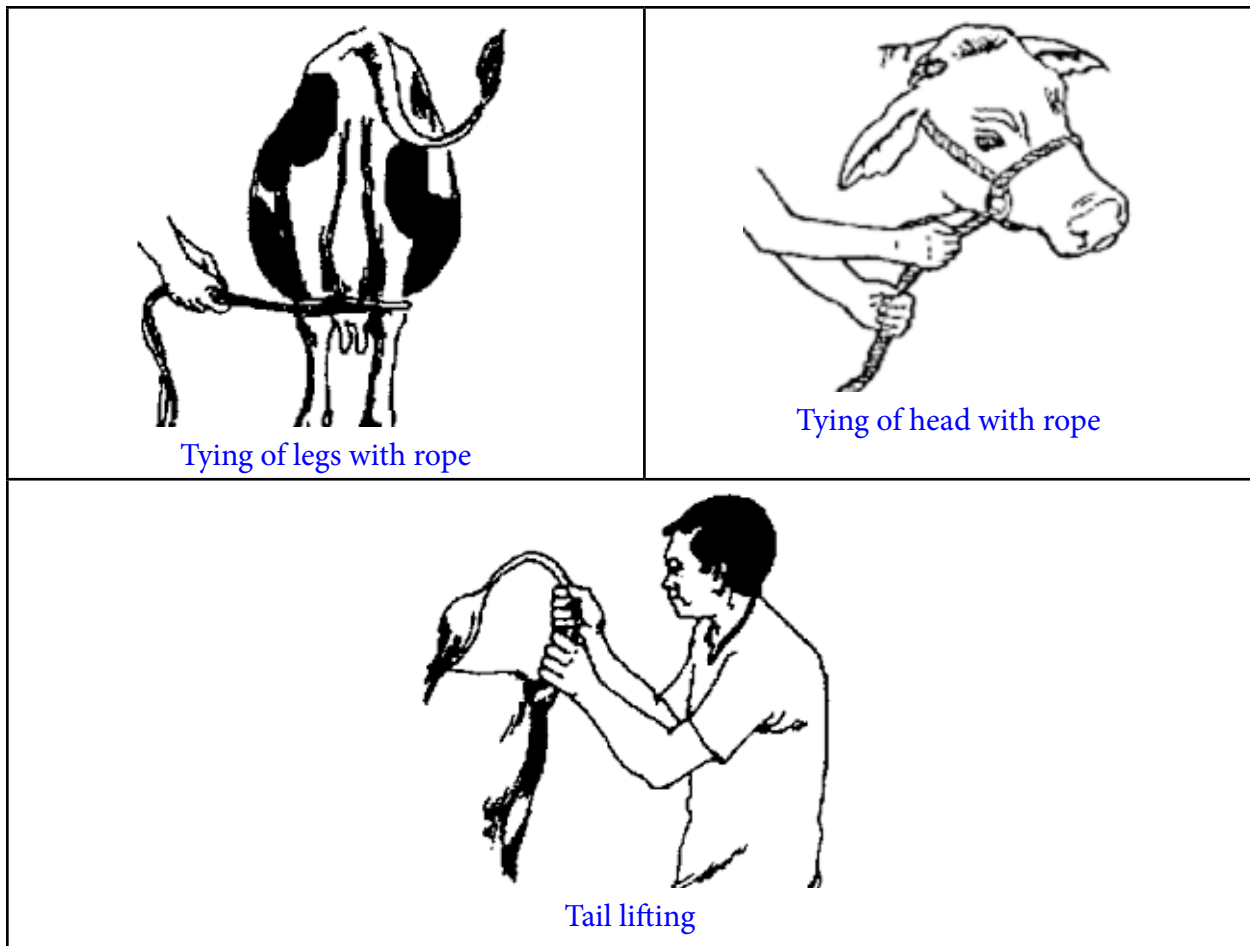
Cattle Casting



Cattle Casting



Cattle Casting



2.3.2 General Inspection from Distance

During general inspection from distance, following changes may be noted for accurate diagnosis of disease:

Behavior/ Appearance: Bright/ Dull or Apathetic/ Dummy / Coma/ Anxiety/ Restlessness/ Mania/ Frenzy

Voice:	Hoarse/ Weak/ Soundless
Eating:	Appetite/ Prehension/ Mastication/ Swallowing/ Regurgitation
Defecation:	Loose / diarrhea/mucous
Urination:	Color of urine/pain during urination
Posture:	Arching/ Saw horse/ Tucked up/ Straddling of legs
Gait:	Movement of limbs can be expressed in terms of rate/range/ force/ direction of movement.
Condition:	Normal/ Obese/ Thin/ Emaciated (Cachectic)
Conformation:	Shape/ Size/ Symmetry of different body region
Skin:	Hair/ Sweating/ Lesions/ Discharge/ Itching/ Lusture

2.3.3 Inspection of Body regions from Distance

During inspection of body region from distance, following abnormalities may be noted for proper diagnosis of disease:

Head:	Swelling of mandible
Eyes:	Discharge (Infection)/ Retraction (Dehydration)/ Spasm
Nose:	Discharge/ Dilatation
Mouth:	Salivation/discharge
Neck:	Edema/wound/lesion
Thorax:	Respiratory rate/ Rhythm/ Depth / Type/ Noise of respiration
Abdomen:	Shape/ Size/ contour/ Symmetry
External Genitalia:	Discharge/tumor/wound
Mammary Gland:	Swelling/ edema

2.3.4 Routine Physical Examination

Physical Examination of a patient consist of Palpation /Percussion/ Tactile Percussion/ Auscultation/ Combined Percussion and Auscultation of the animal.

During routine physical examination, following vital parametres may be noted for disease diagnosis:

- Vital Signs (Temperature / Pulse/ Respiration/ Weight)
- Fever: Rectal temperature should be recorded
- General Appearance
- Skin (Color/ Texture/ Moisture/ Hair/ Parasite/ Lesions)
- Lymph node (Enlargement/ Consistency/ Pain)
- Eyes (Exudation/ Color of mucous membrane)
- Ears (Discharge/ Waxing/ Parasite)
- Nose (Discharge/ Swelling)
- Mouth (Salivation/ Smell / mucous membrane)
- Neck and Back (Deformity/ Pain)
- Thorax (Shape/ Size/ Wound)
- Abdomen (Symmetry/ Distension/ Rigidity)
- Genitalia (Palpation for over growth)
- Extremities (Walking/ Swelling/ Deformities if any)
- Neurologic (Walking/ Reflex)

2.4 Recording of Body Temperature of Cattle

Body temperature of cattle is measured by taking rectal temperature with the help of a mercury/digital thermometer. Hold the thermometer against the wall of the rectum for two minutes to get an accurate body temperature of the animal rather than the fecal temperature. Clean the thermometer with alcohol and wipe it with cotton after every use. Nowadays Infrared based thermometer is available in the market which will be highly useful for taking temperature in aggressive and ferocious animals.



Digital Thermometre



Mercury Thermometre

Vital Parametres of Cattle

S. No.	Parametre	ReferenceRange
1.	Rectal Temperature (°F)	100.5 -101.5
2.	Respiration (rate/min)	20-30
3.	Hear rate (beats/min)	60-80
4.	Capillary Refill Time (Sec)	1-2
5.	Mucous membrane (Conjunctival)	Pink and Moist
6.	Rumen motility	5 contraction/3 min

2.5 Collection of Blood from Cattle

2.5.1 Jugular Venipuncture

Using the halter, the head is elevated slightly, drawn to the side opposite the jugular vein to be sampled, and tied to a stationary surface. The vein is occluded by digital pressure in the jugular groove low in the neck. Insert 18 gauge needle into the distended jugular vein at approximately 45°. When positioned in the vein, collect blood. When the desired volume has been collected, the occluding pressure is removed.

2.5.2 Coccygeal Venipuncture

Blood collection from the coccygeal (tail) vein is performed with the animal restrained in a crush. The tail is held in one hand such that the ventral surface is accessible. The ventral surface of the tail is cleaned with a swab to remove faecal material. A needle is then inserted perpendicular to the skin surface on the midline between (approximately) the third and fourth coccygeal vertebrae. When blood flows from the needle, the syringe is attached and the sample is collected. After sample collection is complete the tail is released. The syringe may be attached to the needle prior to insertion with gentle aspiration used to determine if the needle is in the correct location.

A variety of collection devices may be used like, vacutainers, bleeding tubes, syringe and

needle. Restraint should ensure quick, easy and safe collection of the sample causing minimal distress. This may involve use of a bail, race, or crush for tail bleeding. Operators should use gloves and disinfect them between animals to prevent the transmission of blood-borne diseases. Equipment such as vacutainer holders should also be cleaned between animals.



Jugular vein puncture



Tail vein puncture

2.5.3 Preparation of blood smear

- New microscope slides, preferably with beveled edges, should be used
- Ideally smear should be made from freshly drawn blood to which no anticoagulant has been added
- Place the end of second slide (Spreader slide) against the surface of the first slide, holding it at a comfortable angle of about 30°C.
- Draw the spreader slide gently into the drop of blood and push the spreader slide forward with a steady even motion.
- Dry rapidly by waving in the air or by using a fan in humid climate
- Stain within 1hr for best results

2.5.3.1 Staining of the slide

Leishman's stain

- Flood the air dried blood film with undiluted stock Leishman's stain and leave for 1-2 min.
- Dilute the stain on the smear with double the volume of buffered distilled water and stain for 5 to 15 min.
- Blow on the mixture to aid mixing
- Wash with distilled water until the film has a pinkish tinge
- Wipe the back of the slide to remove excess stain and allow to dry
- For differential leukocyte count, examine the slide under oil immersion and count 100 cells (Neutrophil, Lymphocyte, Eosinophil, Monocyte and Basophil) totally and express in percentage or number

2.5.4 Erythrocyte count

- Fresh un-clotted blood or anticoagulant added blood may be used
- After rubber tubing is attached to a Thoma erythrocyte -diluting pipette, identified by the 101 mark above the bulb, draw the blood exactly to the mark 0.5 using gentle suction on the mouthpiece
- The tip of pipette should be wiped free of blood before inserting it in Hayem's/ Gower's solution
- The diluting fluid must be drawn into the pipette with steady suction to the 101 line above the bulb
- Shake the pipette for at least 2-3 min and load the sample in hemocytometre and count the erythrocyte under low power (10x) in microscope
- Sum of the cells in the 5 small squares* 10000 = Total erythrocyte /microlitre

2.5.5 Leukocyte count

- Follow the technique described under the erythrocyte count, except for the diluting pipette that has the mark 11 above the bulb
- Draw the blood exactly to the 0.5 mark and wipe blood from the outside
- Place the pipette in WBC diluting fluid and slowly to the mark 11 above the bulb
- Shake for 3 min and load the sample in hemocytometre and count the leukocyte under low power (10x) in microscope
- Sum of the cells in the 4 corner squares* 50 = Total leukocyte /microlitre

2.5.6 Estimation of Hemoglobin

- Place N/10 HCL in diluting tube up to the mark 20.
- Take blood in the haemoglobin pipette up to 20-cubic-mm-mark and blow it into diluting tube and rinse well.
- After 10 minutes add distilled water in drops and mix the tube until it has exactly the same color as the comparison standards.
- Note the reading, which indicates the percentage of haemoglobin.
- The Hb estimation of the given sample is g/dl

2.5.7 Estimation of PCV

- Mix 0.4 ml of EDTA with 2 ml blood.
- Fill the Wintrobe tube upto upper most mark with the help of pasture pipette or syringe.
- Fill the another Wintrobe tube to balance first one.
- If the blood sample is not available, fill the tube with water.
- Place the Wintrobe tube in opposite side in centrifuge. Turn the centrifuge to slow speed, then slowly increase the speed to 3,000 rpm for 30 min.

- After 30 min, switch off the centrifuge and allow it to stop by itself.
- Take out the Wintrobe tube and read PCV directly with the help of graduation mark given on the tube.

3. Diagnosis of Parasitic Diseases in Cattle

3.1 Introduction

Cattle generally suffer from a variety of parasitic infections/infestations throughout their life. Some of these infections are responsible for high morbidity and mortality in acute cases, whereas, most of the parasitic diseases result into reduced productive and reproductive performances as well as overall health status of the animals in chronic cases. The clinical symptoms produced in most of these diseases are overlapping and unreliable for confirmatory diagnosis. However, it is important to mention that some parasites (gastrointestinal helminths and coccidia) infecting livestock are found in digestive tract and their eggs/larvae/oocysts stages are discharged through the faeces of the host, while haemoprotozoa are found in the circulatory system of the host. In order to diagnose gastrointestinal parasitic agents infecting ruminants, examination of faeces is performed and for the diagnosis of haemoprotozoa, blood examination is the gold standard.

3.2 Clinical signs of common parasitic infections/infestations

Disease	Important Clinical signs	Diagnosis
Fasciolosis	Diarrhoea or constipation, bottle-jaw, oedema of dependent body parts, anaemia, anorexia, weight loss, reduced milk yield	Parasite egg in faecal examination
Amphistomosis	Watery foul smelling diarrhoea, bottle-jaw, dehydration, anorexia, colic etc.	Pink coloured immature flukes in faeces
Gastrointestinal nematodosis	Diarrhoea, anorexia, body weight loss, reduced milk yield	Parasite egg in faecal examination
Trypanosomosis	Intermittent fever, severe anaemia, petechial haemorrhage in visible mucous membrane, weakness and occasional nervous signs	Wet and thin blood smear examination
Theileriosis	High fever (upto 107°F), swelling of superficial lymph nodes, nasal discharge, lachrymation, coughing, anorexia	Thin blood smear examination
Babesiosis	High fever, haemoglobinuria (red urine), dramatic reduction in milk yield, anorexia	Thin blood smear examination
Mange	Intense itching, dermatitis, alopecia etc.	Skin scraping examination

3.3 Faecal examination

Faecal examination procedures are simple to perform and identification of most of the parasitic agents is also possible. The faecal examination procedure involves three basic steps viz. collection of fecal samples, sample processing, and microscopic examination for identification of parasitic stages.

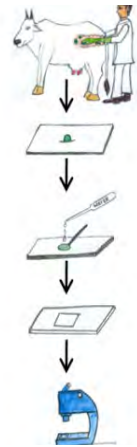
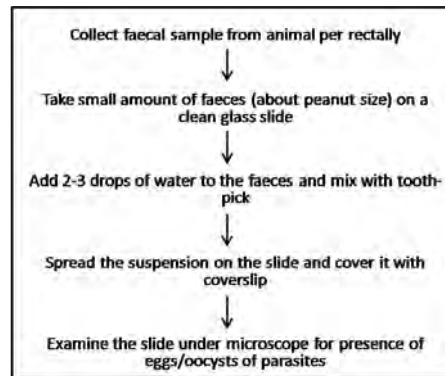
3.3.1 Collection of fecal samples

Fecal sample is generally collected directly from the rectum of the animals in a polythene bags or any suitable container free from dust/soil,etc. In case, the animal is furious and non-cooperative, freshly voided faecal sample from the top of the faecal pat may be collected for examination. After collection, fecal sample must be examined freshly

otherwise incubation of feces for some time may lead to hatching of eggs to larval stages. If examination of fresh feces is not possible then the same may be preserved in 10% formalin and it can be stored for few days under laboratory conditions.

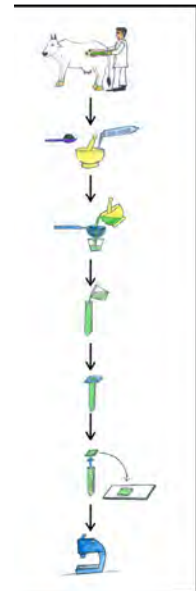
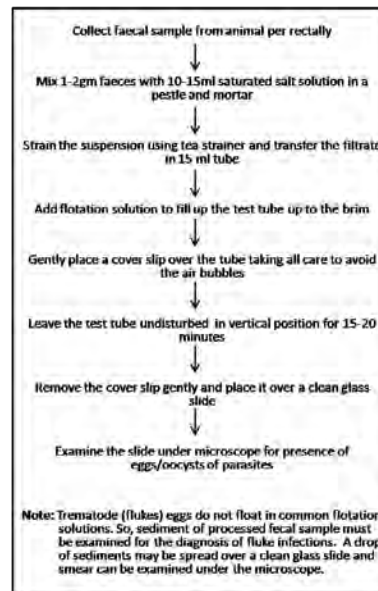
3.3.2 Faecal sample processing and microscopic examination

The fecal examination procedures are generally quick and most of the gastrointestinal parasitic infections can be diagnosed.



3.3.3 Direct smear examination method

In this method small amount of fecal sample (about peanut size) is taken on a clean, grease free glass slide. 2-3 drops of water are then added to the fecal sample and a faecal suspension is made with the help of a tooth pick. The suspension is spread over the slide and finally a cover slip is placed over the smear and the slide is examined for detection of GI parasitic stages (eggs/ larvae/oocysts) under the microscope using appropriate magnification (10X or 40X of eye piece). Whole area of the smear must be examined starting from one corner to the other. A sample must be declared negative after examination of 3 consecutive smears prepared from the same sample. This test is easy to perform but the limitation with this test is its poor sensitivity. Sequential steps of the technique is given below:



3.3.4 Concentration method

To improve the diagnostic sensitivity of direct smear examination method, fecal samples are processed with different flotation solutions having higher specific gravity than the most of the parasitic eggs. The high specific gravity of these solutions allows the gastrointestinal parasitic eggs or oocysts to float on the top of solution, which can be detected easily in microscopic examination. Saturated salt solution, Sheather's sugar solutions, 33% zinc sulphate and 35% magnesium sulphate solutions are few examples of flotation solutions commonly used in diagnostic laboratories. Sequential steps of flotation technique is given below:

3.4 Blood examination

The causative agents of haemoparasitic diseases (trypanosomosis, babesiosis, theileriosis, anaplasmosis) are very small in size (microscopic) and thus a very careful blood smear preparation, staining and examination is required for accurate diagnosis. Out of all the haemoparasites, trypanosomes are found extracellularly (in plasma), where

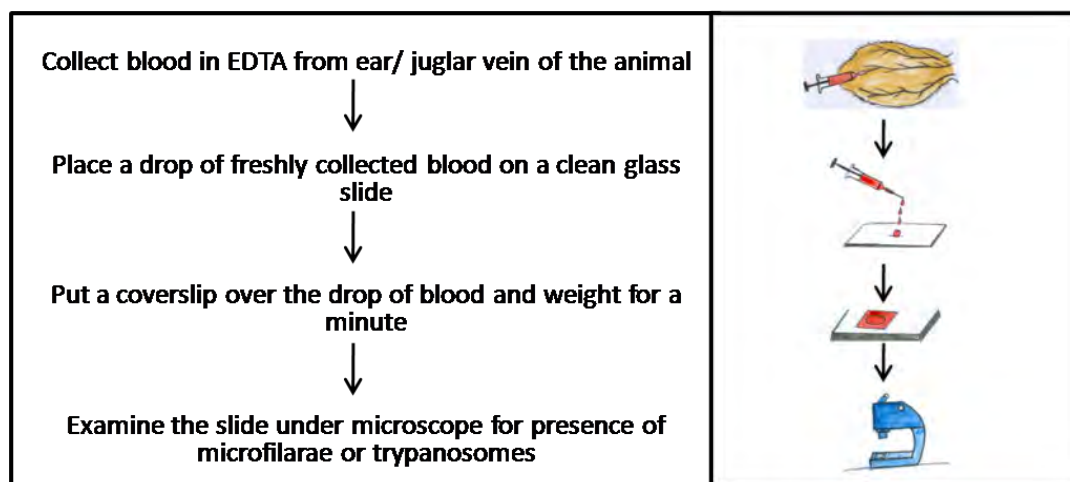
as others are found inside erythrocytes. Though, microscopy is considered as the gold standard for identifying the blood parasites but sometimes low level of infection cannot be detected by this method and thus repeated blood sample examination on alternate days is required. The entire blood examination procedure involves basically three main steps viz. collection of blood samples, blood smear preparation and staining, and microscopic examination for identification of parasitic stages.

3.4.1 Blood collection

For examination of different blood parasites, approximately 1.0 to 2.0 ml blood sample is required. Blood may be collected from the peripheral circulation of animals (ear veins) in clean glass tube/ vial with anti-coagulant (EDTA/Heparin).

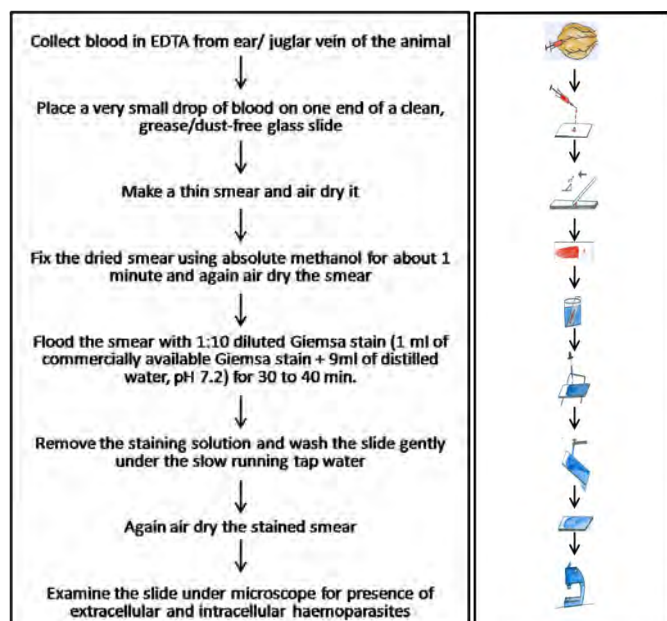
3.4.2 Wet smear examination

This is a quick method and used for screening of extracellular parasites like trypanosomes and microfilarae. Only freshly collected blood should be examined by this method. The procedure for wet smear examination is described below:



3.4.3 Thin blood smear preparation and staining

After collection of blood, it may be used for thin smear preparation followed by staining and microscopic identification. The procedure of thin blood smear preparation and staining is given in the box. Giemsa stain is used for staining of the blood smear. Before staining with Giemsa stain, the smear should be fixed with cent percent Methanol for 1min. Other Romanowsky stains, viz., Leishman or Wright's stains can also be used for staining of blood smears. These are alcoholic stains and thus prior fixation of blood smear with absolute methanol is not required. Air dried blood smears are covered with counted drops of any alcoholic stains and allowed to react for 30 sec. to 1 minute. Then the



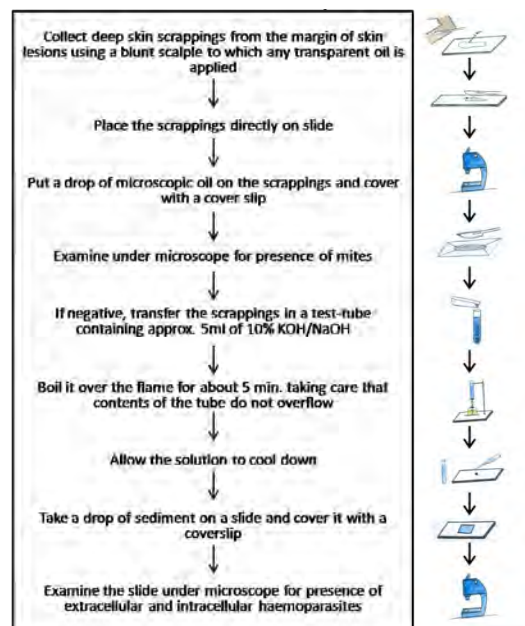
stain is diluted on the smear itself with distilled water (double the quantity of stain) and mixed thoroughly with the help of a pasteur pipette. The diluted stain is allowed to react for 20 min. The stain is then drained off and the smear is washed under a slowly flowing tap water. After air drying, the slide is examined under the microscope.

3.4.4 Microscopic examination of blood smears

Stained blood smears can be examined under microscope for detection of different parasites. For examination of a stained smear, tip of smear should be screened thoroughly. Extracellular parasites like trypanosomes and microfilariae can be examined under X100 and/or X400 magnification, whereas intracellular haemoparasites (*Babesia* sp., *Theileria* sp. and *Anaplasma* sp.) can be identified under X1000 magnification. Different parts of the smear should be thoroughly screened for confirming the presence or absence of parasites in the blood.

3.5 Skin scraping examination

Causative agents of mange (*Demodex* spp., *Sarcoptes* spp. and *Psoroptes* spp.) are very small in size (microscopic) and are found in the skin/ hair follicles/ sebaceous glands of animals. *Demodex* spp. and *Sarcoptes* spp. are found in the deeper layers of the skin, while *Psoroptes* spp. is found superficially. Thus, a very careful collection of skin scraping and its examination is required to diagnose the disease. Skin scrapings should be collected from the periphery of a visible skin lesion and the hair over this area should be clipped away. Scrapping is taken by means of a scalpel or a blunt blade. The skin is moistened with little quantity of liquid paraffin or any transparent oil and the same may be applied on the scalpel as well. Deep skin scrapings should always be collected and it should be continued until a slight amount of capillary blood oozes out from the scrapped area. The procedure of skin scraping examination is given below:

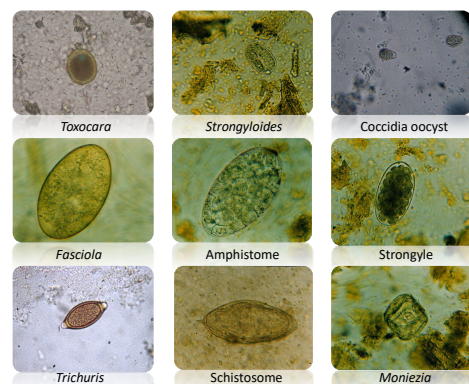


3.6 Control of Ectoparasitic diseases

Ectoparasites are major causes of livestock production losses in any Gaushalas and livestock farm which not only cause the production loss but they act as vectors of many hemoprotozoan diseases. Important ectoparasites are mange, mites, lice, fleas and flies. The ectoparasites live permanently on the skin and can be controlled by directly treating with ectoparasiticides.

Ticks are specialized obligate haematophagous ectoparasites and are second to mosquitoes as vectors of a number of human pathogens it transmits, and the most important vector of pathogens affecting cattle worldwide. In animals, tick infestations are much more severe than in humans. Animals can be parasitized by thousands of ticks, which multiply the effect on the host, either by direct injuries or disease

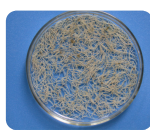
Parasitic eggs/oocysts commonly found in faecal samples of cattle/buffaloes



Parasites and parasitic infections



Ascarid worm



Stomach worm



Tape worm



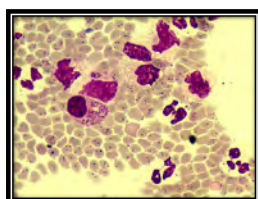
Coccidiosis in calf



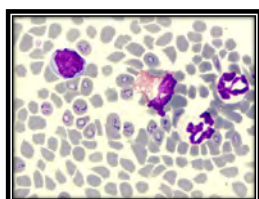
Tick infestation

Division of Parasitology, ICAR-IIVRI

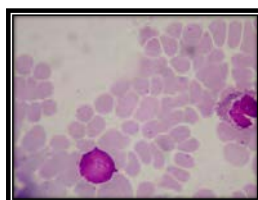
Common blood parasites of cattle and buffaloes



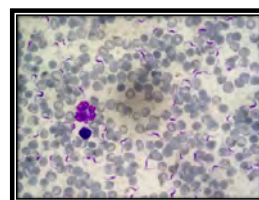
Theileria



Babesia



Anaplasma



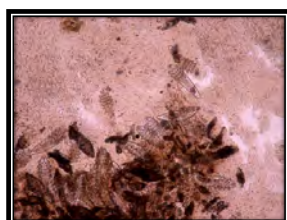
Trypanosoma

Parasitology Division, ICAR-IIVRI

Common mange-mites of cattle and buffaloes



Demodectic mange in a cow



Demodex mite



Sarcoptes mite



Psoroptes mite

Parasitology Division, ICAR-IIVRI

transmission. Direct injuries to animals can be very serious, and are mainly observed in infestations with ixodid ticks. In India, cattle are frequently heavily infested with multi-species of ticks and cause extensive damage to the livestock health and production. Tick infestations in animals are linked with environmental conditions and 28-30° C temperature and 85% and above relative humidity are the most suitable conditions for tick propagation. As because the average temperature and humidity in most of the cattle rearing states in India is favourable for tick propagation, tick infestations are very common in cattle farms. However, the pattern of infestations may vary. For example: In the eastern part of the country the ideal temperature and humidity for tick infestation is maintained throughout year except December and January. While in the southern part of country except some parts of Karnataka, the environmental conditions are maintained at optimum level throughout the year. In the northern part of the country, the tick infestations level usually reaches at low level during November to February. The tick infestation pattern in the western and central part of India is almost like southern India with infestations starts from May end or early June month of the year and continues till November with a low level infestation occur sometimes during end of December to Mid of February. Due to variations in ascending and descending peak of infestations in different parts of the country, the tick management planning is to be designed accordingly.

Following ectoparasiticides are commonly used in Gaushala animals:

3.6.1 Topical application

- a) Pyrethroides compounds (permethrin, deltamethrine, Cypermethrine etc) compounds are available in market and can be used as spray on animals at the rate of 3 mL/litre of water and to be repeated as and when required.
- b) Amitraz (N-methyl- N'-(2,4-xylyl) formamidine - DMPF) are available in market and can also be used as spray on animals at the rate of 3 mL/litre of water and to be repeated as and when required. Amitraz is available as a spray or dip for use against mites, lice, and ticks in domestic livestock.

Note: The compounds are toxic to body. Before application, animals should be allowed to drink ad-lib water, thereafter the mouth should be tied with a soft rope temporarily at least for 1 hour. Such type of topical application should not be encouraged in cloudy weather to avoid absorption of the drug.

3.6.2 Systemic application

Ivermectins compounds (Ivermectine, Moxidectine, Doramectine etc) are used systematically (Subcutaneous route @ 200ug/kg bwt or 1mL/50Kg bwt at every 15 days intervals).

3.7 Routine herd disease detection kit

3.7.1 Electrical Conductivity Test The electrical conductivity test in milk is preformed to measure the concentrations of Sodium and Chloride ions in milk. The milk of mastitis udder exhibits higher electrical conductivity than normal milk due to tissue damage and there is subsequent increase in Sodium (Na^+) and Chloride (Cl^-) ions conc. and decrease in potassium (K^+) and lactose in milk. Changes in electrical conductivity can be detected by instrumentation when the conductivity sensors are being incorporated in automated milking systems. Change in electrical conductivity is one of the earliest manifestations associated with new infections making the early detection and recording of possible mastitis cases routinely.

3.7.2 California mastitis test

CMT is very useful tool to identify quarters infected with clinical and subclinical mastitis. The reaction is then visually scored depending on the amount of gel formed (Table 1). The CMT is a simple, inexpensive, rapid screening test and is useful in determining which quarter of the cow is most affected. The California mastitis test (CMT) is conducted during milking of cows. CMT paddle is used to collect about three to four ml of fore milk from each quarter of cows after discarding few streams of milk to which an equal volume of CMT reagent (5 mg of Bromocresol purple, 15 gm of sodium hydroxide and 15 ml of Teepal detergent is mixed with 985 ml distilled water to make 1litre CMT reagent) is mixed. After mixing of the CMT reagent the paddle is immediately rotated by swirling/circular motion. CMT reagent changes the color (from a red to a purple color if the pH is high) and consistency in case of any inflammatory changes in the infected udder. The reaction is graded by intensity of gel formation and color changes as per following table:

CMT grade	Description	Point score
Negative(N)	No change	0

Trace (T)	Slime formation which disappears with continuous movement of paddle	1
Weak (+)	Distinct slime, but no gel formation of slight purplish color	2
Distinct (++)	Viscous with gel formation which adheres to the margin of the cup with color changes (purplish)	3
Strong positive (+++)	The gel form convex projection and does not dislodge after swirling movement of the CMT paddle	4

3.7.3 Rose bengal plate test (RBPT)

The RBPT is used to detect antibodies against Brucella organism and this test is used as a screening test for brucellosis in organized dairy herd.

3.7.3.1 Procedure

The equal volume (25-30 ul) of neat serum (if possible non-inactivated) and of antigen are placed side by side on a plate and mixed thoroughly and rapidly. The plate containing mixture is shaken lightly for 4 minutes.

3.7.3.2 Interpretation of results

Negative- No agglutination

Positive- any visible agglutination.

Flocculates (false agglutination):un-interpretable or unreadable.

3.7.4 Johnin test

It is a single intra dermal (SID) Test or Delayed Hypersensitivity test by which the bovine paratuberculosis is screened in any dairy herd. It is an onsite test, where animals are housed. Test is conducted on the animals above 2 months of age. Johnin PPD is injected via intra-dermal route in neck region. Skin thickness of the injection site is read before and after 72hrs of inoculation.

Positive case

Increase in skin thickness of 4 mm or more, or presence of clinical signs viz. exudation, necrosis, pain, and inflammation of the lymphatic duct of that region or the lymph node, 72 hours post-inoculation.

Negative case

Increase in skin thickness less than 2 mm and without clinical signs viz. exudation, necrosis, pain, inflammation of the lymphatic duct of that region or the lymph node, 72 hours post-inoculation.

3.7.5 Tuberculin test

It is also a single intra-dermal (SID) Test or Delayed Hypersensitivity test by which the bovine tuberculosis is screened in any dairy herd. It is an onsite test, where animals are housed. This test is conducted on the animals above 2 months of age. The bovine tuberculin PPD is injected via intra-dermal route in neck region. The skin thickness of the injection site is read with the help of Vernier Caliper before and after 72hrs of inoculation.

Positive case

Increase in skin thickness of 4 mm or more, or presence of clinical signs *viz.* exudation, necrosis, pain, and inflammation of the lymphatic duct of that region or the lymph node, 72 hours post-inoculation.

Negative case

Increase in skin thickness less than 2 mm and without clinical signs *viz.* exudation, necrosis, pain, inflammation of the lymphatic duct of that region or the lymph node, 72 hours post-inoculation.

4. Management of Major Infectious Diseases

Infectious diseases of livestock are a major threat to global animal health and welfare and their effective control is crucial for dairy health, for safeguarding and securing national and international food supplies and for alleviating rural poverty in developing countries like India. Some devastating livestock diseases are endemic in many parts of the world and threats from old and new pathogens continue to emerge, with changes to global climate, agricultural practices and demography presenting conditions that are especially favorable for the spread of arthropod-borne diseases into new geographical areas. Zoonotic infections that are transmissible either directly or indirectly between animals and humans are on the increase and pose significant additional threats to human health and the current pandemic status of new influenza A (H₁N₁) is a typical example of the challenge presented by zoonotic viruses. Some of the issues relating to infectious diseases of livestock maintained in Gaushalas are discussed below:

4.1 Bacterial diseases

Pathogenic bacteria are bacteria that can cause infection. Although most bacteria are harmless or often beneficial, some are pathogenic. Each species has specific effect and causes symptoms in dairy animal that are infected. Immuno-compromised individuals are more susceptible to pathogenic bacteria. Some pathogenic bacteria cause disease under certain conditions, such as entry through the skin via a cut, through sexual activity or through a compromised immune function. Therapeutic management and prevention of important bacterial diseases to the dairy industry are discussed.

4.1.1 Mastitis

Mastitis, one of the most costly diseases of dairy animals, is the inflammation of mammary parenchyma and characterized by physiochemical changes in the milk and pathological changes of mammary tissue. Udder will be hot and painful in touch and milk will show the presence of flakes and sometimes blood and pus may be seen. Mastitis is of two types based on clinical manifestations: clinical and subclinical mastitis. Although clinical mastitis can easily be diagnosed by visible signs of mammary / udders inflammation and gross abnormalities of milk, diagnosis of subclinical mastitis is not so easy except elevation of somatic cell count in milk (mostly neutrophils and epithelial cells) and decline in milk production.

4.1.1.1 Diagnosis

Physical examination of udder and milk is sufficient to diagnose the mastitis. For diagnosis of subclinical mastitis, strip cup California mastitis test (CMT) and somatic cell count are ideal. For bacterial isolation, milk sample should be sent to diagnostic laboratory.

4.1.1.2 Clinical management

- A non-steroidal anti-inflammatory drug once daily for 2-3 days
- Intra-mammary infusion of broad spectrum antimicrobial preparation twice daily for 3-4 days.
- Parenteral (intravenous or intramuscular injection) use of antibiotics at high dose for 4-6 days
- Intravenous administration of large quantities of electrolyte solution in peracute cases.
- Oxytocin may be used to promote milk down.
- Surgical amputation may be required for gangrenous quarter.
- Fibrosed udder is very difficult to cure and needs long term therapy.

4.1.1.3 Preventive measures

- Pre and post-milking teat dipping with KMnO_4 solution is very effective.
- Dry cow therapy: use of long acting antimicrobial at the end of milking of each lactation is helpful to prevent mastitis in dry period and subsequent lactations.
- No vaccine is available for mastitis.

4.1.2 Hemorrhagic septicemia (HS)

Haemorrhagic septicaemia (HS) is a major disease of cattle and buffaloes manifested by an acute, highly fatal septicemia with high morbidity and mortality. Outbreaks mostly occur during the monsoon with high humidity and high temperatures. Classical HS as defined by the OIE is caused by *Pasteurella multocida* serotypes B:2 and E:2. Serotype B:2 has been identified in most areas where the disease is endemic, whereas serotype E:2 has been found only in Africa.

4.1.2.1 Transmission

- Stress factors like high temperature and humidity, concurrent infection (blood parasites or foot and mouth disease), poor nutrition or work stress are generally associated with outbreaks.
- Disease is most prevalent during the rainy season.
- Infection occurs by contact with infected oral or nasal secretions from either healthy carrier animals or animals with clinical disease, or by ingestion of contaminated feed or water.

4.1.2.2 Clinical signs

- In peracute form of HS, death occurs within 8-24 hr.

- Animals often have fever, hyper salivation, nasal discharge, and difficult respiration. However, due to short duration of disease these signs may easily be overlooked.
- Acute disease can persist up to 3 days, and less often 5 days, and is characterized by fever of 104°-106°F (40°-41.1°C), restlessness and reluctance to move, hyper salivation, lacrimation, nasal discharge that begins as serous and progresses to mucopurulent, subcutaneous swelling in the pharyngeal region that extends to the ventral neck and brisket (and sometimes the forelegs), progressive respiratory difficulty, cyanosis, terminal recumbence, and possibly abdominal pain with diarrhea.

4.1.2.3 Treatment and control

- Sulphonamides and oxytetracycline is the drug of choice for effective treatment.
- Killed vaccines are most commonly used for prevention.
- Oil-adjuvant vaccine provides protection for 9-12 month and is given annually.



Brisket oedema in HS.

4.1.3 Black quarter

It is an acute infectious and highly fatal, bacterial disease of cattle, buffaloes, sheep and goats. Young cattle between 6-24 months of age, in good body condition are mostly affected. It is soil-borne infection which generally occurs during rainy season. In India, the disease is sporadic (1-2 animal) in nature. It is a bacterial disease caused by *Clostridium chauvoei*

4.1.3.1 Symptoms

- Fever (106-108°F), loss of appetite, depression and dullness
- Suspended rumination
- Rapid pulse and heart rates
- Difficult breathing (dyspnoea)
- Lameness in affected leg
- Crepitating swelling over hip, back and shoulder.
- Swelling is hot and painful in early stages whereas cold and painless later.
- Recumbence followed by death within 12-48 hrs.

4.1.3.2 Treatment

- Penicillin @ 10,000 units/kg body weight IM and locally daily for 5-6 days.
- Oxytetracycline in high doses i.e. 10-20 mg/kg body weight IM or IV for 5-6 days
- Incise the swelling and drain off the pus fluid if any.
- B.Q. antiserum in large doses, if available.

- Injection of Antihistaminic (Pheniramine) @ 5-10 ml IM OD for 2 days

4.1.4 Brucellosis

Disease in cattle and buffalo is caused by *Brucella abortus* and is mainly responsible for abortion in cows and orchitis and epididymitis in bulls of dairy herd.

4.1.4.1 Transmission

- Natural transmission occurs by ingestion of organisms, which are present in large number in aborted fetuses, fetal membranes, uterine discharges and milk.
- Cattle may ingest contaminated feed and water or may lick contaminated genitals of other animals.
- Venereal transmission by infected bulls to susceptible cows appears to be rare.
- Transmission may occur by artificial insemination when *Brucella*-contaminated semen is deposited in the uterus but, reportedly, not when deposited in the mid cervix.
- *Brucella* may enter the body through mucous membranes, conjunctivae, wounds, or intact skin in both people and animals.

4.1.4.2 Clinical Signs

- Abortion is the most obvious manifestation in heifers after 5 months of pregnancy.
- Infections may also cause stillbirth or weak calves, retained placenta, and reduced milk yield.
- Usually, general health is not impaired in uncomplicated abortions. Seminal vesicles, ampullae, testicles, and epididymus may be infected in bulls; therefore, organisms are present in the semen. Testicular abscesses may occur in bull.
- Longstanding infections may result in arthritic joints in some cattle.

4.1.4.3 Control

- Vaccination of female calves with *B abortus* Strain 19 vaccine at the age of 4-6 months once in life time is effective.

4.1.5 Johne's Disease

Johne's disease is caused by *Mycobacterium paratuberculosis* and characterized by progressive emaciation in cattle and buffaloes with chronic diarrhoea and thickening of the intestinal wall.

4.1.5.1 Transmission

- Disease spread by ingestion of feed and water contaminated by the feces of infected animals.
- Incubation period extends from 12 months to several years.



Cachectic cattle due to John's disease.

- Animal aged 3 to 6 years mostly suffer from the disease. Affected animals may not show clinical symptoms and continue to discharge organisms in feces.
- Organisms persist in pastures for about 1 year.
- Organisms are susceptible to sunlight, drying and high pH of soil; continuous contact of urine with feces reduces the life of bacteria.
- Clinical signs appear mainly during 2-6 years of age. Infected animals which are apparently healthy often show clinical signs after parturition.

4.1.5.2 Treatment

The treatment against this disease is not recommended in dairy herd.

4.1.5.3 Control

- The affected animal should be segregated and their feces properly disposed off.
- No vaccine for Johne's disease is available in India.
- Periodic testing with Jhonin test is helpful to identify any new cases in the farm/herd.

4.2 Viral Diseases

Viral diseases of farm animals are one of the major threats to agriculture and can cause considerable damage at local, regional, and even at the international level both in industrialized and in developing countries. In the last two centuries considerable efforts have been invested in understanding the causes and pathogenesis of viral diseases of domestic animals. These studies have introduced new methodologies for the diagnosis, treatment, and control of veterinary viral diseases with newer technologies. Following text will furnish information on important viral diseases in dairy animals of Gaushalas.

4.2.1 Foot-and-mouth disease (FMD)

Foot-and-mouth disease (FMD) is a highly contagious disease of cloven footed animals in cattle and buffalos and characterized by fever and blister-like sores on the tongue and lips, in the mouth, on the teats and between the hooves. Disease causes severe production losses and while the majority of affected animals recover, the disease often leaves them weakened and debilitated. Disease is endemic in India and producing serious economic losses for reduced productivity and due to the ban on export of livestock products to other countries.

4.2.1.1 Symptoms

- High fever
- Blister-like lesions on the tongue, nose and lips, mouth, teats and between the toes which then burst, leaving painful ulcers.
- Blisters cause a heavy flow of sticky, foamy saliva that hangs from the mouth.
- Lameness
- Infected animals sway from one foot to the other due to the tenderness of the feet.

- Sloughing of tongue, teats and hooves.
- Hooves may contract maggot infestation.
- Although older cattle usually do not die from the infection, they suffer a severe illness which leaves them in a weakened state.
- Anorexia and loss of milk production.
- Complication: panting for long time even after recovery.

4.2.1.2 Transmission

Virus is extremely contagious and spreads rapidly unless it is contained. This usually requires quarantining infected farms, followed by burning of infected utensil with hygienic measure in the premises. Anyone having contact with animals in infected countries should not go near susceptible animals for at least five days.

4.2.1.3 Treatment

- Suitable non-steroidal anti-inflammatory drug twice daily till drop of temperature.
- Broad spectrum antimicrobial preparation for 5 days.
- Vitamin A containing multivitamin must be given for recovery of epithelial cells.
- Fluid and electrolyte in sufficient quantities via intravenous route is recommended.
- Mouth lesions should be washed with boric acid and glycerol to provide soothing effect.
- Hoof lesions should be washed with Potassium permanganate and fly repellants may be applied on the lesion to avoid maggot infestation.

4.2.1.4 Control

- Affected animals should be isolated immediately.
- Vaccinate the unaffected animals immediately.
- Strict bio-security measures should be implemented.
- Restrict the movement of animals and farm personnel between infected and uninfected premises.
- Disinfect the affected places with alkaline agents (i.e. Sodium bicarbonate, Calcium Carbonate etc).

4.2.1.5 Prevention

- Newly received animals at Gaushala should be quarantined for 21 days and vaccinated with trivalent killed FMD vaccine.

4.2.2 Infectious bovine rhinotracheitis (IBR)

Infectious Bovine Rhinotracheitis (IBR) is a highly contagious, infectious respiratory disease that is caused by Bovine Herpesvirus-1 (BHV-1) and can affect young and older cattle. In addition to causing respiratory disease, this virus can cause conjunctivitis,

abortions, encephalitis, and generalized systemic infections. IBR is characterized by acute inflammation of the upper respiratory tract.

4.2.2.1 Clinical Signs

- Fever
- Coughing
- Depression
- Loss of appetite
- Hyperemia of the mucosa
- Nasal discharge
- Conjunctivitis
- Drop in milk production
- Infertility
- Abortion

4.2.2.2 Treatment and prevention

- There is no effective treatment for viral diseases.
- Infected animals should be isolated from the rest of the herd and treated with anti-inflammatory drugs and antibiotics to resist secondary infections if any.
- Carrier cattle should be identified by screening and removed from the herd.
- No suitable vaccine is available in India

4.2.3 Rabies

Rabies is an acute, progressive viral encephalomyelitis that principally affects carnivores and bats, although any mammal can be affected. The disease is fatal once clinical signs appear. Rabies is found throughout the world. Globally, the dog is the most important reservoir, particularly in developing countries. Rabies is caused by lyssaviruses in the Rhabdovirus family.

4.2.3.1 Transmission

It occurs via introduction of virus-laden saliva into tissues, usually by the bite of a rabid animal. Although much less likely, virus from saliva, salivary glands, or brain can cause infection by entering the body through fresh wounds or intact mucous membranes. Usually, saliva is infectious at the time clinical signs occur, but domestic dogs, cats, and ferrets may shed virus for several days before onset of clinical signs.

4.2.3.2 Clinical signs

Furious Form:

- Irritable
- Hyperactive

- Change in voice
- Aggressively use its teeth, claws, horns, or hooves
- Altered posture and expression
- Paralytic Form

This is manifest by ataxia and paralysis of the throat and masseter muscles, often with profuse salivation and the inability to swallowing.

4.2.3.3 Prevention and control

- Notification of suspected cases, and euthanasia of dogs with clinical signs and dogs bitten by a suspected rabid animal
- Reduction of contact rates between susceptible dogs by leash laws, dog movement control, and quarantine
- Mass immunization of dogs by campaigns and by continuing vaccination of young dogs
- Stray dog control and euthanasia of unvaccinated dogs with low levels of dependency on, or restriction by, people
- Dog registration.

Pre-exposure vaccine is administered on days 0, 7, and 21 or 28. For healthy, unvaccinated animals bitten by a rabid dog, post-exposure prophylaxis consists of wound care, local infiltration of rabies immune globulin, and vaccine administration on days 0, 3, 7, 14, and 28

4.3 Parasitic diseases

Parasitic diseases pose a serious threat to animal health and more difficult to control. Parasites have a better capacity to overcome host resistance. Vectors if involved, are more difficult to control on the animal and in the environment. Parasites remain viable in the vector for long time. Diagnostic techniques not very well developed and vaccines generally not available. Important parasitic diseases with regard to Gaushalas have been discussed.

(A) Hemoprotozoan diseases

4.3.1 Babesiosis Babesiosis is caused by intra-erythrocyte protozoan parasites of the genus *Babesia*. It affects a wide range of domestic and wild animals.

4.3.1.1 Transmission: The main vectors of *B bigemina* and *B bovis* are *Rhipicephalus (Boophilus)* spp ticks, in which transmission occurs trans-ovarially. Although the parasites can be readily transmitted experimentally by blood inoculation and mechanical transmission by insects.

4.3.1.2 Clinical signs

- The acute disease generally runs a course of one week.
- Fever (frequently $\geq 106^{\circ}$ F) persists for long time.

- In appetite, increased respiratory rate, muscle tremors, anaemia, jaundice, and weight loss; hemoglobinaemia and hemoglobinuria occur in the final stages.
- CNS involvement due to adhesion of parasitized erythrocytes in brain capillaries can occur with *B bovis* infections.
- Either constipation or diarrhoea may be present.

4.3.1.3 Treatment and control

- Antibabesial drugs like diminazene aceturate @ 3.5 mg/kg via IM route and imidocarb @ 1.2 mg/kg via SC route. However, imidocarb @ 3 mg/kg provides protection from babesiosis for 4 wk and will also eliminate *B bovis* and *B bigemina* from carrier animals.
- Supportive treatment is advisable, particularly in valuable animals, and may include the use of anti-inflammatory drugs, corticosteroids, and fluid therapy.
- Blood transfusions are recommended in severely anaemic animals.
- Control of ticks using ectoparasitocides agents is must.

4.3.2 Anaplasmosis

Clinical bovine anaplasmosis is usually caused by *Anaplasma marginale* with an appendage has been called *Anaplasma caudatum*, but it is not considered to be a separate species. Cattle are also infected with *Anaplasma centrale*, which generally results in mild disease.

4.3.2.1 Transmission: The disease is transmitted by ticks (*Dermacentor*, *Rhipicephalus*, *Ixodes*, *Hyalomma*, *Argas*, etc.). In animals <1 yr old anaplasmosis is usually subclinical, in yearlings and 2-yr-olds it is moderately severe, and in older cattle it is severe and often fatal.

4.3.2.2 Clinical signs

- Progressive anaemia
- Inappetence
- Loss of coordination
- Difficulty in breathing
- Rapid pulse and increased heart rate
- The colour of urine may be brown
- A transient febrile response, with the body temperature rarely exceeding 106° F (41° C) occurs at about the time of peak rickettsemia
- Mucous membranes appear pale and then yellow

4.3.2.3 Treatment and control

- Commonly used treatment consists of a single IM injection of long-acting oxytetracycline at a dosage of 20 mg/kg.

- Blood transfusion to partially restore the PCV greatly improves the survival rate of more severely affected cattle.
- Carrier state may be eliminated by administration of a long-acting oxytetracycline preparation (20 mg/kg, IM, at least two injections with a 1-wk interval).
- Supportive treatment is advisable, particularly in valuable animals, and may include the use of anti-inflammatory drugs, corticosteroids, and fluid therapy.
- Control of ticks using ectoparasiticide agents is must.



Lymphnode enlargement in Theileriosis.

4.3.3 Theileriosis

Theileriosis is also an hemoprotozoan disease caused by *Theileria* spp. The most important species affecting cattle are *T. parva* and *T. annulata*, which cause widespread death in tropical and subtropical areas. The disease is transmitted by the tick (*Rhipicephalus* spp).

4.3.3.1 Clinical signs

- Fever (> 106° F) occurs 7–10 days after parasites are introduced by feeding ticks
- Lymph node swelling becomes pronounced and generalized
- Lymphoblasts in Giemsa-stained smears of needle aspirates from lymph nodes contain multinuclear schizonts.
- Anorexia
- Lacrimation and nasal discharge
- Terminally, difficulty in respiration (dyspnoea) is common.
- Death usually occurs 18–24 days in untreated cases.

4.3.3.2 Treatment and control

- Drug of choice is Buparvaquone @ 2.5 mg/kg b.wt. IM which is highly effective if administered in the early stages of clinical disease but is less effective in the advanced stages
- Sometimes long-acting oxytetracycline given simultaneously; although oxytetracycline has little therapeutic effect when administered after development of disease. It inhibits development of the parasite when given at the outset of infection.
- Supportive treatment is advisable, particularly in valuable animals and may include the use of anti-inflammatory drugs, corticosteroids, and fluid therapy.
- Control of ticks using ectoparasiticide agents is must.

4.3.4 Trypanosomosis

Trypanosomosis is commonly known as Surra and caused by *Trypanosoma evansi*. Surra affects mainly camels and horses but buffaloes and cattle are also affected

4.3.4.1 Transmission

Agent is transmitted from animal to animal mechanically by hematophagous flies, including *Tabanus* spp and *Musca* spp.

4.3.4.2 Clinical Signs

- Fever and progressive anemia.
- Weight loss and icterus.
- Progressive weakness and lethargy.
- Edematous swellings of the lower parts of the body (legs, briskets, inguinal area and abdomen).
- Urticarial plaques in the skin Petechial hemorrhages of the serous membranes (eyelids, nostrils and anus).
- Recurrent episodes occur during the course of disease.

4.3.4.3 Treatment and control

- Anti-trypanosomal drugs like quinapyramin sulfate and diminazeneaceturate (curative) can be used for effective treatment.
- Supportive treatment is advisable, particularly in valuable animals, and may include the use of anti-inflammatory drugs, corticosteroids, and fluid therapy.
- Control of flies using ectoparasiticides agents is must.

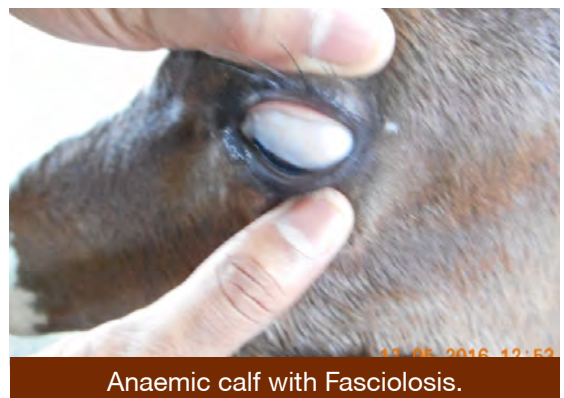
(B) Endoparasitic diseases

4.3.5 Fasciolosis

Fasciolosis, an economically important parasitic infection caused by a fluke *Fasciola hepatica* is seen in cattle, buffalo and other small ruminants. The disease is often fatal in young animals in conjunction with "black disease".

4.3.5.1 Clinical signs

- The acute syndrome can be complicated by concurrent infections with *Clostridium novyi*, resulting in "black disease" (clostridial necrotic hepatitis), although this is now less common due to vaccination against clostridial diseases.
- In subacute disease, large number (500–1,500) of metacercariae are ingested over longer periods of time; survival is longer (7–10 wk), even in cases with significant hepatic damage, but deaths occur due to haemorrhage and anaemia.
- Chronic fasciolosis can be seen in all seasons but manifests primarily in late fall and winter. Important clinical signs include anaemia, unthriftiness, sub-



mandibular oedema, and reduced milk production.

4.3.5.2 Treatment and control

- Several drugs are available to treat infected ruminants, including Triclabendazole, clorsulon (cattle and sheep only), Albendazole, Fenbendazole, Closantel, Rafoxanide, and Oxyclozanide.
- Control measures for *F. hepatica* ideally should involve removal of flukes in affected animals, reduction of the intermediate host snail population
- Prevention of livestock access to snail-infested pasture.
- Routine deworming will prevent the disease.

4.3.6 Amphistomosis

An economically important parasitic infection caused by a numerous species of paramphistomes (*Paramphistomum*, *Calicophoron*, *Cotylophoron*) in ruminants. The adult parasites are pear-shaped, pink or red, up to 15 mm long, and attach to the lining of the rumen. Immature forms are found in the duodenum and are 1–3 mm long.

4.3.6.1 Transmission

Eggs are passed in the faeces, and miracidiae hatch in the water and infect planorbid or bulinid snails. Development in the snail is similar to that in the life cycle of *Fasciola hepatica*, with the snail shedding cercariae that encyst on the herbage. In the ruminant host, the young flukes excyst and remain in the small intestine for 3–6 wk before migrating forward through the reticulum to the rumen. Eggs are produced 7–14 wk after infection.

4.3.6.2 Clinical signs

- Diarrhoea with foul smell
- Affected animals exhibit anorexia, polydipsia, unthriftiness, and severe diarrhoea.
- Extensive mortality may occur, especially in young cattle and sheep.
- Older animals can develop resistance to re infection but may continue to harbour numerous adult flukes.

4.3.6.3 Treatment and control

- Control measures to reduce the host snail population are as for control of fasciolosis. Treatments with reported success (efficacies >90%) are oxyclozanide (two doses 3 days apart) and the combination of bithional and levamisole.
- Prevention of livestock access to snail-infested pasture
- Routine deworming will prevent the disease.

4.3.7 Gastrointestinal parasitism

The common stomach worms of cattle are *Haemonchus placei* (barber's pole worm, large stomach worm, wire worm), *Ostertagia ostertagi* (medium or brown stomach worm), and *Trichostrongylus axei* (small stomach worm).

4.3.7.1 Clinical signs

- Severe diarrhoea
- Anaemia during heavy *Haemonchus* infection
- Hypoproteinemia and oedema particularly under the lower jaw (bottle jaw) and sometimes along the ventral abdomen.
- Heavy infections can result in death before clinical signs appear.
- Other clinical signs include progressive weight loss, weakness, rough coat, and anorexia.

4.3.7.2 Treatment and control

- Broad-spectrum anthelmintics currently available belong to five different chemical groups:
 - 1) Benzimidazoles (white drenches),
 - 2) Imidazothiazoles (yellow drenches),
 - 3) Macrocyclic lactones (clear drenches),
 - 4) Amino-acetonitrile derivatives, and
 - 5) Spiroindoles.



Pot belly appearance due to severe endoparasitism.

The Benzimidazoles include Thiabendazole, the forerunner of modern broad-spectrum anthelmintics, which set a new standard in efficacy and are still widely used today.

- Routine deworming is required to prevent gastrointestinal parasitism
- Periodic fecal examination is also helpful to control such parasitism

4.3.8 Schistosomiasis

Schistosomes are members of the genus *Schistosoma*, family Schistosomatidae. Adult worms are obligate parasites of the vascular system of vertebrates.

Transmission: The occurrence of cattle schistosomes within their range is discontinuous, depending on the presence of intermediate snail hosts, their level of infection, and the frequency of water contacts.

4.3.8.1 Clinical signs

- Diarrhoea, weight loss, anaemia, hypoalbuminemia, hyperglobulinemia, and severe eosinophilia that develop after the onset of egg excretion.
- Severely affected animals deteriorate rapidly and usually die within a few months of infection, while those less heavily infected develop chronic disease with growth retardation. In the intestinal form, passage of eggs through the gut wall causes the lesions, while in the hepatic form, granulomas form around eggs trapped in the tissues.
- Other hepatic changes include medial hypertrophy and hyperplasia of the portal veins, development of lymphoid nodules and follicles throughout the organ, and periportal fibrosis in more chronic cases.

- Extensive granuloma formation also is seen in the intestine. In severe cases, numerous areas of petechiation and diffuse haemorrhage are seen in the mucosa, and large quantities of discoloured blood may be found in the intestinal lumen.
- Nasal schistosomiasis is associated with cauliflower-like growths on the nasal mucosa, causing partial obstruction of the nasal cavity and snoring sounds when breathing.
- Hemorrhagic and/or mucopurulent nasal discharge is a common feature.

4.3.8.2 Treatment and Contro

- Praziquantel (25 mg/kg) is highly effective, although two treatments at 3–5 wk apart may be required.
- The most effective way to control cattle schistosomiasis in endemic areas is to prevent contact between the animals and the parasite by fencing of water bodies and supplying clean water.

(C) Ectoparasitic diseases (mange, mite, tick, flea, etc.)

Ectoparasites are organisms which inhabit the skin or outgrowths of the skin of another organism (the host) for various periods, and may be detrimental to the latter. Various ectoparasites cause significant infestations in many kinds of domestic animals. Many of these ectoparasites (e.g. most lice) are host specific, while others (e.g. many ticks) parasitize a wider range of hosts. Several ectoparasites currently associated with domestic animals have been acquired by the introduction of either host or parasite into new regions, as animals have become domesticated throughout the world. Many ectoparasites are known to be vectors of pathogens. However, ticks in large aggregations causes' anemia and hypersen-sitivity reaction.



Tick infestation in cattle.

Direct losses: Direct losses are a result of discomfort and damage caused by the parasites. Discomfort results in drops in milk production and retarded growth rates. Ticks, blowflies, sheep keds and mites cause direct damage to hides resulting from rubbing and scratching due to pruritis.

Indirect losses: Indirect losses are due to diseases transmitted by ectoparasites.

- Tick borne diseases - Babesiosis, Anaplasmosis, Dermatophilosis, Theileriosis and Heart Water.
- Flies - transmit mastitis and keratoconjunctivitis, Trypanosomiasis and other diseases
- Midges - transmit Bluetongue, African Horse Sickness and other diseases
- Treatment and prevention.

Spray and dipping

- Amitraz 0.025-0.050% @ 3ml/Litre of water for topical application.
- Deltamethrin or cypermethrine @ 3ml/Litre of water for topical application.

Injectable

- Ivermectin or Doramectin @ 200ug/Kg bwt at SC route.
- Pour-on product Permethrin 4%.

Prevention and control

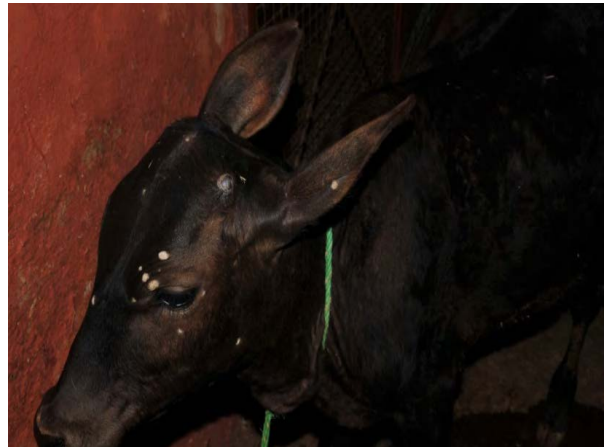
- Insecticides, pour on, spray, and dip programs.
- Ear tags containing pyrethroids.
- Good sanitation, optimum nutrition, drainage of confinement areas, removal of droppings, and cleaning feeding areas.

(D) Fungal diseases (Dermatomycoses, etc.)

This is the most common infectious skin disease affecting beef cattle. It is caused by a fungus, and is transmissible to man. Typically, the disease appears as crusty grey patches



Fungal infection in calf.



Fungal infection in calf.

usually in the region of the head and neck and particularly around the eyes. As a first step in controlling the disease, it is recommended that, whenever possible, affected animals should be segregated and their pens or stalls cleaned and disinfected. Clean cattle which have been in contact with the disease should be watched closely for the appearance of lesions and treated promptly. Proper nutrition, particularly high levels of Vitamin A, copper and zinc while not a cure, will help to raise the resistance of the animal and in so doing offer some measure of control.

For treatment ointments containing anti-fungal drug is useful. Systematically, Greseoflavin @ 7.5 mg per kg body-weight may be used.

5. Management of Non-Infectious Diseases

Number of noninfectious diseases have been documented to occur in dairy animals of Gaushalas, affecting all body systems. Gastrointestinal diseases appear to be the most common afflictions, particularly indigestion, enteritis, respiratory problem, congenital defects, etc. The major causes of noninfectious disease of the GI tract include dietary overload or indigestible feeds, chemical or physical agents, obstruction of the stomach and intestines caused by the ingestion of foreign bodies or by any physical displacement

or injury to the GI tract that interferes with the flow of ingesta, enzyme deficiencies, abnormalities of the mucosa that interfere with normal function (eg, gastric ulcers, inflammatory bowel disease, villous atrophy, neoplasms), and congenital defects. GI manifestations such as vomiting and diarrhoea may develop secondary to systemic or metabolic diseases such as uremia, liver disease, and hypoadrenocorticism. Major non-infectious diseases of dairy importance discussed.

5.1 GI tract disorders

5.1.1 Bloat

Over distention of the rumen and reticulum with the gases of fermentation, either in the form of persistent foam mixed with the ruminal contents, called primary or frothy bloat, or in the form of free gas separated from the ingesta, called secondary or free-gas bloat.

5.1.1.1 Clinical findings

- Bloat is a common cause of sudden death in farm animals.
- In lactating dairy cattle, bloat commonly begins within 1 hr after being turned onto a bloat-producing pasture.
- Bloat may develop on the first day after being placed on the pasture but more commonly develops on the second or third day.
- In primary pasture bloat, the rumen becomes obviously distended suddenly, and the left flank may be so distended that the contour of the paralumbar fossa protrudes above the vertebral column; the entire abdomen is enlarged.
- As the bloat progresses, the skin over the left flank becomes progressively more taut and, in severe cases, cannot be "tenting".
- Dyspnoea and grunting are marked and are accompanied by mouth breathing, protrusion of the tongue, extension of the head, and frequent urination.
- Rumen motility does not decrease until bloat is severe.
- In secondary bloat, the excess gas is usually free on top of the solid and fluid ruminal contents.
- Secondary bloat is seen sporadically.
- There is tympanic resonance over the dorsal abdomen left of the midline. Free gas produces a higher pitched ping on percussion than frothy bloat.
- Distention of the rumen can be detected on rectal examination.
- In free-gas bloat, the passage of a stomach tube or trocarization releases large quantities of gas and alleviates distention.

5.1.1.2 Treatment

- Variety of antifoaming agents are effective, including vegetable oils (eg, peanut, corn, soybean), simethicone and mineral oils (paraffins) @ 250–500 ml. Dioctyl sodium sulfo-succinate, a surfactant, is commonly incorporated into one of the above oils and sold as a proprietary antibloat remedy, which is effective if administered early. Poloxalene (25–50 g, PO) is effective in treating legume bloat

but not feedlot bloat.

- Placement of a rumen fistula provides short-term relief for cases of free-gas bloat associated with external obstruction of the esophagus.
- In life-threatening cases, an emergency rumenotomy may be necessary.
- A trocar and cannula may be used for emergency relief, although the standard-sized instrument is not large enough to allow the viscous, stable foam in peracute cases to escape quickly enough. A larger bore instrument (2.5 cm in diameter) is necessary, but an incision through the skin must be made before it can be inserted through the muscle layers and into the rumen. If the cannula fails to reduce the bloat and the animal's life is threatened, an emergency rumenotomy should be performed.
- If the cannula provides some relief, an antifoaming agent can be administered through the cannula, which can remain in place until the animal has returned to normal, usually within several hours.
- Additionally antihistaminic, rumenotorics and multivitamins should be given.

5.1.1.3 Control and prevention

Satisfactory method available to prevent pasture bloating is continual administration of antifoaming agent during the risk period. Available antifoaming agents include oils and fats and synthetic nonionic surfactants. Oils and fats are given at 60–120 ml/head/day; doses up to 240 ml are indicated during dangerous periods. Poloxalene, a synthetic polymer, is a highly effective nonionic surfactant that can be given at 10–20 g/head/day and up to 40 g/head/day in high-risk situations. Ionophores effectively prevent bloat, and a sustained-release capsule administered into the rumen and releasing 300 mg of monensin daily for a 100-day period protects against pasture bloat and improves milk production on bloat-prone pastures.

5.1.2 Grain overload in ruminants (lactic acidosis, carbohydrate engorgement, rumenitis)

Grain overload is an acute disease of ruminants that is characterized by rumen hypomotility to atony, dehydration, acidemia, diarrhea, depression, incoordination, collapse, and death in severe cases.

5.1.2.1 Clinical findings

- Carbohydrate engorgement results in conditions ranging from simple indigestion to a rapidly fatal acidemia and strong ion (metabolic) acidosis.
- Within 24–48 hr of the onset of severe overload, some animals will be recumbent, some will be staggering, and others will be standing quietly; all will be completely off feed.
- Immediately after consuming large quantities of dry grain, cattle may gorge themselves on water, but once ill they usually do not drink at all.
- Respirations tend to be shallow and rapid, up to 60–90/min.
- Heart rate usually is increased in accordance with severity of the acidemia; the prognosis is poor for cattle with heart rates > 120 bpm.

- Diarrhea is common and usually profuse and malodorous. Feces are soft to liquid, yellow or tan, and have an obvious sweet-sour odor.
- Feces frequently contain undigested kernels of the feed that has induced the overload. In mild cases, dehydration equals 4–6% body wt, but losses may reach 10 to 12% in severe cases.
- Acute laminitis may be present and is most common in those animals not severely affected; chronic laminitis may develop weeks or months later.
- Anuria is a common finding in acute cases, and diuresis after fluid therapy is a good prognostic sign.

5.1.2.2 Treatment

- In standing animals, rumenotomy is preferred to rumen lavage, because animals may aspirate during the lavage procedure and only rumenotomy ensures that all ingested grain has been removed.
- Rigorous fluid therapy is needed to correct the metabolic acidosis, dehydration and to restore renal function. Initially, over a period of ~30 min, 5% sodium bicarbonate soln. should be given IV (5 L/450 kg). During the next 6–12 hr, a balanced electrolyte solution, or a 1.3% solution of sodium bicarbonate in saline, may be given IV.
- During the convalescent period, which may last 2–4 days, good-quality hay and no grain should be given, and the grain then reintroduced gradually.
- If treatment was not started early enough to prevent acidification of the ruminal contents, and mycotic infection of the rumen wall ensues, relapse is likely within 3–5 days and the prognosis is grave.
- Administration of Thiamine is required to revive the rumen microflora.
- If possible, cud transplantation from healthy animals is very helpful.

5.1.2.3 Prevention

- Accidental access to concentrates should be avoided.
- Feedlot cattle should be introduced gradually to concentrate rations over a period of 2–3 wks, beginning with a mixture of ≤50% con. in the milled feed containing roughage.

5.1.3 Indigestion

Simple indigestion is usually associated with a sudden change in the pH of the ruminal contents, such as a decrease in ruminal pH due to rapid fermentation of ingested carbohydrates or an increase in ruminal pH due to forestomach hypomotility and putrefaction of ingested feed. It can also result from accumulation of excessive quantities of relatively indigestible feed that may physically impair rumen function. Multiple animals are usually simultaneously affected because simple indigestion has a nutritional basis, although the severity of the clinical signs can vary among animals.

5.1.3.1 Clinical signs

- Clinical signs depend on the type of animal affected and cause of the disorder.

- Overfeeding of silage causes anorexia and moderate drop in milk production.
- Rumen is usually full, firm, and doughy; primary contractions are decreased in rate or absent, but secondary contractions may be present although usually decreased in strength.
- Temperature, pulse, and respiration are normal. Feces are normal to firm in consistency but reduced in amount. Recovery usually is spontaneous within 24–48 hr.

5.1.3.2 Treatment and control

- Treatment is aimed at correcting the suspected dietary factors. Spontaneous recovery is usual when animals are fed a typical ruminant diet.
- Administration of 20L of warm water or saline via a stomach tube, followed by vigorous kneading of the rumen, may help to restore rumen function in adult cattle.
- Magnesium hydroxide PO may be useful when excessive amounts of grain have been ingested, but magnesium hydroxide should only be administered to cattle documented to have low ruminal pH (<6); otherwise, excessive forestomach and systemic alkalization can result.
- Purported rumenatorics (eg, nux vomica, ginger, tartar emetic, parasympathomimetics) are not recommended as ancillary treatments.
- If too much urea or protein has been ingested, vinegar (acetic acid) may be administered PO to return rumen pH to the normal range.
- If the number or activity of ruminal microbes is reduced, administration of 4–8 L of ruminal fluid from a healthy cow will help.
- Oral or intravenous electrolyte solutions may be needed to correct electrolyte and acid-base abnormalities, particularly in dehydrated cattle.

5.2 Respiratory disorders (cold, pneumonia etc)

Aspiration Pneumonia (Foreign-body pneumonia, Inhalation pneumonia, Gangrenous pneumonia)

Aspiration pneumonia is a pulmonary infection characterized by inflammation and necrosis due to inhalation of foreign material. Severity of the inflammatory response depends on the material aspirated, the type of bacteria aspirated, and the distribution of aspirated material in the lungs.

5.2.1 Clinical findings

- Affected animals show pyrexia 104–105°F (40–40.5°C), a painful expression, arched back, inappetance, depression, toxic mucous membranes, and an increased respiratory rate (>40–60 breaths/min) with a shallow abdominal component.
- Often associated with a purulent nasal discharge that sometimes is tinged reddish brown or green.
- Milk yield is greatly reduced to zero in lactating animals.
- Thoracic auscultation reveals reduced lung sounds over affected consolidated

lung, with increased breath sounds over normal lung.

- In cows that aspirate ruminal contents as a consequence of becoming cast with hypocalcaemia, toxemia is usually fatal within 1–2 days.

5.2.2 Prevention and treatment

- Broad-spectrum antibiotics should be used in animals known to have inhaled a foreign substance without waiting for signs of pneumonia to appear; however, this rarely occurs in farm animals presented with severe clinical signs.
- A trans-tracheal wash can help identify the causative agent for which an antibiotic sensitivity can be obtained.
- Care and supportive treatment include NSAIDs such as flunixinmeoglumine.
- Despite all treatments, prognosis is poor, and efforts must be directed at prevention.

5.3 Production disease

Previously known as “Metabolic diseases”, owing to the fact that they affect body’s metabolism adversely, the term “Production diseases”, introduced subsequently. Based on etiology and nature of the disease process, occur as a result of higher production beyond the animal’s metabolic capacity, high producing dairy animals always prone to abnormality. Breeding and feeding of high milk yield animals attribute to imbalance between “input” of dietary nutrient and “output” of production leading to depletion of body reserve i.e. “throughput inches. Susceptibility appears to be related to extremely high turnover of fluids, salts and soluble organic materials during the early part of lactation under the strong hormonal influence. Important production diseases are discussed in the following text.

5.3.1 Milk fever

Parturient paresis is an acute to peracute, febrile, flaccid paralysis of dairy cows that occurs most commonly at or soon after parturition and manifest by generalized paresis, and circulatory collapse.

5.3.1.1 Clinical findings

Stage 1: Animals are ambulatory but show signs of hypersensitivity and excitability. Cows may be mildly ataxic, have fine tremors over the flanks and triceps, and display ear twitching and head bobbing. Cows may appear restless, shuffling their rear feet and bellowing. If calcium therapy is not instituted, cows will likely progress to the second, more severe stage.

Stage 2: Animals are unable to stand but can maintain sternal recumbence. Cows are obtunded, anorectic, and have a dry muzzle, subnormal body temperature, and cold extremities. Auscultation reveals tachycardia and decreased intensity of heart sounds. Peripheral pulses are weak. Cows often tuck their heads into their flanks, or if the head is extended, an S-shaped curve to the neck may be noted.

Stage 3: Cows lose consciousness progressively to the point of coma. They are unable to maintain sternal recumbency, have complete muscle flaccidity, are unresponsive to stimuli, and can suffer severe bloat. As cardiac output worsens, heart rate can approach 120 bpm, and peripheral pulses may be undetectable. If

untreated, cows in stage 3 may survive only a few hours.

5.3.1.2 Treatment

- Treatment is directed toward restoring normal serum calcium levels as soon as possible to avoid muscle and nerve damage and recumbency. Recommended treatment is IV injection of a calcium gluconate salt, although SC is also used.
- A general rule for dosing is 1 g calcium/45 kg (100 lb) body wt. Calcium is cardiotoxic; therefore, calcium-containing solutions should be administered slowly (10–20 min) while cardiac auscultation is performed.
- If severe dysrhythmias or bradycardia develop, administration should be stopped until the heart rhythm has returned to normal. Endotoxic animals are especially prone to dysrhythmias caused by IV calcium therapy.

5.3.1.3 Prevention

- Feeding of low-calcium diets during the dry period.

5.3.2 Ketosis (acetonemia, ketonemia)

Ketosis is a common production disease of adult cattle. It typically occurs in dairy cows in early lactation and is most consistently characterized by partial anorexia and depression. In addition to inappetance, signs of nervous dysfunction, including pica, abnormal licking, incoordination and abnormal gait, bellowing, and aggression, are occasionally seen.

5.3.2.1 Clinical findings

- Cows maintained in confinement stalls, reduced feed intake is usually the first sign of ketosis.
- Cows with ketosis often refuse grain before forage.
- In group-fed herds, reduced milk production, lethargy, and an “empty” appearing abdomen are usually the signs of ketosis noticed first.
- On physical examination, cows are a febrile and may be slightly dehydrated.
- Rumen motility is variable, being hyperactive in some cases and hypoactive in others.
- CNS disturbances are noted in a minority of cases showing symptoms like, abnormal licking and chewing, chewing incessantly on pipes and other objects in their surroundings.
- Occasionally, incoordination and gait abnormalities along with aggression and bellowing observed.

5.3.2.2 Treatment

- Treatment of ketosis is aimed at reestablishing normoglycemia and reducing serum ketone body concentrations.
- IV administration of 500 ml of 50% dextrose solution is a common therapy.
- Glucose therapy generally results in rapid recovery, especially in cases occurring near peak lactation.

- Glucose and glucocorticoid therapy may be repeated daily as necessary. Propylene glycol administered orally (250–400 g/dose [8–14 oz]) once per day acts as a glucose precursor and is effective as ketosis therapy.
- Long-acting insulin preparation given IM at 150–200 IU/day may be beneficial.

5.3.2.3 Prevention and control

- Prevention of ketosis is via nutritional management. Modifying diets of late lactation cows to increase the energy supply from digestible fiber and reduce the energy supply from starch which may aid in partitioning dietary energy toward milk and away from body fattening.

5.3.3 Postparturient hemoglobinuria (PPH)

Postparturient hemoglobinuria is a sporadic condition seen worldwide that most commonly affects individual high-yielding dairy cows at the onset of lactation. It is characterized by development of peracute intravascular hemolysis and anemia with potentially fatal outcome. Exact cause is unknown, but phosphorus depletion or hypophosphatemia has been incriminated as a major predisposing factors. Severe intracellular phosphorus depletion of red blood cells (RBCs) is known to increase osmotic fragility of the RBCs, possibly predisposing to intravascular hemolysis.

5.3.3.1 Clinical signs

- Clinical cases are rare, but when they occur, the case fatality rate is high (10%–30%).
- Rapid intravascular hemolysis leads to severe anemia, tachycardia, weakness, hemoglobinuria with dark brown or red urine, and pallor over several days.
- Milk production drops rapidly.
- Affected cows also may have fever, diarrhea, and tachypnoea.
- Hemolytic crisis of survived cow may take several months to recover completely.
- Icteric signs with the evidence of increased erythropoiesis observed in subclinical convalescent cows.

5.3.3.2 Treatment

- Parenteral IV administration of monosodium di-hydrogen phosphate (60 g in 300 ml of sterile water) followed by oral treatment with 200–300 g of sodium phosphate salts every 12 hr is suitable for rapid correction of hypophosphatemia.
- Copper glycinate (120 mg available copper) has been recommended in cases with copper deficiency as the underlying cause.
- Transfusion of large quantities of whole blood is the best treatment for severely affected cows.
- Crystalloid fluids may be beneficial if blood is not available and may protect the kidneys against toxic and anoxic damage, but monitoring the PCV and the total protein concentration is required to prevent third spacing due to the decreased intravascular oncotic pressure.

5.4 Deficiency diseases (vitamin and mineral deficiency)

Criteria should be followed to assess importance of nutrition in etiology of deficiency diseases:

- If the deficiency of specific nutrient may be occurring in diet.
- Suspected specific nutrient is causing the observed symptom or not.
- Supplementation of the specific nutrient can prevent the condition or not.
- Proper dietary and animal evaluation as well as response to supplementation is necessary before diagnosing a deficiency.

i) Vitamin A

Vitamin A (retinol) is necessary for the function of light-sensitive nerve cells (photoreceptors) in the eye's retina. It also helps to keep the skin and the lining of the lungs, intestine, and urinary tract.

Symptoms

Night blindness is an early symptom. Blindness can eventually develop. The eyes, skin, and other tissues become dry and damaged, and infections develop more often. Loss of reproductive function is one of the major causes in vitamin A deficiency. In the male, libido is retained but degenerative changes on the germinative epithelium of the seminiferous tubules causes reduction in number of motile, normal spermatozoa. In female, conception is usually not interfered with, but placental degeneration leads to abortion and the birth of dead or weak young. Placental retention is common.

Treatment and Control: Vitamin A deficiency should be treated immediately with vitamin A @ 440 IU/kg. The minimum daily requirement in all species is 40 IU of vitamin A/kg BW.

ii) Vitamin K

The major clinical sign of vitamin K deficiency in all species is impaired blood coagulation. Other clinical signs include low plasma prothrombin levels, increased clotting time and hemorrhage. In its most severe form, a lack of vitamin K will cause subcutaneous and internal hemorrhages, which can be fatal. Microorganisms in the rumen synthesize large amounts of vitamin K, and a deficiency is seen only in the presence of a metabolic antagonist, such as dicumarol from moldy sweet clover. Dicumarol poisoning can be reversed by administration of vitamin K. Parenteral vitamin K₁ is an effective treatment @ 1.1- 3.3 mg per kg body weight.

iii) Vitamin D

Vitamin D deficiency is usually caused by insufficient solar irradiation on animals and is manifested by poor appetite and growth followed by osteodystrophy. Deficiency of vitamin D in young one causes rickets due to inadequate mineralization of bone characterized by bending of the long bones and enlargement of the joints. In adults deficiency causes osteomalacia.

Treatment and Control: Affected animals should receive adequate calcium and phosphorus in the diet. The administration of supplementary vitamin D to animals by in diet or by injection is necessary only when exposure to sunlight or the provision of natural ration containing adequate amounts of vitamin D is impractical. A total daily intake of 7-12 IU/kg BW is optimal.

iv) Vitamin E deficiency

Dietary deficiencies of selenium and vitamin E and conditioning factors like dietary polyunsaturated fatty acids are the major cause.

Clinical findings: Ill-thrift in calves, lowered milk production in cows, white muscle disease calves, lowered fertility, embryonic death, retained fetal membranes, metritis, poor uterine involution, cystic ovaries, subclinical mastitis and impaired immune function, prenatal death, and abortion.

Prevention: Prevention of major diseases caused by selenium and vitamin E deficiencies can be achieved by dietary supplementation in the feed or water supplies, individual parenteral injections, oral administration, pasture top-dressing etc.

v) Thiamine deficiency

Thiamine deficiency causes poliencephalomalacia (PEM). PEM may be acute or subacute. Animals with the acute form often manifest blindness followed by recumbency, tonic-clonic seizures, and coma. Animals with the subacute form initially separate from the group, stop eating, and display twitches of the ears and face. The head is held in an elevated position. There is cortical blindness with absent menace response but normal bilateral pupillary light reflex. Dorsomedial strabismus may develop. Animals may show ataxia and sometimes a hypermetric gait. As the disease progresses, there is cortical blindness with a diminished menace response and unaltered palpebral and pupillary responses. Dorsomedial strabismus may develop. Head pressing, opisthotonos, and grinding of the teeth may also be seen.

Treatment of choice for PEM regardless of cause is administration of thiamine @ 10 mg/kg, tid-qid, for cattle or small ruminants. The first dose is administered by slow IV, otherwise, the animal may collapse. Subsequent doses are administered IM for 3–5 days. Dietary supplementation of thiamine at 3–10 mg/kg feed has been recommended for prevention.

vi) Cobalt deficiency

Cobalt deficiency is a disease of ruminants ingesting a diet deficient in cobalt, which is required for the synthesis of vitamin B₁₂. Clinical signs include inappetance, gradual loss of body weight, pica, marked pale color of the mucous membranes, decreased milk production and reproductive efficiency, pernicious anemia. Affected animals respond satisfactorily to oral dosing with cobalt or the IM injection of vitamin B₁₂. The recommended level of cobalt in the diet for cattle about 100 microgram/kg DM.

5.5 Poisoning (nitrate, cyanide, oregano-phosphorus etc.)

The farm environment is one in which potentially dangerous substances abound, in the form of weed killers, pesticides, wood preservatives, dips and even fertilizers. Animal medicines and topical preparations, although manufacturers try to build in generous safety factors, are often highly toxic in overdose, and careless inattention to recommended doses or procedures can have serious, even lethal effects, in livestock. This newssheet emphasizes the dangers and, where possible, describes the warning signs of poisoning in livestock by some common and potentially poisonous chemicals used on the farm. Episodes of acute poisoning in farm animals are often dramatic and generally require urgent veterinary intervention, which in all too many instances may be too late.

Laboratory identification of poisons can be laborious and expensive, as because certain specialist laboratories have the technical expertise to carry out the analyses. Prevention by safe storage and strict attention to manufacturers' labeled directions is obviously better than cure.

5.5.1 Nitrate and nitrite poisoning

Many species are susceptible to nitrate and nitrite poisoning, but cattle are affected most frequently. Ruminants are especially vulnerable because the ruminal flora reduces nitrate to ammonia, with nitrite (~10 times more toxic than nitrate) as an intermediate product. Nitrate toxicosis can also result from accidental ingestion of fertilizer or other chemicals. Minimum lethal dose of nitrite is 88-110 mg/kg BW.

5.5.1.1 Clinical findings

Salivation, abdominal pain, diarrhea, vomiting, dyspnoea, with a gasping rapid respiration, muscle tremor, weakness, stumbling gait, severe cyanosis followed by blanching of the mucosae, a rapid, small, weak pulse, and a normal or subnormal temperature. Blood has a chocolate-brown color. There may be pinpoint or larger hemorrhages on serosal surfaces.

5.5.1.2 Treatment

Slow IV injection of 1% methylene blue in distilled water or isotonic saline should be given @ 4-22 mg/kg or more, depending on severity of exposure. Lower dosages may be repeated in 20-30 min if the initial response is not satisfactory. Lower dosages of methylene blue can be used in all species, but only ruminants can safely tolerate higher dosages. If additional exposure or absorption occurs during therapy, re-treating with methylene blue every 6-8 hr should be considered. Rumen lavage with cold water and antibiotics may stop the continuing microbial production of nitrite.

5.5.1.3 Control

Silage suspected of dangerous levels of nitrate should be allowed to aerate overnight before feeding. If hazardous feed is to be fed, supplementation of the diet of sheep and cattle with chlortetracycline (30 mg/kg of feed) or sodium tungstate is partially effective for a period of about 2 weeks in suppressing the reduction of nitrate to nitrite.

5.5.2 Cyanogenic glycoside poisoning (cyanide, hydrocyanic acid)

Most outbreaks of hydrocyanic acid (HCN) poisoning are associated with the ingestion of plants that contain cyanogenic glucosides. The glycosides are non-toxic but HCN may be liberated from them by glycosidase and lyase present in the plant tissue. Ruminal microorganisms also produce glycosidase. A number of specific glycosides have been isolated and include linamarin from linseed and flax, lotaustralin from *Lotus australis*, dhurrin from sorghum, lotus from *Lotus arabicus*, and amygdalin from bitter almonds.

5.5.2.1 Clinical signs

Acute cyanide poisoning: Signs generally occur within 15-20 min to a few hours after animals consume toxic forage, and survival after onset of clinical signs is rarely >2 hr. Excitement can be displayed initially, accompanied by rapid respiration rate. Dyspnea

follows shortly, with tachycardia. The classic “bitter almond” breath smell may be present. Sudden unexpected death may ensue. Mucous membranes are bright red but may become cyanotic terminally. Venous blood is classically described as “cherry red” because of the presence of high venous blood pO₂; however, this color rapidly changes after death. Cardiac arrhythmias are common due to myocardial histotoxic hypoxia. Death occurs during severe asphyxial convulsions.

5.5.2.2 Treatment, Control, and Prevention

Immediate treatment is necessary. The IV injection of a mixture of sodium nitrite and sodium thiosulfate (5 g sodium nitrite, 15 g sodium thiosulfate in 200 ml water for cattle). Hungry cattle should not be allowed access to toxic plants, especially cultivated Sorghum Spp. Free-choice salt and mineral with added sulfur may help to protect against prussic acid toxicity. Grazing should be monitored closely during periods of environmental stress like drought or frost.

5.5.3 Organophosphates (OPs) poisoning

Poisoning by accidental exposure or overdosing with insecticides containing organophosphorus compounds are highly toxic and are readily absorbed by ingestion, inhalation and by percutaneous and perconjunctival absorption. There are two forms of toxicity, cholinesterase inactivation and an organophosphorus-induced delayed neurotoxicity.

5.5.3.1 Clinical findings

In general, OP pesticides have a narrow margin of safety, and the dose-response curve is quite steep. Signs of OP poisoning are those of cholinergic overstimulation, which can be grouped into 3 categories: muscarinic, nicotinic, and central. Muscarinic signs, which are usually, first to appear, include hyper salivation, meiosis, frequent urination, diarrhea, vomiting, colic, and dyspnea due to increased bronchial secretions and bronchoconstriction. Nicotinic effects include muscle fasciculations and weakness. Central effects include nervousness, ataxia, apprehension, seizures and severe depression. In delayed neurotoxicity cases signs do not appear for at least 8 and up to 90 days after the poisoning. Signs include posterior incoordination and paralysis.

5.5.3.2 Treatment

Three categories of drugs are used to treat OP poisoning:

1) Muscarinic receptor-blocking agents, 2) Cholinesterase reactivators, and 3) Emetics, cathartics, and adsorbents to decrease further absorption. Atropine sulfate blocks the central and peripheral muscarinic receptor-associated effects of OPs. Atropine in large (about double the normal) doses 0.25 mg/kg BW is the rational treatment. About one-third of this dose should be given with very slow IV in a 2% solution and the remainder by intramuscular injection. Injections may be repeated at 4-8-hourly intervals as signs return, and continued over a period of 24-48 hours. An improved treatment combines atropine with the cholinesterase-reactivating oxime, 2-pyridine aldoximemetho-chloride (2-PAM, pralidoxime chloride). Dosage of 2-PAM is 20-50 mg/kg, given as a 5% solution IM or by slow IV (over 5-10 min), repeated at half the dose as needed. IV 2-PAM must be given very slowly to avoid musculoskeletal paralysis and respiratory arrest.

Removal of the poison from the animal also should be attempted. If exposure was dermal, the animal should be washed with detergent and water but without scrubbing and irritating the skin. Oral administration of mineral oil decreases absorption of pesticide

from the GI tract. Activated charcoal (1–2 g/kg as a water slurry) adsorbs OPs and helps elimination in the feces.

5.5.4 Bracken fern poisoning

Bracken fern (*Pteridium aquilinum*) is found throughout the world and is among the five most numerous vascular plants. Enzootic hematuria is the most common result of bracken fern poisoning. Poisoning most often occurs during late summer when other feed is scarce, or when animals are fed hay containing bracken fern. Poisoning requires prolonged exposures. Affected livestock must ingest bracken fern for several weeks to years before disease develops.

5.5.4.1 Clinical signs

Affected cattle are weak, rapid body weight reduction and develop pyrexia (106–110°F [41–43°C]) once clinical effects manifest. Calves often have difficulty in breathing, with pale mucous membranes. Hemorrhages vary from minor mucosal petechiation to effusive bleeding, and at times large blood clots form that may be passed in the feces. Coagulation is prolonged, and bleeding may be pronounced and excessive even at small wounds such as small insect bites or minor scratches. Once animals develop clinical disease, poisoning is almost fatal. A less common manifestation of ptaquiloside toxicity is called bright blindness.

5.5.4.2 Treatment

Initial treatment for all species is to discontinue exposure to bracken fern. However, disease can appear weeks after livestock are removed from the fern-infested area. In acutely affected cattle, mortality is usually >90%. Measurement of the platelet count is recommended, as a best prognostic indicator for poisoned animals. Injection of a thiamine solution @ 5 mg/kg is suggested, given initially IV every 3 hr, then IM for several days. Oral supplementation may be required for an additional 1–2 wk, although SC injection of 100–200 mg/day for 6 days has been successful in some cases. Antibiotics may be useful to prevent secondary infections. Blood or even platelet transfusions may be appropriate but require large volumes (2–4 L blood) to effectively treat cattle.

5.5.4.3 Prevention

Most commonly, animals are forced to eat bracken fern when other forage is exhausted in late summer, although some animals may develop a taste for the young tender shoots and leaves. Poisoning can be avoided by improving pasture management to increase production of alternative forage. Bracken fern growth can be retarded by close grazing or trampling in alternative grazing pasture systems. Bracken fern density can be reduced by regular cutting of the mature plant or, if the land is suitable, by deep plowing. Herbicide treatment using asulam or glyphosate can be an effective method of control, especially if combined with cutting before treatment.

5.6 Hematuria

Hematuria indicates the presence of blood in the urine. Main causes of urological hematuria are kidney stones present in the urinary tract or kidney cancer, bladder or urinary tract infection. Some symptoms may be present and be suspected cause of urological hematuria: lumbar or pelvic pain, difficulty urinating, blood clots in the urine, pus in the urine (pyuria), the fact that the blood is found especially in the early urination

(cause urethral or prostatic urethrovaginal) or at the end of urination (cause bladder). In addition to the questions and clinical examination, study of urinary sediment in phase contrast microscope will allow to analyze the shape of red blood cells in the urine. Hematuria is not in itself a disease, but it can be a sign and it is therefore required to treat the predisposing cause of the disease.

5.7 Hemoglobinuria

Haemoglobinuria refers to the presence of free hemoglobin in urine. Excessive intravascular hemolysis is the invariable cause of this clinical sign. Disease conditions that cause hemoglobinuria are babesiosis, leptospirosis, bacillary hemoglobinuria, phosphorus and copper deficiency, water intoxication, copper poisoning, ingestion of certain plants, intravenous infusion of undiluted oxytetracycline and NSAIDS.

Babesiosis is a blood protozoan infection often observed in cross bred cattle and very rarely in buffaloes. Local breeds are generally resistant to this disease. Calves below 6 months are resistant to infection. Sudden onset of moderate to high fever (104-106°F) along with attendant signs of anorexia, depression, loss of rumination are the early signs. Later on, pallor mucosae and dark red to brown red or deep brown colored urine are the prominent signs.

Acute septicemic form of Leptospirosis characterized by causing intra vascular hemolysis, haemoglobinuria and fever. Primarily effect calves during first month of age. Clinical signs of septicemia are high fever, and petechiation of mucosa accompanied by signs of intravascular hemolysis. Adults suffer from sub acute and chronic form. Only sub acute form may produce intravascular hemolysis but of less severity. A consistent accompanying sign is blood stained milk with any physical change in udder.

Bacillary haemoglobinuria is very acute, toxemic and endemic disease characterized by diarrhoea, fever, abdominal pain and sudden death. Differentiation is done by blood film examination. Feces are dark brown or there may be diarrhea with much mucous and some blood. Nutritional hemoglobinuria is associated with low blood phosphorus levels. A prolonged hypophosphatemia is a major predisposing factor. Concurrent copper deficiency potentiates this disease. Buffaloes are more susceptible to this condition. Often disease appears during lactation and sometimes in late pregnancy. Haemoglobinuria is the first sign. Urine color ranges from deep brown to black frothy.

Hemoglobinuria due to water intoxication is a common condition observed in calves of 2-10 months of age. Often the sign appears few hours after drinking water. Clinical signs may vary and in most of the cases haemoglobinuria is the only clinical sign. Animal recover in 3-4 hours. In more severe form, nervous signs may accompany. There is hyperesthesia, muscular tremors, nystagmus and lethargy. Very rarely calves may develop hypothermia, edema of eyelids, arrhythmia and ruminal tympany. Hemoglobinuria can be corrected by treating the primary cause of the disease along with supportive therapy.

5.8 Electrocution/lightning stroke

Injury or death of an animal due to high-voltage electrical currents may be the result of lightning, fallen transmission wires, faulty electrical circuits, or chewing on an electrical cord.

5.8.1 Clinical findings

In most instances of electrocution by lightning stroke, death is instantaneous and the animal falls without a struggle.

Occasionally, the animal becomes unconscious but may recover in a few minutes to several hours; residual nervous signs (eg. depression, paraplegia, cutaneous hyperesthesia, blindness) may persist for days or weeks or be permanent.

Singe marks on or damage to the carcass, damage to the immediate environment, or both, occur in ~90% of cases of lightning stroke.

Beneath the singe marks, capillary congestion is common; the arboreal pattern characteristic of lightning stroke can be visualized best from the dermal side of the skin by subcutaneous extravasations of blood.

5.8.2 Treatment

- Lightning strike and electrocution should be considered true emergencies.
- Even if the effect of electrocution appears mild (as in chewing on an electrical cord), signs of shock or other complications may occur later.
- The survived animals require supportive and symptomatic therapy.
- Euthanasia is warranted for those animals' recumbent with fractures or severe muscle injuries where prognosis is grave.

5.9 Snake bite

There are more than 3500 species of snakes, but only about 250 are venomous. In India there are more than 200 species of land snakes and 20 types of sea snakes, all of them are poisonous. Cobras, common krait, Russell's viper are the common poisonous snakes of India. Effects of snake bite depend upon the quantity of venom injected, species of snakes, size of the bitten animals and the location of bite.

All snakes are not poisonous however, the symptomatic treatment of snake bite can be apparently started with appearance of symptoms and visible phang marks and visual evidence or previous history of appearance of reptiles in the shed, pasture or shelter campus. The treatment is aimed at **"TWIST"** Tourniquet to be applied above the bite/phang marks, bite to be **Washed**, Incision around the bite, **Sucking/Suction** of the envenomed blood/exudate by vacuum apparatus, **Transfer** of the animal to cool environment/ward for administering polyvalent antsnake venom.

5.9.1 Clinical signs

- Local swelling at the site of bite, bleeding and cut mark (often), sloughing of the skin, hemorrhage from rectum, gums and nostrils.
- Excitement and convulsion, regurgitation of ruminal ingesta, incoordination and lateral paralysis.

5.9.2 Treatment

- Place the animal in well ventilated area and avoid excessive movement.
- One unit of Polyvalent antiserum is sufficient for adult cattle.

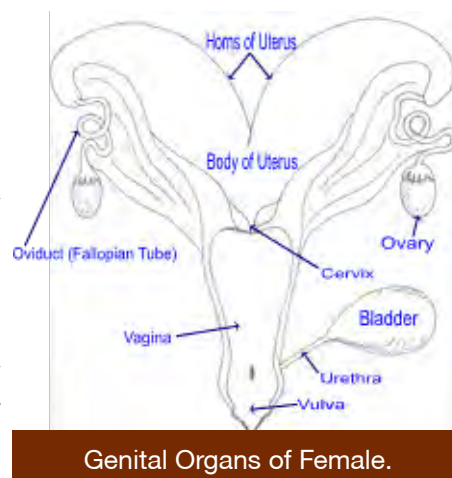
- Broad spectrum antibiotics (Streptopenicillin) and Anti-tetanus serum (1500-3000 IU, SC route) may be administered.
- Dexamethasone @ 40 mg IM and Adchrome or Etamsylate 10 ml IM for control of bleeding.

6. Management of Common Reproductive Disorders

A number of gynaecological and obstetrical disorders have been reported to occur in cows of Gaushalas, which require immediate interventions. These conditions include; prolapse of uterus, repeat breeding, retention of fetal membrane, endometritis, metritis, dystocia etc. Management of most of these disorders require the services of veterinary doctors. However, the basic knowledge about these reproductive disorders including pregnancy diagnosis may help the caretakers in the first aid and primary attention of the conditions until the services of qualified veterinary doctor are available.

6.1 Pregnancy diagnosis

Pregnancy examination should always represent the first step of genital examination. No animal should be treated unless the operator is positive that the animal is not pregnant. No animal should be pronounced non-pregnant unless both the horns of the uterus have been palpated carefully throughout their entire length. A diagnosis of pregnancy should never be made unless the positive signs of pregnancy have been detected and recognized beyond doubt Breeding history should only serve as supplementary information. There are at times, in some animals and certain stages of pregnancy when the positive diagnosis is impossible even for an experienced operator. The "Golden Rule" advises one to admit the inability or doubtfulness and to recommend the re-examination of the animal. Accurate early diagnosis of pregnancy is essential for successful breeding programme. Ability is required for successful practice. Skill is to be developed to indicate the duration within weeks in early and months in late pregnancy.



Genital Organs of Female.

6.1.1 External Indications

The main features are (i) Cessation of estrum, (ii) Increase in abdominal size but not reliable and (iii) Enlargement and edema of udder—it begins around 5th month in heifers while in older cows it appears in last month of pregnancy. Relaxation of pelvic ligaments and relaxation of vulva are visible in last weeks.

6.1.2 Internal indications on rectal examination

Pregnancy diagnosis is based on the following: (i) Presence of the amniotic vesicle, (ii) Increase in size of the uterus– dissimilarity, (iii) Fluid feeling and thinning of the uterus (iv) Slipping of the fetal membranes, (v) Feel of the fetus and its bump, (vi) Feel of the cotyledons, (vii) Enlargement of the middle uterine artery and (viii) Presence of CL. These signs are present in all pregnant animals. However, certain signs alone are not enough to declare an animal as pregnant.

6.1.3 Positive signs of pregnancy are

- (i) Feeling of Amniotic vesicle

- (ii) Feeling of Fetal membranes slip
- (iii) Palpation of Fetus/ Fetal bump
- (iv) Feeling of Cotyledons. Without confirming anyone of these positive signs no cow should be declared pregnant.

6.1.4 Uterine changes during pregnancy

- i) Increase of size of gravid horn and to a lesser extent the non-gravid horn because of the growing fetus and fetal fluid-leading to an enlargement and dissimilarity in size between the horns.
- ii) The increase in size leads to thinning of the uterine wall giving a characteristic fluid, watery "alive" feeling.
- iii) From 40-90 days, the uterus feels somewhat like a thick rubber balloon nearly filled with water.
- iv) The uterus remains mostly in the pelvic cavity upto 3 months afterwards descends into the abdominal cavity.

6.1.5 Amniotic vesicle

It is palpable in the free part of the uterine horn from about 30 days because of its tense nature. Up to about 40 days, it remains spherical after which it becomes oval. After 50-55 days, it loses its tenseness and is not palpable.

The bifurcation of the uterine horns is located. The horns are uncoiled and gently palpated along their entire length between the thumb and middle two fingers. The amniotic sac can be felt as a distinct round or oval turgid object (like a soft shelled hen's egg) slipping between the fingers. The sac should not be compressed directly but gently pushed backwards and forwards. The amniotic sac is located in the pregnant horn in the vicinity of greatest fluid enlargement and thinning of uterine walls.

6.1.6 Fetal membrane slip

Best performed between 35 and 90 days. Identify the bifurcation of uterine horns. Pick up and pinch or compress the enlarged gravid horn between the thumb and either the index or middle finger just cranial to the bifurcation. Allow the structures to slip and identify the slipping of the fetal membrane first and then the uterine wall (Double slipping). In very early pregnancy- it is recommended to grasp the entire horn and let it slip on the ventral aspect so that the thicker connective tissue band can be easily recognized. After 70 days of gestation, it is often easier to slip in the non-gravid horn.

6.1.7 Fetus

Palpation of the fetus before 75 days is not possible because of the smaller size and tenseness of the amniotic sac. Rocking of the flat hand over the enlarged uterus sets the fetal fluids in motion and results in rebound of the fetus against the hand (fetal bump). Upto 4-5 months, the fetal bump can be easily made. In late gestation after 8 months, fetal parts (not bump) are easily palpable.

6.1.8 Placentomes

Become recognizable by rectal palpation at about 80-90 days. First felt in the mid line

by pressing down the uterine body and the base of horns. In early stages, it is difficult to identify them as distinct individual structures. The uterus feels as if it has an irregular corrugated surface and feels like a sack full of small potatoes. Once the uterus sunk into the abdomen between 5 and 7 months, it is frequently impossible to palpate them.

6.1.9 Hypertrophy and fremitus of the middle uterine arteries

In non-gravid horn during early pregnancy, the fremitus is not possible to identify. The artery runs in the broad ligament along a tortuous course passing downwards and forwards over the pelvic brim. Inexperienced persons, sometimes confuse it with iliac and obturator arteries which are highly fastened. Middle uterine artery is very mobile and can be encircled with the thumb and finger. The characteristic hypertrophy and “whirring” (feels like, water surging intermittently through a thin rubber house) is noted in pregnant cows.

6.1.10 Rectal palpation different stages

35-40 days

- Requires more skill.
- Easily detectable in heifers and difficult in older cows.
- Uterus in the pelvic cavity.
- Slight enlargement on the free part of one horn with fluid feeling.
- Detectable dorsal bulging.
- Amniotic sac about the size of the yolk of a hen’s egg.
- CL ipsilateral to the horn containing amnion.

45-50 days

- Uterus in the pelvic cavity
- Difference in size of pregnant and nonpregnant horn.
- Dorsal bulging more pronounced.
- Amnion about the size of hen’s egg (soft shelled egg).
- Membrane slip.

60 days

- Uterus in the pelvic cavity.
- Uterus feels like a narrow ballon filled with water.
- Dissimilarity of horns.
- Membranes slip in both horns.
- Amnion not detectable
- Diametre of the gravid horn is about 6-9 cm.

90 days

- The uterus may be still in the pelvic cavity or over the pelvic brim.
- Uterus about the size of a football bladder.
- Dissimilarity of horns.
- Fetal bump easily palpable.
- Diametre of the gravid horn is about 10-13 cm.
- Cotyledons palpable.

- Fremitus detected.

120 days

- The uterus descends into the abdomen.
- Uterine contour is still palpable.
- Fetus can be palpated.
- Small placentomes can be identified.
- Diametre of the gravid horn is about 12.5-18 cm.
- Fremitus quite distinct.

150 days

- Uterus in the abdominal cavity.
- The cervix over the pelvic brim.
- Distinct crowded Placentomes about the size of ovaries are palpable.
- Fetus may or may not be palpable.

170-230 days

- Cervix at the brim of the pelvis.
- Tight cord like folds of uterus running deep into the abdomen from the cervix.
- Uterus difficult to palpate.
- Placentomes and fetus also difficult to palpate.

230-280 days

- The fetus extends back towards the pelvic cavity.
- The head and front feet palpable.
- Movement of fetus and fetal reflex can be detected.

6.1.11 Differential diagnosis

It should be made with urinary Bladder, rumen, pyometra metritis etc.

BLADDER

- A beginner is likely to mistake a filled bladder for gravid uterus.
- Identify the cervix first.
- Trace from the cervix to check whether the enlarged mass is in continuation with the cervix, if it is so then indeed the uterus.

RUMEN

- Rumen feels like a doughy, flaccid mass whereas the gravid uterus gives a live fluid feeling.
- Tracing from the cervix would reveal the uterus.

PYOMETRA

Normal Pregnancy	Pyometra
Dissimilar horns	Similar horns except in cows where the uterine involution is not complete.
Uterine wall thin	Uterine wall thick
Live fluid feeling	A thick fluid with no resilience.
Double slipping and fetus	No such positive signs of pregnancy

Placentomes palpable depending on the stage of pregnancy	No such positive signs of pregnancy
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METRITIS

- Thick uterine wall with no fluid feeling.
- Foul smelling discharge in metritis easily identifiable.

MUMMIFIED FETUS

Normal Pregnancy	Mummified fetus
Presence of fetal fluids	Absence of fluid
Placentomes and live fetus.	Placentomes and the uterus tightly contracted over a semisolid to solid fetal mass.
Fremitus Present	Mostly absent.

6.2. Prolapse of uterus and vagina

Protrusion of a part or complete uterus out of vulva can occur following calving. The cervico - vaginal prolapses will typically occur before calving, usually at last month of pregnancy. The condition worsens with the time; therefore, early intervention is essential to replace the organs in position and to prevent it from further injury or damage. The prolapsed mass may be dry, congested, inflamed, edematous and may be lacerated.

6.2.1 Correcting a prolapse

(i) Reduction

First attempt should be made to reduce the volume of prolapsed mass then restrain the animal in standing position. Give epidural anesthesia (inject 5 to 10 ml of 2% Lignocaine /Xylocaine into the epidural space between last sacral and 1st coccygeal vertebrae). The urine may be drained by lifting the prolapsed mass above the ischial arch (or) Evacuate the urinary bladder by passing the urinary catheter. The mass should be cleaned with 1:1000 potassium permanganate solution. Massage with warm saline water or sugar solution may be applied - to reduce edema of prolapsed mass.

(ii) Reposition

Before attempting repulsion ensure no rupture of the tissue, if any laceration is seen then the lacerated area should be closed with continuous lambert sutures with horizontal mattress using chromic catgut (No.3). Raise the prolapsed mass to the level of ischial arch. Then the reduced mass should be repelled back into its normal position/original location by applying outside force with palm on the prolapsed mass. Once half portion will go inside then the rest half portion will go easily in a short time.

(iii) Retention

To prevent recurrence, rope truss may be applied.

Rope truss method Place the rope truss over vulvar lips at appropriate location and hold it in position using rope tied around neck and shoulder. Ensure passage of urine.

Vulvar suturing

(a) Lacing of vulva (using umbilical tape/nylon ribbon):

Suture vulva ensuring that the sutures are passing at least 2-3 inches lateral to the vulvar

lips in the hair line. Use knots that can be easily untied or released when desired. Do antiseptic dressing daily.

(b) Buhner's method (Burried or hidden purse string type of sutures):

The vulvar sutures are helpful particularly when the animal is straining too much. Inject 7-8 ml of 2% xylocaine epidurally Disinfect vulva and perineal region. Make 1 cm horizontal skin incision mid way between anus and dorsal commissure and 1.5 cm horizontal incision cranial to the normally projected ventral commissure. Pass Buhner's needle through lower incision to dorsal incision and pass antibiotic soaked suture tape. Pass the antibiotics soaked suture tape on the upposite side also. Tighten the sutures in a way that permits entry of 2 to 3 fingers only.

6.2.2 Drugs

- (i) Give broad spectrum antibiotics like ampicillin or cloxacillin 2 gm i/m bid for 5 days.
- (ii) Inj. Chlorphenaramine maleate 0.4 to 0.5 mg. / kg body wt I/M once daily for 3-5 days.
- (iii) Calcium preparations 200 to 450 ml subcut or i/v.
- (iv) Inj. Melonex 0.5 mg / kg body wt, I/M once daily for 3 days.
- (v) Straining of the animal gradually reduced and ceased after 3 to 4 days.

6.2.3 Management

- (i) Keep constant and close observation to the animal.
- (ii) Give laxative diet to the animal.
- (iii) Once a cow has prolapsed, there's a high chance she will repeat the situation next time. This is due to an inherited problem in which some cows have a structural weakness of the reproductive tract that allows part of the vagina to prolapse during late pregnancy.
- (iv) Some bulls- whose mothers or female ancestors had this weakness - sire daughters that prolapse easily and they may pass this tendency on to their offspring.
- (v) To avoid prolapse problems, a cow that prolapses should be culled and both male and female offspring from such a cow should never be kept for breeding.



Cervico – Vaginal prolapse.

6.3 Repeat breeding (cyclic non-breeder cow)

The animal is apparently normal but not conceiving inspite of 3 or more services (AI or NS) given and having no palpable abnormalities in the genitalia and regularly coming into estrus at 20-21 days interval. Repeat breeding is one of the most important problems the veterinarians face in the field. The causes of RB are given below.

6.3.1 Causes

6.3.1.1 Failure of fertilization

Ovulation in the cow is atypical since it occurs 10-12 hr after the end of estrus and 24 after the onset of LH surge. The ovulatory defects may be due to endocrine deficiency or imbalance and mechanical factors.

6.3.1.2 Delayed ovulation

Certain cows have prolonged estrus and there may be lack of LH that is why the ovulation is delayed. It may be diagnosed by sequential rectal palpation of the ovaries e.g; at interval of 12 or 24 hr.

Treatment

- GnRH analogue 20 microgram I/M (Receptal 5 ml).
- hCG 1500 I.U. (Chorulon) i/m or i/v.
- Repeat AI at 12-24 hr interval two times.

(Note: If the estrus duration in repeater cow is prolonged then shift the AI on 2nd or 3rd day after the onset of estrus. In such cases AI is not advisable on 1st day)

6.3.1.3 Anovulation

It may occur when the cow goes into anestrus or during the first cycle after parturition. Diagnosis of anovulation can be made retrospectively by noting on rectal palpation that a follicle persists longer than one would have suspected. Anovulatory follicle undergoes luteinization and regresses like a normal CL after 17-18 days.

Treatment: Same as described for delayed ovulations.

6.3.1.4 Defects of the ovum

Defective ovum and ageing of ovum results in poor conception rate as ova are viable for only few hours.

% of ova fertilized	AI hrs after ovulation
75	2-8
60	9-12
25	14-16
0	>24

6.3.1.5 Inability of the sperm to fertilize a viable ovum

It includes high sperm abnormalities, low individual motility, low sperm concentration, inflammatory conditions of genital tract and very early AI or ageing of sperms.

6.3.1.6 Inability of gametes to reach at site of fertilization

Anatomical defects of genital tract may be congenital or acquired viz, Segmental aplasia, tubal block and various affections of oviduct leading to obstruction.

6.3.2 Early embryonic death

Embryo loss accounts for the major portion of the reproductive wastage. The embryo death occurs gradually between days 8 and 18 after breeding. The embryo death most of the time occurs before the critical stage of pregnancy recognition i.e; the cow will return to estrus at the normal 20-25 days interval.

6.3.2.1 Causes

The important causes of early embryonic mortality are: Unfavorable uterine environment, hormonal imbalance, infections (sub clinical endometritis), negative energy balance and environmental stress.

6.3.2.2 Treatment

- (i) Administration of hCG or GnRH injection. I/M at 3 to 4 days after AI.
- (ii) Sometimes the administration of 500 mg progesterone on 4th or 5th day of AI tends to increase the pregnancy rate.
- (iii) Intrauterine infusion of antibiotics like Lixen or Cefox TZ etc. may preferably be tried, two to three times at the onset of estrus, or 8 hrs after AI and 24 hr later.
- (iv) 10 seconds stimulation of clitoris at A.I.
- (v) Ensure the animal into positive nutritive balance.
- (vi) Check the semen quality- use only high quality semen.
- (vii) Intrauterine infusion of 5 ml of Lugol's solutions diluted with 20 ml sterile distilled water and AI at next estrus.
- (viii) Flushing of the uterus with normal saline - under a moderate pressure (to remove cellular debris and also mild block in the uterine tubes).
- (ix) Supplementation of Vit E along with selenium and mineral mixture also helpful.
- (x) I/U infusion of 30 to 40 ml of autologous blood plasma two times at 24 hr interval.

6.4 Retained fetal membranes (RFM)

The fetal membranes, if retained in uterus beyond 12 hr after parturition, cause uterine infection, infertility and sterility. Proper treatment and attention should be paid to avoid such undesired sequelae of RFM. The incidence of RFM is quite variable, however, except in circumstances such as brucella infected herds, dystocias or nutritional deficiencies, the range is reported to be in between 7 to 12%. Temporary reduction of milk yield and impairment of appetite occurs in more than 70% of affected cows.



Retention of fetal membranes in a Cow.

6.4.1 Consequences

- (i) An increase in calving to service interval.
- (ii) Increase in number of services per conception.
- (iii) Prolonged inter calving interval.
- (iv) Higher culling rate is observed due to metritis, and sometimes adhesions following RFM.
- (v) The cows which have suffered RFM are at significantly higher risk for developing mastitis, ketosis and others.

6.4.2 Treatment

6.4.2.1 Manual Removal

It involved peeling of the cotyledons from caruncle with one hand and gentle traction of hanging mass using other hand. It should be attempted only after 72 or 96 hr post partum. Manual removal may result into severe damage to endometrium and inhibit the uterine defense mechanism.

6.4.2.2 Medical therapy

- (i) Give antibiotics like ampicillin 2 g i/m or cloxacillin bid for 3-5 days.
- (ii) Inj. Chlorphenaramine maleate 0.4 to 0.5 mg. / kg body wt I/M once daily for 3-5 days.
- (iii) Calcium preparations 200 to 450 ml subcut or i/v.
- (iv) Inj Melonex 0.5 mg / kg body wt, I/M once daily for 3 days.
- (v) Administration of Ecboolic drugs.

Mostly, oxytocin, estrogens, ergot derivatives, calcium preparations and intrauterine insertion of antibacterials and antibiotics are given to control uterine infection.

6.4.3 Prevention

- (i) Provision of exercise alongwith administration of antioxidants like Selenium supplementation alone or with vitamin E and beta- carotene during 4 weeks before parturition i.e. during dry period.
- (ii) Use of oxytocin (30 – 50 IU) immediately after calving.
- (iii) PGF₂ alpha administration just following calving.

6.5 Endometritis

Endometritis is a common cause of infertility in dairy animals and is associated with uterine infection following abnormal parturitions eg; abortion, RFM, premature/still births, dystocia, etc. The common organisms responsible for uterine infection are *C. pyogens*, *E. coli*, *Pseudomonas aeruginosa*, streptococci and staphylococci. The infections in cows resulted in lochia assuming white, yellow white or grey mucopurulent character.



Endometritis in a Cow.

6.5.1 Treatment

An ideal therapy of uterine infection should (a) eliminate bacteria from uterus (b) not inhibit the normal uterine defense mechanism and (c) not cause further adulteration of milk and meat for human consumption.

Antibiotic therapy

(Any broad spectrum like Oxytetracycline, Cefox TZ or Lixen etc.)

The success of IU treatment depends on absorption of the drug in the uterus. When the absorption of drug is low, therapeutic levels in the deeper layers of the uterus and other

parts of the genital tract are not likely to be achieved. Therefore, in this situation, the administration of drug should be done at frequent intervals. Furthermore, irritating IU antibacterials should not be used in post partum dairy cows as might cause a necrotizing endometritis. Hence, systemic administration of antibiotic is fruitful in immediate postpartum cases.

6.6 Cystic ovarian degeneration

Cystic ovarian degeneration (COD) is defined as persistence of an anovulatory follicular structure larger than 2.5 cm for more than 10 days, accompanied by cyclic irregularity in the absence of CL. Cystic ovaries are principally a disease of dairy cows due to improperly timed or inadequate Luteinizing hormone (LH) surge from pituitary.

6.6.1 Etiology

Most common predisposing causes of the condition are season, hereditary, parity, high yield, high protein diet, administration of steroids hormones, miscellaneous and unknown causes.

6.6.2 Symptoms

Symptoms of follicular cysts are usually nymphomania. The nymphomaniac cows ride on other cows but often refuse to stand to be ridden. Sterility hump i.e; tipping of pelvis due to relaxation of sacro – sciatic ligament and adrenal virilism (steer like appearance) are also seen. The genital organs are slightly edematous and atonic and mucus may be whitish grey in colour.

6.6.3 Diagnosis

Based on clinical symptoms and history of short cycles with long duration of heat and rectal examination of genitalia one can find large size table tennis ball like ovary and soft blister like fluid filled follicles therein.

6.6.4 Treatment

Main aim of treating the cyst is either to make it ovulate or to luteinize it.

- (i) Follicular cyst is treated with GnRH 20 microgram (5 ml) I/M or hCG 3000 I.U. to 5000 I.U. I/M.
- (ii) Luteal cyst is treated with PGF₂ (alpha).
- (iii) Many combinations are also used without differentiating whether the cyst is follicular or luteal eg; either hCG or GnRH injected and PGF₂(alpha) administered seven days later. The animal will return into estrus within 60 to 72 hrs of PG injection. It is advisable that breed the animal at subsequent estrus.
- (iv) Mineral supplementation along with vit E and Selenium is also found useful.
- (v) Corticosteroid therapy.
- (vi) Sometimes sexual rest for one or two cycles is also found beneficial in recovery of the animal.

6.7 Cervicitis

It is the inflammation of the cervix. Chronic and severe irritation of cervix by caustic

chemicals or pathogenic bacteria may sometimes lead to fibrosis and stenosis of cervix. Cervical stenosis may follow severe infection or trauma.

6.7.1 Causes

Vaginal infections usually produce cervicitis to the external os of the cervix. The condition also occurs either due to faulty inseminating procedures or unhygienic surroundings and associated with pneumovagina. It is also sequelae of some infectious reproductive diseases.

6.7.2 Diagnosis

It may be done either by vaginal speculum examination and /or by rectal examination.

6.7.3 Treatment

- (i) Should be directed for removal of the cause of irritation, where cervicitis associated with endometritis / metritis usually responds to the treatments indicated for metritis.
- (ii) Douching of cervix and vagina with mild warm antiseptic solutions along with local antibiotics may be helpful in hastening recovery.
- (iii) Administration of iodine preparations.
- (iv) Sexual rest for two or more estrus period is advisable in severe cases.

6.8 Kinked cervix

It is the cervical abnormality and rarely seen in cattle. In this case the cervical canal may be tortuous bent or even stenosed. It is very difficult to pass AI catheter without damage to the cervix. The condition may be due to subsequent fibrosis in previous parturition. It is felt like a firm cylindrical structure located at right angle to its usual position in heifers whereas, in cows' cervix is hard, enlarged, indurated and may be fibrosed. However, the estrous cycle in these animals is regular with mucus discharge.

6.8.1 Treatment:

Since genetic nature of defect, the infertile heifers with kinked cervix should be culled from breeding programme. 10 IU of oxytocin im can be injected in heifers and cows at about 15 minutes before insemination, some success may occur.

6.9 Pyometra

Accumulation of pus in uterus is called as pyometra. It may be of two types (i) Post service or pre-partum pyometra and (ii) post -partum pyometra. Post-service pyometra is mainly due to *Trichomonas fetus* infection. The pyometra is associated with persistent CL in the ovary and failure of estrus due to suppression of endometrial luteolytic factor. True pyometra seldom recovers spontaneously.

6.9.1 Diagnosis

- (i) By history of a longer period of anestrus.
- (ii) By rectal examination the uterine wall is usually thickened, flaccid and atonic.

6.9.2 Treatment

It should be aimed (i) to cause lysis of the CL so that animal comes into estrus when UDM

is more functional and active (ii) to evacuate the pus and (iii) to overcome the uterine infection. PGF₂ (alpha) is the best drug to treat pyometra. (Note: It causes luteolysis, dilatation of cervix and contraction of uterus hence the pus inside the uterus can be evacuated). The treatment may be repeated after 10 days, if required. The cervix will be relaxed slowly within 5-6 days. Oxytocin 40-60 units a day later may be given for hastening expulsion of pus, followed by parental antibiotics for 3 days.

6.10 Care and management of aborted animals

Abortion becomes herd problems in two situations like endemic abortion when there is an increased incidence of abortion over a longer period of time and secondly abortion outbreak when a clustering of abortion incidence occurs in a shorter period of time frame. Beside early and late embryonic losses, abortion occurs usually at three stages i.e. either at early (between days 42 to 120 days), mid- (between 120 to 180 days) or late (between 180 to 260 days) stage of gestation. Generally, in a dairy herd, the incidence of abortion ranges from 0.4% to 10.0% which is considered to be the normal range. However, the incidence exceeding 10.0% is alarming for a healthy herd requires immediate intervention. The following care and managemental practices should be adopted to address the situation:

- Proper hygienic and bio-security measures must be taken around animal's micro- as well as macro-climate.
- The cows which is aborted the fetus should be identified and isolated from the healthy animals.
- Following identification, collection of fetal materials and placental tissue should be sent to the diagnostic laboratories as early as possible for identification and isolation of the organisms.
- There is an urgent need to evaluate systematically the aborted materials (early fetal parts or placental membranes, genital discharge and sera of the affected animals) for the identification of the causative organisms responsible for the abortion.
- If the occurrence of abortion coincides with any new cow or bull introduction, such animals must be immediately segregated and examined for the organisms.
- There should be provision of an adequate immunization program against the causative organisms.
- Maintenance of adequate breeding and treatment records are necessary to avoid insemination of pregnant animals in heat (few cows may show the incidence of gestational heat during pregnancy) and the use of the medications which are contra indicated during pregnancy.
- Reduce the stress in the aborted cows.

6.11 Dystocia

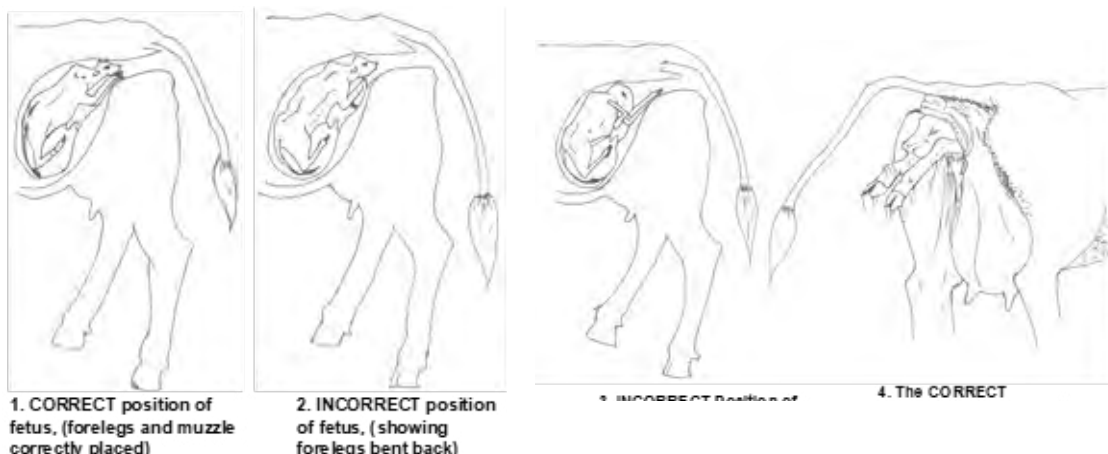
6.11.1 Causes of dystocia

The causes of dystocia may be divided into the basic and the immediate causes. The basic causes of dystocia include hereditary, nutritional, management, infectious, traumatic, miscellaneous etc.

- a. **Hereditary causes:** Hereditary defect in the dam predisposing to dystocia are inguinal hernia, double uterus, hypoplasia of vagina, vulva and uterus, uterine unicornis, twining and inherited breed characteristics, besides the hereditary

defect in the dam the known hereditary defect of foetus and fetal membranes are the achondroplastic calf, hydrocephalus, prolonged gestation and dropsy of fetal membrane and fetus.

- b. **Nutritional and managemental causes:** Animals that are stunted due to malnutrition frequently develop dystocia at parturition. High feeding level may favour dystocia especially in heifer by excessive deposition of fat in the pelvic region predisposing to difficult parturition. Severe vit-A deficiency and other deficiencies may predispose to uterine infections and death of the fetus and other deficiencies may predispose to uterine infections and death of the fetus and thus be a factor in producing abortion and dystocia.



The Position of Foetal Calf in Late Gestation.

- c. **Infectious causes:** Death of fetus may be a contributory factors due to infection affecting the pregnant uterus and its content e.g., Brucellosis, Trichomoniasis etc. All known infectious diseases should be controlled so that late abortion or remature birth in which dystocia is common and if kept it at a minimum.
- d. **Traumatic causes:** These causes are very rare, torsion or twisting of uterus may follow sudden slipping r rolling in advanced pregnancy. Ruptures of pelvis with secondary deformities are seen most commonly in domestic animals, this may cause stenosis of birth passage resulting in dystocia at parturition.
- e. **Miscellaneous causes:** Uterine inertia may lead to causation of dystocia. Hormonal imbalance of oestrogen, progesterone or relaxin or failure of uterine muscle to react to oxytocin or failure of release of oxytocin may result in delay of the 1st stage or 2nd stage of parturition.

6.11.2 How to approach a case of dystocia?

Things required

Obstetrial instruments, gumboots, drugs, syringe, apron etc. each case of dystocia constitutes a clinical problem which may be saved if correct procedure is folloed and correct diagnosis is the basis of second obstetrical practice.

History of the case

Before preceeding to interfere with the animal, the comprehensive history of case should whenever possible, be obtained. Much of it will be outcome of attendant but many points will also be elicited from personal observations.

- Has full term arrived, it is delivery premature?
- Is the animal primigravida or multigravida?
- What is her previous breeding history?
- What has been her general management during pregnancy?
- When did straining begin, what was the nature? Slight, intermittent or forceful and frequent?
- Has straining ceased?
- Has a water bag appeared and if so when it was seen?
- Has there may escape of fluid?
- Has any part of fetus appeared at the vulva?
- Has an examination been made and has assistance been attempted and so what its nature?
- In the case of multiparous species have any young been born naturally or otherwise and if so when and will they alive at birth?
- In the case of bitch, cat has there been vomiting?
- Is the animal still taking food?

6.11.3 General examination of animal

The physical and general conditions of animal should be noted. If recumbent is the merely resting or exhausted. Body temperature and pulse rate should be noted and the significance of abnormalities considered. Regular attention should be paid to the vulvar parts. The fetus may be protruding and it may be possible to understand the nature of the dystocia from these or exposed fetal membranes are dry or moist. Bleeding if profused, generally indicate recent injury to the birth canal, a dark brown foetid discharge indicates a glassy delayed case.



Dystocia with prolapse.

6.12 Care and management of pregnant animals

Following breeding, the cows should be monitored for 2-3 consequent cycles for non-return to estrus. The animals those show non-return to estrus should be identified and kept from the cows those with return to estrus. All the non-return cows should be presented for pregnancy diagnosis by trans-rectal examination earliest by 45 days following breeding and a re-check between 60-90 days for further confirmation. The following heads should be taken in to care:

Data recording:

Data recording is very essential for all operations related to pregnant animals rearing and management. It is essential to maintain all the breeding records for each animal in a separate sheet carrying the information like day of heat onset, duration estrus, type of

discharge (white and transparent-water or glass like appearance or any abnormal type like curd-like or yellowish etc.). The identification number of bull or details of semen used should be recorded.

Regular Veterinary Check-up

A periodic gynaecological check-up should be done throughout pregnancy for any abnormal genital discharge and regular veterinary check-up for well being of the animal.

Hygienic set up

The area adjacent to the animals and resting place should be disinfected prior to allocation of the area. A strict bio-security measure should be adopted to avoid transmission of disease transmitted by air and water borne pathogens. A pregnant sick animal should be identified and isolated from the healthy herd and animal aborted fetus or showing abnormal genital discharge should be separated from the main healthy animals.

Housing

All the declared pregnant cows should be kept together but avoided the overcrowding. Pregnant animals approaching parturition more precisely 4-5 days prior to calving should be isolated and kept in single calving pen which should be clean, well ventilated, bedded and disinfected prior to shifting. There should be optimum space for sitting and standing for each cow allotted in a pen.

Feeding/ nutrition

In a general principle, adequate nutritional support should be given to the each pregnant animal to meet out the nutritional requirement of a pregnant mother along with the growing fetus. An additional nutritional requirement is always advisable for each pregnant animal apart from the daily maintenance requirement. Care should be given much from 5 months onwards when the growth of the foetus is faster. An additional concentrate mixture @ 1.25-1.75 kg per day basis should be offered to each pregnant animal since 5 months and be increased to 3.4-4.5 kg from 8 months till first 4 weeks postpartum in order to avoid the negative energy balance and to prevent the metabolic disorders like Ketosis and milk fever etc. Clean water should be made available adequately and during hot summer cold water in the form of ice block may be added. Container should be kept clean in a routine manner and requires a regular check.

Drying of cows

The pregnant cows should be dried of 60 days prior to expected date of calving for conserving the energy to be supplied to the faster grown fetus, avoid negative energy balance peri-partum period and future lactation.

Exercise

During last one month, pregnant animals should require space for exercise in order to avoid any difficulties at parturition. Congested area with thick density may be avoided so that animal should have sufficient space to go for walk. The floor area should be clean and dry to avoid slip which may cause damage to the fetus. Feeding manger and water should not be far away and avoid grazing a far if in practice.

Special care

Pregnant animal approaching parturition seeks special attention. It is always advisable to shift each of them in single pen to take special care. Keen attendance with vigilant watch is required to identify the start time of labor and the expected calving in due time if delays should be communicated for veterinary assistance.

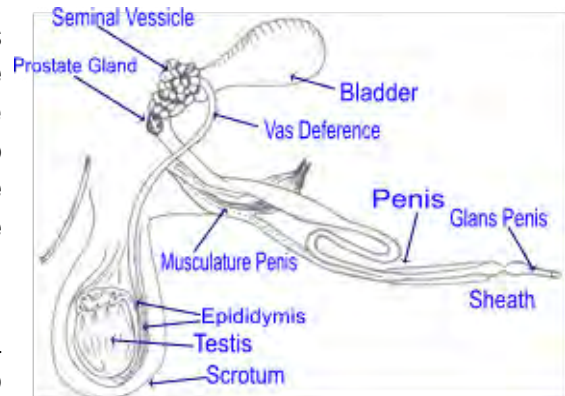
Feed Requirement

The ration should contain 15-20 Kg green fodder, 4-5 Kg of dry fodder, 2-3 Kg of compound

cattle feed in the form of concentrate mixture, 1 Kg oil cake, 50 g mineral mixture and salt @30 g on daily basis. Besides, an immune modulator support, antioxidant trace elements and vitamins 15 days prior to term would be beneficial to reduce the parturition and post-partum complications.

6.13 Management of common reproductive affections in male animals

Generally, bull is regarded as half of the herd. Considering that maintaining healthy bulls are basic prerequisite not only to get future progenies but also to prevent communicable diseases to females. Like females, bulls also suffer from many diseases; some of them are anatomical in nature and other they acquire during their life. Maintaining healthy bulls, therefore, is an imperative need to achieve good fertility and overall herd health. An andrological investigation is essential for thorough check up of bulls on a regular basis in order to identify the sick and diseased bulls, their early isolation and provide optimum veterinary aids.



Genital Organs of Male.

Some important infertility condition that bulls suffer from is summarized below:

6.13.1 Reduced libido

Many bulls show reduced to complete lack of libido because various reasons like ageing, lack of exercise, overweight, deficiency of vit-A and phosphorus, diseases locomotor problems, injury to the genital organs, hormonal deficiency etc. Some bulls do not show any signs of maleness even when presented before the estrus females, while some may nuzzle the vulva and lick the urine and some bulls protrude the penis but do not mount. Improved husbandry practices, balanced feeding, avoidance of under feeding or overfeeding, sexual rest and regular exercise may prevent the occurrence of the poor libido.

6.13.2 Inability to copulate

Bulls also show reduced to complete inability to copulate. This may be characterized either by failure of erection or failure to mount, failure to protrude the penis, failure to achieve intromission or failure to ejaculate the semen. This condition is caused due to various conditions like rupture penile musculature, locomotor dysfunction, phimosis, stenosis of preputial orifice, insufficient protrusion of the penis or deviation of penis or for many other reasons.

6.13.3 Persistence penile frenulum

Persistence of a frenulum, a band of tissue that extends from near the ventral tip of the glans penis to the prepuce, occasionally cause a sharp ventral bending or deviation of penis and render intromission difficult or impossible. This leads to difficulties in intromission. Surgical correction by cutting of the band of tissue may be helpful for future but avoid breeding due to hereditary transmission of the affection.



Persistence Penile Frenulum.

6.13.4 Rupture of the penis

This is a common and potentially serious disorder in bulls. It is generally attributed to vigorous copulatory thrust against the perineum of the cow, but it may also occur spontaneously during masturbation, presumably due to high pressure within the penile musculature at erection. The management of penile rupture may be possible by surgical intervention. However, surgical evacuation of the haematoma 10 - 12 days after its development accelerates the healing process. Affected bull should be isolated. An added complication in cases of penile haematoma is apparent loss of sensation in the glans penis, which prevents the normal copulatory thrust reflex.



Penile Haematoma

6.13.5 Injury to prepuce mucosa

Intermittent eversion of varying lengths of prepuce mucous membrane is of normal feature of certain breeds. Any inflammatory changes in everted mucosa cause local edema and hyperemia. Immediate application of emollient dressing and replacement and retention within the sheath usually result in complete resolution without significant fibrosis.



Cork-screw deviation of penis

6.13.6 Penile deviation

Deviation of penis is common occurs in most bulls after intromission due to unknown causes. Spiral deviation, corkscrew deviation and ventral deviation are the types of penile deviation found in bulls. The condition can be corrected surgically.



Penile Tumor

6.13.7 Penile Neoplasm

The important neoplasms of the penis are fibropapilloma, papillary carcinoma and transmissible venereal tumor. They are uncommon but may occasionally prevent protrusion of penis.

6.13.8 Phimosis

Phimosis or stenosis of the preputial orifice prevents the normal protrusion of the penis. The conditions may arise either due to congenital cause or acquired causes as a result of trauma and inflammatory conditions.

6.13.9 Balanoposthitis

Because of their close anatomical association, inflammatory condition of penis and prepuce occurs together. It occurs in bulls due to viral and bacterial causes. Ulcerative balanoposthitis is accompanied by pain and swelling of in the area of penis. Fibrous adhesions may develop resulting in an impaired protrusion of the penis. Mild antiseptic douches or antibiotic or antiseptic ointment helps in cleaning the infection.

6.13.10 Cryptorchidism

Incomplete descent of testis is a hereditary disease uncommon in bulls. The incidence of cryptorchidism in cattle is less than 1%. One or both testicles may be retained either in inguinal canal or abdomen. Unilateral cryptorchids are frequently observed in Gir, and other Indian bulls including Zebu. Apart from genetic cause, other factors like anatomical obstruction in the inguinal canal, unskilled use of rubber rings while castration etc may also contribute the condition. Although the unilateral cryptorchids may donate semen, but due to hereditary in nature, cryptorchids should not be allowed for breeding purpose.

6.13.11 Testicular hypoplasia

Testicular hypoplasia is a congenital failure in the development of the germinal epithelium of the seminiferous tubules. It is commonly observed in bulls of one or two years of age and reported in Gir, Crossbred and Holstein Friesian bulls. It may be unilateral or bilateral in nature. Sexual desire appears normal in affected bulls hence difficult to assess the condition. Due to hereditary in nature, generally bulls are avoided from breeding.

6.13.12 Testicular degeneration

Degeneration of the spermatogenic epithelium due to damaging external influences is common in bulls. The condition may vary from mild to very severe degree, may be unilateral or bilateral in nature. It may be temporary or permanent depending on the type, severity and duration of injury. Affected testes are small, softer and resilient than normal and later become shrunken and harder and testicular atrophy develops in advanced cases. The animal shows normal sexual behavior. There is no suitable treatment once the degeneration of spermatogonial cells occurred, however, correction can be made based on type of insulations.

6.13.13 Orchitis

Inflammation of the testes or orchitis is common in bulls. It is caused by bacteria and virus, and brucellosis is the most common one among the causes. It may be unilateral or bilateral. Usually spermatogenic function of the inflamed testicle is irreversibly destroyed. Acute infection is characterized by hyperaemia, hot and swelling. Testes may become grossly enlarged up to two to three times than the normal size and often painful reveals on palpation leading to altered gait. Treatment with high doses of antibiotics or sulfonamides never gives satisfactory results. Surgical removal of affected testicles advised to preserve the function of other gland. In acute orchitis application of ice pack and sexual rest is helpful.

6.13.14 Epididymitis

In each species epididymitis may be caused by the organisms responsible for orchitis. In cattle IBR virus has also been implicated in the etiology of epididymitis apart from other bacterial agents. Acute epididymitis interferes with spermatogenesis by using thermal degeneration in both testicles. Early removal of the inflamed epididymis together with its attached testis is therefore advisable. Chronic epididymitis is unlikely to influence the scrotal thermo-regulatory mechanism.

6.13.15 Seminal vesiculitis

Inflammation of seminal vesicles or seminal vesiculitis is common in bulls. It is more

commonly unilateral but may be bilateral. In bull, the common pathogen is *Brucella abortus* and may be acute or chronic in nature and abscess formation is more common. Localised peritonitis may occur in the caudal abdomen leading to unwillingness to undertake movements thereby unable to mount and ejaculatory thrust. Successful treatment is difficult to achieve and in cases of vesiculitis caused by *Brucella* organism it should not be attempted. The bull should be withdrawn from service and culled. Other infection may be treated with antibiotics but the likelihood of cure is of little effect.

7. Management of Common Surgical Conditions

In addition to infectious and noninfectious general veterinary medical conditions, there may be several conditions in the animals at Gaushala, which require surgical intervention. Trauma leading to wounds and fractures, foot and hoof affections, arthritis, paralysis, congenital deformities, horn cancer, tumours, ingestion of foreign bodies, *etc.* are some of the common conditions that are regularly recorded in the animals at Gaushala. Management of most of these conditions requires the services of a qualified veterinary surgeon/ practitioner; however, the basic knowledge about these conditions may help the caretakers in providing first aid and initiating primary treatment until the services of a qualified veterinarian are sought.

7.1 Fractures

Fracture is a break in the continuity of the bone. Fractures are common in animals and are caused either by direct trauma like automobile accidents or by indirect trauma caused while running, jumping or falling from a height. Fracture may also be caused by violent muscle contractions or by systemic/metabolic diseases like in rickets or osteomalacia, wherein the bone becomes weak leading to fracture.

Based on the communication of fracture site with the environment, it can be classified as simple (closed) fracture or compound (open) fracture. Based on the extent of fracture line, it can be classified as incomplete or complete fracture. Based on the direction of fracture line in relation to the longitudinal axis of the bone, fracture can be called as: transverse, oblique, spiral, comminuted (more than two bone fragments) or multiple (two or more independent fractures of the same bone) and based on the location of the fracture, it can be classified as: diaphyseal, metaphyseal or epiphyseal fracture.

7.1.1 Diagnosis of fracture

Diagnosis of a bone fracture is relatively easy. The first sign of a fracture is generally a non-weight bearing lameness. The fracture site shows signs of swelling, and the animal carry the affected leg, though it can move on three legs. Incomplete fractures, sometimes, are difficult to detect, as they usually cause only mild lameness. Confirmative diagnosis of a fracture can be done by radiographic examination. Generally both medio-lateral and craniocaudal or dorso-plantar/dorso-palmar views are indicated for accurate diagnosis of the fracture. In recent years digital X-ray has increased the accuracy of diagnosing a fracture.

7.1.2 First Aid

First aid and careful handling of the animal before definite fracture fixation is important in veterinary practice. The animal should not be forced to walk on the broken bone or transported to the hospital without a proper splint, to avoid a relatively simple fracture becoming a comminuted or compound fracture. The animal must be restricted from

moving on three legs to reduce further damage to the surrounding soft tissues, vessels and nerves. Fractured limb should be stabilized first by applying splint to the fractured limb, which allows the animal to regain control of the leg even though it cannot put complete weight on it. In excited animals it may be necessary to sedate the animal for splinting. A rigid splint is placed over the layer of cotton role applied over the skin and wrapped with a cotton/elastic bandage. Splint should not be used directly against the animal's skin. At least two pieces of wood/PVC tubing must be placed 90° apart (never 180°), one along the outer surface and the other along the front or the back of the leg. Placing the splint along the inner and outer surface of the leg is ineffective, as it does not prevent the leg from bending.

7.1.3 Factors to be considered before fracture fixation

Early care and fracture fixation to stabilize the bone fragments is essential to minimize fracture complications. Several factors that should be considered while selecting the technique of fracture management include age, body Weight and species of the animal, location and type of fracture, presence or absence of soft tissue and neuromuscular trauma, closed or open fracture environment, ability of the animal to stand and walk, behavioral nature of the animal, the facilities available and above all the experience of the surgeon with a particular technique.

7.1.4 Fracture Fixation Techniques for common fractures

Generally cattle are excellent patients for treatment of fractures as they spend most of the time lying down, have a tremendous potential for bone healing and are most resistant to contralateral limb breakdown and stress laminitis, and usually well tolerate the fixation devices. However, heavy body weight, angular placement of long bones and difficulty in postoperative care make the fracture management in large bovines difficult. Prognosis is generally poor in cases which remain recumbent for prolonged period. Several fracture fixation techniques have been described in the literature for the treatment of long bone fractures, like plaster cast, Thomas splints, combination of Thomas splint and cast, hanging pin cast, transfixation pinning, transfixation pinning with cast, linear and circular ring fixators, intramedullary pinning/nailing, interlocking nails, bone plates and combination of plating with external skeletal fixation, etc. All these treatment techniques may be successful if applied well in recommended situations.

7.1.4.1 Tibia

Tibial fractures are encountered in all age groups of cattle. The etiology of tibial fracture is mostly traumatic. In very young animals fracture may be induced by forced extraction of malpresented calves during birth or by kick from the dam. In adult animals, fracture may be caused during transport, at pasture or in sheds.

Treatment of tibial fractures is a challenge, especially in heavy animals. Tibial fractures have been reported to heal satisfactorily by conservative treatment like stall rest, application of plaster cast or Thomas splint-cast combinations. Conservative treatment of



Application of circular fixator for management of fracture of tibia in a cow.

tibial fractures, however, usually does not result in acceptable fracture healing, especially in fractures proximal to the distal diaphysis and fractures with complications like open fracture, mal-union, delayed union, contra lateral limb angular deformity and tendon breakdown. Different types of hanging pin casts have also been used; however, they are inferior to the other methods of fixation.

The internal fixation of tibial fracture can provide sufficiently rigid fixation, while allowing adjacent joint mobility. Intramedullary pinning/nailing has been used for treatment of tibial diaphyseal fractures with some success, especially in young animals. Bone plating provides accurate anatomic reconstruction and fracture healing with minimal convalescent period.

External skeletal fixation with transfixation pinning has been successfully used in treatment of tibial fractures both in experimental and clinical cases. Transfixation pinning is accomplished by placing two or more pins transversely through the proximal and distal bone fragments and fixing the protruding ends with external bars. Four ring circular fixator can also be used to repair tibial fractures and osteotomy in calves.

7.1.4.2 Radius-Ulna

Fractures of radius-ulna are not uncommon in bovines, and the incidence may vary from as high as 10-15% of all fractures. Most radius fractures occur in the middle to proximal diaphysis and are comminuted; and are frequently closed with most open fractures involving the distal diaphysis or physis.

Generally the fractures of radius-ulna are most suited for external fixation or external skeletal fixation as the bones are fairly straight and surrounded by little soft tissue. Closed fractures, especially of the distal radius may be treated successfully by a full limb cast. Different designs of dynamic axial fixators have been used successfully in radius-ulna in calves



Application of acrylic cast for the management of radius in a cow.

7.1.4.3 Metacarpus/metatarsus



Application of epoxy-pin fixator for treatment of fracture of metatarsus in a cow.



Application of circular fixator for treatment of fracture of metacarpus in a cow.

Fractures of the metacarpus or metatarsus are the most common fractures recorded in bovines and most involve the forelimb. Most of the closed fractures are treated successfully by application of the cast. Transfixation pinning and casting, cast spanning only the affected region (in animals weighing up to 150 kg) or spanning the whole limb (in animals weighing more than 150 kg), provides greater stability. External skeletal fixation is generally indicated in open, infected or comminuted fractures.

7.1.4.4 Femur

Femur fractures normally occur in neonatal calves, most often due to forced extraction during dystocia. Fracture of femur in adult cattle is occasionally seen after falling during mounting or on slippery flooring. Femur fractures in mature animals have grave prognosis due to heavy body weight, large muscular cover around the bone and difficulty to reduce the fracture. Hence, they are not generally treated. Some cases may respond to stall rest. In calves, intramedullary pinning/nailing is generally undertaken with good success. Stack pinning, using 4-5 intramedullary pins provide better results.



Stack pinning for treatment of femur fracture in a calf.

7.1.4.5 Humerus

The shaft fractures in calves managed conservatively by stall rest generally shows satisfactory functional results. Open reduction and the use of intramedullary K-nail or interlocking nail have been reported to be successful in the management of diaphyseal fractures.

7.2 Arthritis

Arthritis is an important disease from economic point of view. The losses occur due to culling of the affected animals, expensive treatment and poor performance record. Arthritis or joint disease occur in cattle of all age groups and breeds and can be divided mainly into two types i.e. infectious and non-infectious arthritis. If pus is present, the infectious arthritis is also termed as septic/pyogenic/suppurative arthritis. Non-infectious arthritis is generally termed as degenerative arthritis or degenerative joint disease (DJD). The frequency of occurrence of DJD in ruminants is far less than the infectious arthritis.

7.2.1 Infectious arthritis

Infectious arthritis is frequently encountered in young calves as joint ill or neonatal polyarthritis, but it may also be found in older cattle. Infectious arthritis may occur by direct inoculation of microorganisms through the traumatic lesion, extension from particular injuries or by haematogenous spread. Almost all pathogenic bacteria have been recognized to cause infectious arthritis in cattle. The important bacteria include

Brucella abortus, *Erysipelas* sp., *Pneumococcus* sp., *Streptococcus*, *Staphylococcus*, *E. Coli*, *Proteus*, *Salmonella*, *Corynebacterium pyogenes*, *Mycoplasma* and *Lactococcus lactis*.

The common clinical signs of infectious arthritis are lameness, pain, enlarged and tender joint. The animals may be reluctant to bear weight and stand with affected limb partially flexed. Calves have a tendency to walk on toes. The enlargement of the joint is attributed to the distension of joint capsule, peri-articular oedema and fibrosis. Elevation of temperature, respiration and pulse may also be observed in cases of acute infectious arthritis. Radiographic findings may not be visible in early stages but in later stages soft tissue swelling, distention of joint capsule, widening and narrowing of joint spaces and still in later stages subchondral bone destruction, exostosis, intercapsular and extra capsular periosteitis, osteomyelitis could be observed.

A variety of changes have been reported in synovial fluid following septic arthritis in cattle. Discolouration of synovial fluid and opacity of synovial fluid are suggestive of presence of flocculant debris. The pH of the synovial fluid may be reduced in septic arthritis. Synovial fluid may exhibit high leukocytic count. Mean relative viscosity of synovial fluid may be reduced.

Treatment of infectious arthritis includes parenteral or intraarticular administration of antibiotics, joint drainage, joint lavage by mild antiseptics and replacement of infected synovia with healthy joint fluid and intraarticular injection of DMSO.

7.2.2 Degenerative arthritis

It is characterized by degeneration and erosion of articular cartilage, eubernation of subchondral bone, lipping and osteophyte formation at the joint margins. Synovitis and joint effusion are often associated with the disease. The condition is also known as osteoarthritis, osteoarthrosis, hypertrophic arthritis, arthritis deformans or degenerative joint disease (DJD). The condition commonly occurs in aged cattle. However, condition has also been reported in growing calves.

The predisposing factors for degenerative arthritis include aging, nutritional deficiencies, inheritance, malconformation, medication of corticosteroids.

Degenerative arthritis is simply a process of organ failure if the joint is viewed as an organ. As a result of inflammatory response, leukocytes, prostaglandins, phospholipase A₂, lysosomal enzymes, serine proteinases, metallo-proteinases, cytokines, calpains,



Joint ankylosis due to degenerative arthritis.

hyaluronidase and superoxide and hydroxyl radicals are released in the synovial fluid and affect the nutrition of the cartilage. This leads to the drainage to chondrocytes and collagen fibres resulting in loss of elasticity and surface integrity of the cartilage. Microfractures may occur with loss of cartilage fragments into the joint cavity. The bone may be exposed and bone proliferation may lead to the formation of osteophytes at joint margins. The osteophyte chips may be seen in joint space in advanced cases. The cartilage and bone fragments present in the joint further injure the articular tissue and thus maintain the vicious cycle of degradation.



Arthritis in a cow.

The clinical signs of degenerative arthritis may vary with the type of the disease and degree of degeneration. Progressive lameness, stiff gait, prominent bony prominences and crepitus can be

observed in most of the affected animals. The characteristic radiographic features of the disease include diminished joint spaces, formation of marginal osteophytes, subchondral lysis or cyst formation, sclerosis and remodelling of joint shape. However, these changes may not be prominent in early stages of the disease. Diagnostic arthroscopy can accurately determine the source of problem.

Arthrography is indicated for diagnosis of chronic joint distension with or without lameness and where a more complete evaluation of suspect articular cartilage, subchondral bone and synovial membrane lesions is needed. Approximately 5-20 cc of 25% concentration of tri-iodinated water soluble contrast material should be used. If possible, an equal volume of synovial fluid should be withdrawn before contrast material is injected.

Synovial fluid examination is a routine procedure and it gives an indication of the degree of synovitis and metabolic derangement within the joint. Synovial fluid samples are collected aseptically using disposable syringe and needle (20 gauge 1 inch). Following aspiration of synovial fluid, it is transferred to both plain and EDTA container tube. Synovial can be examined for different parameters. Normal appearance of synovial fluid is pale yellow and clear and free from flocculent debris. Uniformly diffuse hemorrhages represent an acute traumatic situation; whereas dark yellow or pale amber color represents previous haemorrhage and is associated with chronic traumatic arthritis. The presence of opacity and flocculent material indicates synovitis. Infectious arthritis results in serofibrinous sample. Synovial fluid of most of the osteoarthritic joints is grossly opaque and flocculation is present.

Normally, synovial fluid does not clot. In pathological conditions, it clots and the size of the clot is roughly proportionate to degree of synovitis. Synovial fluid protein is approximately 25-35% of the plasma protein concentration in the same animal. The normal value has been documented as 1.81 ± 0.26 g/dl. The total protein increases with joint inflammation and it tends to approach that of plasma. Viscosity is a measure of the quantity and quality or degree of polymerization of the hyaluronate. Relative viscosity (RV) can be measured with a viscosimeter and it indicates meaningful trends in the development and progression of an inflammatory state. It decreases (proportionate with the intensity of the inflammation) with synovitis and it may reflect both the dilution of hyaluronate by effusion and a depolymerization of hyaluronate.

Mucinous precipitate quality (MPQ) is evaluated by adding 0.5 ml of synovial fluid to 2.0 ml of 2% acetic acid and mixing it with a rod. When MPQ is normal, a tight ropy mass is formed in a clear solution (MPQ is good). As mass gets softer, it can be classified as fair (soft mass with some shreds), poor (shreds and small soft masses) and very poor (mucin suspended in a cloudy suspension). The MPQ usually parallels the changes in relative viscosity.

Cell count can be done in synovial collected in EDTA. Haemocytometre is used for counting TLC using normal saline as diluent. For DLC, smears are air dried and stained with Wright's stain. Erythrocytes are normally not present. WBC in synovial fluid may be around 87 cells/mm³. But it can be in thousands also and are quite variable. Neutrophils, lymphocyte and large mononuclear cells are observed. Neutrophils are generally less than 10%.

7.2.3 Treatment

The choice and efficacy of treatment depends upon the stage of the disease and the degree of active inflammation. The principles of treatment include prevention or treatment of any primary cause to minimize permanent compromise of the joint, alleviation of the immediate compromising effect of inflammation contributing to articular cartilage degeneration and treatment of articular cartilage loss and or degeneration. Rest in conjunction with other therapy may provide some relief but prolonged immobilization has unfavorable influences on joint functions. Administration of polysulfated glycosaminoglycans has a protective effect in the early exercise period. Low levels of ultrasound and diathermy have also been found to have beneficial effects.

A variety of NSAIDs have been used in the treatment of joint disease. NSAIDs such as eltenac, etodolac and buprenorphine have been reported to be more effective. During last decade sodium hyaluronate or hyaluronic acid has gained popularity as one of the agents for the treatment of DJD. The beneficial effects of intra-articular administration of hyaluronic acid have been reported in cows. The allotransplantation of synovial fluid into joints of bovine with arthropathies has also been reported with beneficial effects.

Surgical treatment such as removal of osteochondral fragments, debridement of hypertrophic articular tissue, internal fixations, arthrodesis, joint resurfacing surgery, perichondral and periosteal autografting and chondrocyte allografting can be practiced in the treatment of degenerative arthritis in bovines.

7.3 Laminitis

Laminitis (pododermatitis aseptica diffusa or diffuse aseptic coriitis), inflammation of laminae and papillae inside the hoof, is a debilitating disease that results in functional and /or morphological changes within the claw. It can be broadly classified into three categories i.e. acute/subacute, chronic and subclinical laminitis. Laminitis is one of the leading causes of lameness in cattle. The estimate of number of the cows affected with laminitis in a herd could range from 60 to 90%. In addition to the economic importance, laminitis is also considered as a welfare issue in animals due to severe pain and stress felt by the affected animals.

7.3.1 Etiology

Laminitis has a multifactorial etiology but, nutrition and management have been recognized as the important factors leading to development of laminitis. Increased

feeding of fermentable carbohydrates has been implicated as a cause of laminitis in cattle. A higher total concentrate amount and higher dietary protein intake all resulted in a higher lameness score than in controls fed less intensive diets. High moisture diets fed to the heifers before calving could also result in significantly more lameness and sole lesions than dry nonfermented diets. Other important factors that predispose the cattle to laminitis include metabolic and digestive disorders, hormonal changes associated with parturition and lactation. Infectious diseases such as mastitis, metritis and foot rot, environmental factors like hard surface, lack of bedding, lack of exercise and factors like poor body conformation, excessive body weight etc. are also considered important predisposing factors for laminitis in cattle. Trauma has also been suggested to contribute significantly to the development of laminitis in dairy cattle.

Laminitis is considered to be a stress related condition. It could be inferred that many changes in feeding, management and environment brought about especially around calving period may interact to cause considerable stress, responsible for the development of laminitis.

7.3.2 Pathogenesis

A magnitude of factors is considered to predispose the cattle to laminitis but its pathogenesis is not clearly understood. Local factors such as weight distribution, body and foot conformation, concrete flooring etc. may suggest some role of local mechanisms in the pathogenesis, however, the presence of symmetrical and bilateral lesions in the feet of the affected animals suggested a local manifestation of systemic disease. Laminitis could be due to oedema, hyperemia, haemorrhage and necrosis caused by vascular changes induced by release of histamine in the hoof.

Feeding of diets rich in carbohydrate could lead to acute and subacute lactic acidosis. As pH continues to drop, there is increased production of lactic acid in rumen. Vasoactive substances like histamine and endotoxins could be produced by dying and decaying bacteria due to low rumen pH as a result of over production of lactic acid. These endotoxins alone or in combination with histamine could be considered to initiate vascular changes responsible for development of laminitis.

In addition to the situation of acidosis, endotoxins can be released in many disease conditions including post-parturient infections. Endotoxins/histamine once released as a result of different pathological processes create vascular constriction and dilatations, which in turn cause the development of several unphysiological arterio-venous (AV) shunts increasing the blood pressure. The increased blood pressure causes seepage of blood through the vessel walls, which ultimately are damaged. The damaged vessels lead to serum exudation, oedema and internal haemorrhages in the solar corium, thrombosis, expansion of corium and ultimately causing severe pain.

The mechanical trauma from the hard floor causes further damage to the vessels in the corium. As a result of mechanical damage nutrient supply to the epidermal cells is reduced, which leads to the breakdown of stratum germinativum in the epidermis. These changes ultimately cause corium degeneration and breakdown of lamellar region associated with the dermal-epidermal junction, which in turn results in breakdown between the dorsal and lateral lamellar support of the hoof tissue. Ultimately the lamellar layer separates and the pedal bone takes on a different configuration in relation to its position in corium and dorsal wall. As the bone shifts in position, it causes the compression of soft tissue between the bone and sole, which is extremely susceptible to damage. The compression of soft tissue results in haemorrhages and thrombosis, and further enhancement of oedema

and ischaemia resulting in the necrotic area within the solar region of the foot.

7.3.3 Symptoms

Acute/subacute laminitis: It is characterized by lameness accompanied by systemic illness. The conditions may affect all feet. Animals are often seen standing with all feet tucked up underneath the body or with their front feet close together or crossed. Animals refuse to move, particularly on the hard ground. In severe cases, animal may not be able to rise. Muscular tremors and excessive sweating are also common. The pulse and respiratory rates are often increased. Mucous membranes are hyperemic but rectal temperature is usually normal. The hooves are tender and warm above the coronary band. A prominent distension of the veins is common in hind legs. Pulsation can be felt on the volar common digital artery at the distal quarter of the metacarpus. Swelling, redness and tenderness of the band may also be present.



Subclinical laminitis: Onset of subclinical laminitis can be slow, long and insidious process that is dependent upon the persistency of low-grade insults. It is only after the careful examination of the hooves that local signs can be observed. Hooves show irregular and marked horizontal ridges and concavity at the dorsal wall. Flattening, broadening and overgrowth of the hooves are also common. Horn becomes physically softer and there may be yellowish discolouration of the sole. Haemorrhagic stains are manifested in the solar area particularly in the area of white line, apex of the sole and sole-heal junctions. These haemorrhagic lesions become more evident on trimming the sole. White line separations, frequent dorsal wall ridges and rotations of the pedal bone are characteristic internal manifestations of subclinical laminitis.

Chronic laminitis: The local changes in chronic laminitis are more severe and advanced than the subclinical form. The growth pattern of the keratinised horn is disrupted and the shape of the digit is altered to become more elongated, flattened and broadened. The grooves and ridges on the dorsal wall become more prominent giving the hoof a rippled appearance. Internally, the pedal bone could be separated from the dorsal wall. Ulceration can be demonstrated at the solar regions of the foot. Double sole with yellowish discolouration is a major clinical sign. The white line may be loosened and penetration of the white line with dirt and infection may result in white line disease. In severe situations, the distal aspect of the pedal bone can protrude through the corium and hard horned tissue of the sole.

7.3.4 Treatment

The symptomatic treatment has been the most popular treatment of laminitis. Acute inflammation and pain can be controlled by administration of NSAIDs, the antihistaminics or cortico-steroids. Removing the animal from the suspected cause is by far the most important step. The animal should be kept in a comfortable environment with soft bedding and adequate rest. Feeding of carbohydrate diet should be stopped and adequate dry

hay may be helpful. The administration of mineral oil may be useful to block absorption/ remove the toxic substances from the gut. Administration of peristaltic stimulants may be beneficial in accelerating the action of mineral oil. Transfer of rumen contents from healthy animals to diseased animals in cases of acetonemia may also be useful. About 5 litres of ruminal contents can be transferred after removing the abnormal contents as much as possible.

Administration of electrolytes containing sodium carbonate intravenously as well as orally may be useful in correcting the acidosis. In the early course of the disease, if there is no perceptible heat in the hooves, hot water therapy may be helpful to eliminate the toxic elements through vasodilatation and increased circulation. In later stages, however, standing the cattle in cold running water could be useful. Claw trimming may also be useful to dig out hoof lesions, provide drainage, and to lower the lesion area to have proper healing.

7.3.5 Prevention and control

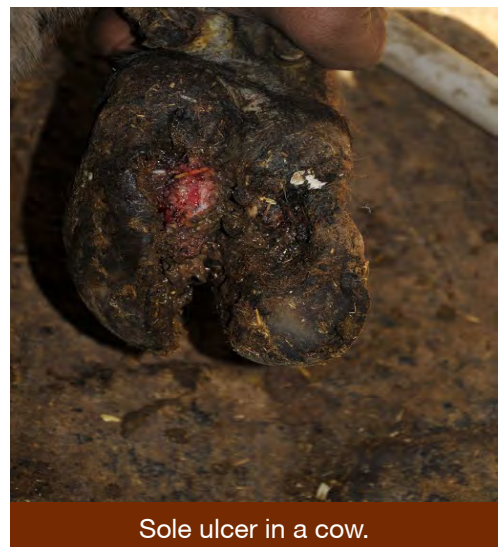
Laminitis related lesions have a high heritability. Therefore, it would be beneficial to include lameness and claw lesion records in breeding programmes. Diet and feeding arrangements are important to prevent and control laminitis. Supplementation of trace elements, minerals and biotin may have beneficial effect on hoof health in intensively managed primiparous dairy calves. A sudden change in the diet should be avoided when the animals are first introduced to concentrate feeds. It should be gradually increased to reach the intended amount at parturition. The animals should be raised in a comfortable environment. Sudden transfer of the animals to hard surface at the time of parturition should be avoided. Regular claw trimming can also help to detect lesions at an early stage and also prevent lesions by correcting the loading.

7.4 Miscellaneous foot affections

Lameness in bovine is a serious welfare issue and causes significant economic losses to livestock owners. It has been ranked the third most common disorders after mastitis and reproductive failure in terms of causing economic losses to the farmers. Hoof and Claw disorders account for 70 to 90% of diagnosed cases of lameness in cattle. A brief description of common foot disorders is presented in the following text.

7.4.1 Sole ulcer

Sole ulcer is characterized by a bulge of granulation tissue sticking through the sole. It is also known as Pododermatitis circumscripta or Rusterholtz ulcer, which typically occurs at sole-heal junction. Sole ulcer generally occurs on the lateral claw of the hind foot and medial claw of the front foot. It however, more commonly occurs in the hind foot and one or both foot may be affected. Sole ulcer is generally associated with laminitis and is preceded by haemorrhages at sole-heal junction. However, moist bedding, manure, excessive wear and poor hoof trimming may also predispose the animals to sole ulcer. Sole ulcer associated pain has also been considered as animal welfare issue.



Sole ulcer in a cow.

Treatment of sole ulcer consists of removal of granulation tissue at the level of solar horn, removal of all under run horn and trimming of the affected claw back to its correct weight bearing surfaces, in such a way that maximum weight bearing is done by the unaffected area. Use of rubber or wooden block to the normal area of claw to remove the total weight bearing from the affected area may be ideal treatment for advanced cases of sole ulcer. Cauterising dressings such as copper sulphate, lead acetate, etc. have been tried to prevent further growth of granulation tissue. Supplementation of biotin @ 40 g/day along with application of orthopaedic shoe may also be useful. In severe cases infection may travel upwards and may involve flexor tendon, navicular bursa, navicular bone and even the pedal bone. In such cases digit amputation may be needed.

7.4.2 White line disease

White line is a cemented junction between the wall of the hoof and the sole and as such it is a point of weakness. There may be several physical, nutritional and environmental factors that can lead to softening of white line. Once softened, small fragments of dirt and stones may become impacted in the white line. Further softening of the hoof or possibly more standing on debris may force it deeper into the white line until the contaminated material reaches the corium. At this level bacteria multiply, pus is formed and the pressure and inflammation thus formed induce lameness. White line may open apart followed by abscess formation at coronary band. White line disease typically starts to develop around the time of parturition and tends to be most severe in early weeks of lactation. Hormonal changes brought about around the parturition thus seem to play a vital role in the development of white line disease.

Drainage of the lesion is a vital aspect of treatment of white line disease. The lesion at the bearing surface can be opened using hoof trimmers. As much the debris should be removed as possible. All under run horn should be removed to expose the corium beneath. If infection has travelled under the wall, it should be exposed. Supplementation of biotin in feed has been found to reduce the risk of white line disease in multiparous cows.

7.4.3 Heel erosion

Heel erosion, also known as slurry heel or under run heels, begins at the bulb of the heel. These erosions start as pits on the surface and develop into parallel grooves that get filled with black material and bacteria. The horn can separate at the grooves to form a flap. A new sole develops underneath and the material becomes packed in between the layers. Loss of heel horn, an important weight bearing surface, leads to dorsal rotation of tip of the pedal bone and increased concussion between the caudal aspect of the pedal bone and the corium, which may result in lameness and solar ulceration. Chronically affected animals may develop dropped pasterns. Corrective claw trimming, formalin footbaths and improving the managemental and housing conditions are major control measures.

7.4.4 Sole abscess (Septic traumatic pododermatitis)

A sole abscess is a focal area of subsolar infection (sepsis trapped beneath the sole), usually layered between the old sole and the new sole. It occurs due to housing of animals in filthy or muddy conditions, sequel to puncture wound, trauma etc. Clinically there is mild to severe lameness and usually no external swelling. Explore any and all the black specs or spots, as small spot as the tip of needle, leads to abscess. A small amount of fetid brownish discharge should ooze from cavity, don't expect much puss. Treatment includes identification of subsolar abscess and paring of the area to allow for drainage.

Antiseptic application, bandage, NSAIDS can be used.

7.4.5 Vertical cracks (Sand cracks)

Vertical fissure usually in the dorsal abaxial wall of variable length. Predisposing factors include dry brittle horn, trauma, poor nutrition, trace element deficiency (zinc, copper, selenium), poor hoof conformation. Diagnosis is typical from appearance. Clinically there is no lameness, lameness only occurs if there is coronary band involvement or extension into sensitive lamina. Treatment aims at providing drainage for infected cracks, horizontal grooving to check crack extension. Stabilization of crack with wall patch, removal of detached horn. Prevention can be achieved by routine hoof trimming and use of oils on at risk cattle. Addition of trace minerals viz zinc, manganese, cobalt and copper in diet.

7.4.6 Horizontal cracks (Thimbles)

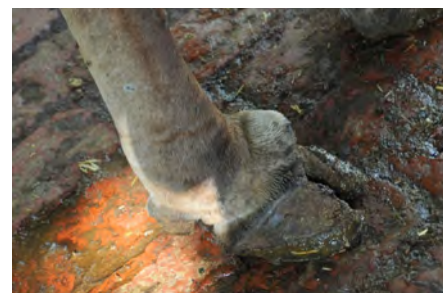
These are the cracks that cause disruption of the hoof wall parallel to the coronary band. Etiology involves metabolic episodes such as toxemia, fever and laminitis. Clinically lameness develops only if cracks extend into sensitive lamina. Treatment is done by draining infected lamina, stabilization or removal of free wall. In buffalo and cattle thimble may result after recovery from FMD and selenium toxicity.

7.4.7 Hairy heel warts (digital dermatitis, digital papillomatosis, strawberry footrot, verrucous dermatitis)

This is a chronic proliferative (cauliflower like) inflammation of the skin just beyond interdigital space. The digital dermatitis is a contagious disease and many animals may be affected in a herd. Etiology is unknown but a spirochete has been implicated. Diagnosis is made by typical wart like or hair like appearance between and above the bulbs of heel. Clinically lameness may be absent to severe and lesions vary in size. The earliest lesion recognized is digital dermatitis as a reddened circumscribed area typical above the interdigital cleft on planter surface of pastern (Strawberry lesion). As the lesions progresses focal hypertrophy of the dermis and epidermis leads to raised conical projections appearing much like wet grey terry cloth. In later stages papilliform projections of the blackened keratin may extend 10-15 mm from surface (the hairy wart stage). Treatment involves surgical resection and topical antibiotic therapy. Later is much more popular 5-15 ml of topical oxytetracycline is applied via a cotton dressing wrap. Terramycin 100 g in 3 litre of water to be sprayed on heels of effected cows for 5 days then every other day for 3 treatments, repeat monthly. Prgnosis is good for short term basis. Preventive measures include use of foot bath using 2% formalin, 5% copper sulphate, 5% zinc sulphate.

7.4.8 Bovine foot rot (interdigital necrobacillosis, foul in the foot, interdigital pododermatitis)

This is an acute or subacute necrotizing inflammation of the interdigital skin and underlying tissue characterized by moderate to severe lameness. It is one of the most common causes of bovine foot lameness. *Fusobacterium necrophorum*, *Dichelobacter nodosus* and *Bacteriodes melaninogenicus* are responsible organisms. Diagnosis is made by characteristic lesion and odor. Diseases is manifested in the form of sudden onset of mild to severe lameness with accompanying lesions ranging from



Interdigital pododermatitis in a cow.

superficial necrosis to deep clefts and fissures between the claws. Differentials include Interdigital dermatitis, foreign bodies, interdigital hyperplasia, lacerations and digital dermatitis. Treatment includes cleaning of effected area and debridement of effected tissue. Antibiotics (penicillin, tetracycline, sulfas, ceftiofur. Prevention can be achieved by footbath every 2 weeks. Vaccine is available (Volar, Miles Lab., St. Louis, USA) but is not very popular.

7.4.9 Corns (interdigital hyperplasia, interdigital fibroma)

A thickening of the Interdigital skin causing a mass to protrude between the claws. Etiology includes result of chronic irritation due to poor confirmation, poor foot trimming, heredity (Herefords). Diagnosis is from chronic proliferative swelling in the dorsal or mid aspects of the interdigital space. Clinical signs are manifested as innocuous corns, absent to severe lameness, infected corns are extremely painful. Treatment: if the corn is small, conservative therapy with the local or systemic antibiotics. If corn is large and is causing lameness, surgical removal is necessary. Cryosurgery and Cautery methods have also been used. Prognosis is good.

7.4.10 Foreign bodies

Stones, wires, sticks, nails etc. may all puncture the sole and Interdigital space causing various degree of lameness. Cleaning and examination of sole/Interdigital space will usually reveal offending object. Remove the object, clean and flush the puncture, use antibiotic locally or systemically if necessary.

7.4.11 Septic coffin joint (foot evil, septic pedal arthritis)

This is the Inflammation and infection of the coffin (DIP) joint. This is characterized by heat, swelling and pain above the coronary band and occasionally, draining tracts at the coronary band. Clinical signs are manifested in the form of 3-legged lameness with swelling and inflammation of the region immediately above the coronet. The swelling is usually more pronounced on the dorsal surface than it is around the bulbs. There may be an open draining wound just above the coronary band. Diagnosis is made ultimately by radiography. During early course of disease a radiograph may show only a widened joint space. Complicated cases of sole ulcer and white line disease may result in septic arthritis of coffin joint, tendinitis, tenosynovitis of DDF and avulsion of DDF. Treatment of the septic joint is difficult because it is protected by the hoof. A wooden block can be applied to the unaffected claw. Claw amputation is probably the treatment of choice.

7.4.12 Cork screw claw

It is the rotation of the claw (usually lateral, hind limb) on its long axis; hoof wall elongates and rolls under the solar surface. It is not very common but most bovine practitioners will see these periodically. Diagnosis is made by characteristic appearance. Clinically lameness may be absent to moderate; as the condition advances, the animal's ability to walk is impaired with a subsequent loss of condition and productivity. If condition becomes chronic and severe, there will be secondary disease or bony changes. Treatment consists of frequent trimmings (every 6 months) which allow the



Corkscrew hoof in a cow

animal to continue to be a productive unit. The first step in trimming a corkscrew is to cut away the elongated abaxial wall of which the animal is actually bearing weight (the wall has taken the place of the sole). The abaxial wall should be trimmed back to normal wall length. The toe should be cut back to match the toe length of the unaffected digit. Due to genetic factor animals with cork screw claw may not be bred.

7.4.13 Scissor hooves and overgrown hooves

Scissor hoof is the excessive growth of the claws such that the toes are extremely long and overlap; there is no rotation. Over grown hooves are the elongated toes that curve upwards and acquire a rocker or slipper shape (Slipper Shoe). These conditions are mostly result after chronic laminitis. In buffalos animals may develop slipper or scissors hooves after recovery from FMD. Hoof trimming will take care most of the cases of scissor claw and overgrown claw.



Scissor hooves in a cow.

7.4.14 Preventive measures for healthy hooves

Claw trimming is an integral part of the hoof health programme in cattle. Dutch method of claw trimming is regarded as the universal and most popular method of paring hooves in cattle. In most developed countries claw trimming once or twice a year is mandatory requirement of the dairy farms. Trimming or paring can be done by using hoof cutter or nipper and hoof knives. Alternately, use of hoof grinders is much quicker, easier and less time consuming and animals can be restraint in an ordinary crate but excessive over growth hooves may require casting of the animal.

7.4.14.1 Procedure

After proper restraint first cut is given to restore the toe length. Firstly inner claw toe length is restored and claw is trimmed. This is followed by trimming of the outer hind claw Length of the claw depends on the body weight or breed but generally 4-5 inches is considered appropriate. The toe cut or first cut is given with hoof cutter. Toe of the claw is restored to normal length. Once the toe length has been restored, second cut is given to unload the claw. This is done by removing a sliver of hoof horn with the hoof knife. Once the inner and outer claw are equal weight bearing after repeated trimming of the outer claw in hind limb, excess of loose horn is pared from the inner claw. The electric grinder is much quicker but proper restraint is mandatory. Third step is to lower the claw at the axial side towards axial groove. This is done to shift the weight towards the abaxial wall, the hard part of the hoof. This procedure is repeated every six months to one year or after the calving season.

7.4.15 Other common preventive measures

- Provide comfortable lying surface for the animal. Under Indian conditions, animals should spend 8-10 hours on kachha floor. A cow should lie down for 10-12 hrs per day to give desired rest to feet.
- Provide copper sulphate (5%) or formaline (2%) foot bath for cattle.
- Concentrates should be fed in 3-4 divided parts and should invariably follow greens or fodder.

- Claw trimming should be adopted as a routine practice on an organized farm.
- Periparturient diseases such as mastitis, metritis etc. should be promptly treated to avoid development of hoof lesion.

7.5 Upward fixation of patella

Upward fixation of patella is a common orthopedic condition of the large ruminants. It is known by several names in different localities such as *Jhanak, Sarnail, Ragda, Tanch, Tanak*

7.5.1 Etiology/ predisposing factors

1. Exploitation activity
2. External trauma leading to laceration or elongation of the ligamentous structures
3. Breed and genetic predisposition
4. Faulty conformation of the hind limb
5. Morphological changes of the medial trochlear ridge of femur
6. Damage to the nerve supplying the quadriceps femoris muscle

7.5.2 Symptoms

Upward fixation of patella can be unilateral or bilateral and can be permanent or recurrent in nature. It occurs mostly in buffaloes but is also reported frequently in young working bullocks.

Recurrent dorsal fixation is not apparent in resting animals in which the patella occupies its normal position in relation to the femoral trochlea. It is manifested during progression by an intermittent fixation of the patella through the hooking of the medial patellar ligament over the prominent upper extremity of the trochlear ridge. When the animal is forced to move, the condition becomes evident by occasional jerky steps during otherwise normal progression. It frequently disappears as the animal warms up. In due course as the condition progresses the symptoms become more frequent and the gait more obviously disturbed. Stifle and the hock joints are periodically fixed in extension and this gives the limb an unusual rigidity, while over-flexion of the fetlock causes the toe of the hoof to drag upon the ground during progression.

Animals suffering from permanent dorsal fixation, when forced to walk, carry their leg rigidly with the fetlock flexed and the toe dragged on the ground with the weight supported by the flexed digit. After some time animal adapts its gait by bringing the limb forward in abduction in the swinging phase, without flexion of the hock and stifle joints. When an attempt is made to back the animal, it often refuses to move.

7.5.3 Surgical treatment

Main aim of medial patellar desmotomy is to dislodge the patella from medial trochlear



Hyperextension of limb due to upward fixation of patella.

ridge, thus leading to free movement of stifle joint. Surgery can be performed with the animal in the standing position or in lateral recumbency. There are two common methods to this surgery viz. blind/ closed method and open method.

7.5.3.1 Standing approach with blind method

The site of the skin incision is indicated by a small depression that may be felt between the middle and medial patellar ligaments above their insertion on the tibial tuberosity. The operational site is shaved and painted with tincture of iodine. Local anesthetic (2% Xylocaine, 2-5 ml.) is injected subcutaneously over and around the ligament. Sterile surgical gloves are worn and the usual aseptic precautions observed. A small incision is made in the skin between the middle and the medial patellar ligaments just proximal to tibial tuberosity, taking care not to penetrate the joint capsule.

A tenotom is then pushed through the skin incision under the medial patellar ligament, near its insertion at tibial tuberosity, with its cutting edge in vertical direction. Once positioned correctly, the cutting edge is then directed towards the ligament. The tenotom is now slowly moved while strongly pressed against the ligament which is normally transected in a single movement of the blade. Severance of the ligament is indicated by the development of a deep depression between the cut ends. If the ligament is not completely transected the procedure is repeated.

7.5.3.2 Blind method in lateral recumbency

In uncooperative patients, it is difficult to perform surgery in standing condition and such animals are cast and restrained on the ground with the affected limb at lower side. Forelimbs and the upper hind limb are tied together and the affected limb is extended backward by pulling a rope tied at the region of fetlock. Pushing the point of hock towards the ground, rotates the stifle joint to better expose the site of incision. Cranial tibial tuberosity is located and the groove between medial and middle patellar ligament is now palpated. In this position, medial patellar ligament occupies the topmost position and is traced easily. Surgery is then completed in the same manner as in standing approach.



7.5.3.3 Open method

In open method, after aseptic preparation of the surgical site on the affected limb and infiltration of local anesthesia, a 3 cm linear incision is given 0.5 cm lateral to the medial patellar ligament near its insertion on the tibial tuberosity. Artery forceps are used for blunt dissection of the fascia from underneath the medial patellar ligament, and the ligament is then lifted over the forceps. After properly exteriorizing the ligament, it is cut transversely using a scalpel. The skin incision is closed by few interrupted sutures.

7.5.3.4 Postoperative care

Daily antiseptic dressing of the surgical wound and postoperative antibiotic cover, especially after open method, is all that is needed post-surgery. The results are miraculous and animal walks without a limp immediately after successful surgery.

7.5.3.5 Possible postoperative complications

1. Transaction of middle patellar ligament
2. Transaction of collateral ligaments
3. Penetration of joint capsule
4. Hemorrhage
5. Infection

7.6 Urolithiasis

Urolithiasis is the disease of prime importance in domestic animals all over the world. The disease has multifactorial etiology. A proper knowledge and detailed study of these factors can help the farmers and veterinary practitioners in laying down necessary preventive and managemental strategies. Previous studies on urolithiasis showed that animals at a variety of locations and under diverse climatic conditions are affected, but States of Punjab, Haryana, Uttar Pradesh, Bihar, Madhya Pradesh, Odisha, Andhra Pradesh and Tamilnadu had very high incidence of urolithiasis. At international level disease has a common occurrence in North American countries, United Kingdom, Australia, Switzerland, Scotland, Japan and Africa. Protein rich diet, concentrate feeding, changes brought about by weaning, early age of castration, lower water consumption, deficiency of Vitamin-A during winter season and high water loss during summer are thought to be some of the factors responsible for urolithiasis. Different workers in diverse climatic and managemental conditions have reported different predisposing factors.

7.6.1 Predisposing factors and prevalence of urolithiasis

Urolithiasis has been reported from all corners of the world. The reported number of cases of urolithiasis does not reflect the actual incidence of this malady, which may be even higher in animals as many cases with renal calculi may remain asymptomatic and thus undetected. There seems to be little information available about hospital incidence of urolithiasis in different species and it may vary from place to place. Clinical cases of urolithiasis are mostly recorded in male animals. Among the male ruminant urethral obstruction mostly occurs in castrated animals though incidence in non-castrated animals has also been recorded. Amongst the large ruminants, cattle are more commonly affected than buffaloes. It seems that the formation of uroliths is as likely in females as in males but chances of obstruction are more in males due to the narrow and longer urethra in males, in comparison to females. In male ruminants, presence of sigmoid flexure put the male ruminants at a higher risk of obstructive urolithiasis.

Urolithiasis has been reported in all age groups of animals. However about one third of the cases of urolithiasis in bovines are below two years of age. A high incidence of urolithiasis occurs during winter months, which could be due to lower consumption of water and deficiency of Vitamin A in extreme winter months. Lower incidence of urolithiasis during August to November could be due to sufficient availability of Vitamin A and availability of more grass for grazing during these months. A high incidence of urolithiasis in bovines has also been recorded in extreme summer possibly due to more water loss from the body.

7.6.2 Managemental practices

Managemental practices may play an important role in predisposing animals to the

problem of urolithiasis. A high incidence of urolithiasis was reported in ruminants. Castration at young age deprive the animal from normal development of urethra due to deficiency of testosterone hormone, concomitantly the absence of testosterone hormone decreases the protective hydrophilic colloids in urine and thus increases the incidence of urolithiasis. In animals castrated at an early age, the extrusion of urethral process for prophylactic and therapeutic amputation of urethral process becomes difficult, as separation of glans penis from prepuce is controlled by testosterone hormone at puberty. Bulls and partial castrates are found capable of passing larger calculi than steers, due to large size of their urethra, however, most of the differences in the urethral diameter occur after weaning, thus the castration deferred until weaning may be of limited value in combating urethral obstruction in range steers.

Type of food provided to the animals may also affect the incidence of urolithiasis in animals. Chances of siliceous uroliths are higher in range fed animals. A high incidence of obstructive urolithiasis is also recorded in feedlot lambs.

Availability of water and animals' ability to drink water may influence the incidence of urolithiasis to a great extent. Chronic dehydration raises urine specific gravity and uric acid saturation, and decreases the urine pH and thus may predispose the animals to calculi formation. Conversely, hydration may decrease the risk of urolithiasis through multiple mechanisms, such as increasing crystalline product transit through the kidneys, thus decreasing contact time with potential absorptive surfaces.

7.6.3 Clinical observations

Dullness, anorexia, restlessness, constipation, tympany, uraemic odour from mouth, rough hair coat and erect hair, anaemia, swollen face, pressing of head in terminal stages are the major clinical observations found in ruminant obstructive urolithiasis. Respiration rate and heart rate may be increased, however decrease in heart rate may also be observed. Rumen motility may decrease in most of the cases. When the calculi lodge in the urethra, a pressure develops in the bladder, producing mild colicky symptoms such as stretching, treading with the rear limbs and occasionally kicking at the abdomen. The most characteristic sign is an up and down pumping of an elevated tail in bovine. This action is associated with contractions of the bulbospongiosus muscle designed to expel urine through the urethra. A rectal examination reveals a distended bladder. Encrustation on the preputial hair may also be noted.

The animals with partial obstruction show signs of anorexia, dysuria, stranguria characterized by prolonged urination time, sustained urinating posture and dribbling of urine. Small amounts of urinary crystals or concretion deposits may be seen on the hair around the prepuce in some animals. On palpation a tense bladder is observed in the caudal abdomen. The animals with complete obstruction show the signs of anorexia, depression, anuria, tail flagging, frequent urinating efforts without any urination, kicking at the abdomen, flank gazing, vocalization, teeth grinding of pain and uneasiness manifested by frequently sitting down and standing up and rolling on the ground. The apparent abdominal pain is demonstrated by stretching out of all the four limbs.

If the blockage persists for long time, either the urethra or the bladder will rupture. The main history in these animals is a painful straining and other signs of obstruction initially; however, afterwards animal may stop straining. These animals gradually become depressed and anorectic. In these cases, there will be bilateral abdominal distension and water belly condition, and fluid thrills on abdominal ballotment are seen. The animals

are generally moderate to severely dehydrated, as evident from sunken eyes, rough hair coat and dry muzzle. Urinary bladder is not palpable.

Following urethral rupture, urine escapes into the tissue surrounding the penis, and an edematous type of swelling occurs on the abdominal floor and necrosis of the tissue starts. Diagnosis in bovine is determined by the characteristic swelling, absence of urination, and elevation of blood urea nitrogen (BUN). Paracentesis of the edematous area may produce a few drops of fluid with an old urine odor. Rectal palpation usually reveals a partially filled bladder, but careful examination may indicate thickness of the bladder and adhesion to the greater omentum (Jennings, 1984).

7.6.4 Surgical managements

Catheterization from the external urethral orifice to locate the site of calculus lodgement is not possible in cattle because of the presence of the sigmoid flexure. Since sigmoid flexure is the most common site, post-scrotal urethrotomy is commonly performed for the removal of the calculus, however, many times calculus lodged at the proximal site and urethrotomy incision need to be extended upwards or pre-scrotal urethrotomy may be needed to remove the calculus located at most distal part of the penis.

7.6.4.1 Tube cystostomy

Tube cystostomy is the recent method of management of urolithiasis in ruminants, particularly in male calves, in which a Foley's catheter is placed into the urinary bladder lumen via a laparotomy. It has been used in the treatment of urethral obstruction, urethral rupture or ruptured urinary bladder. The animal is restrained under lumbosacral epidural analgesia as for cystotomy. Left ventral abdominal area from the level of umbilicus to the



Tube cystostomy in a calf.

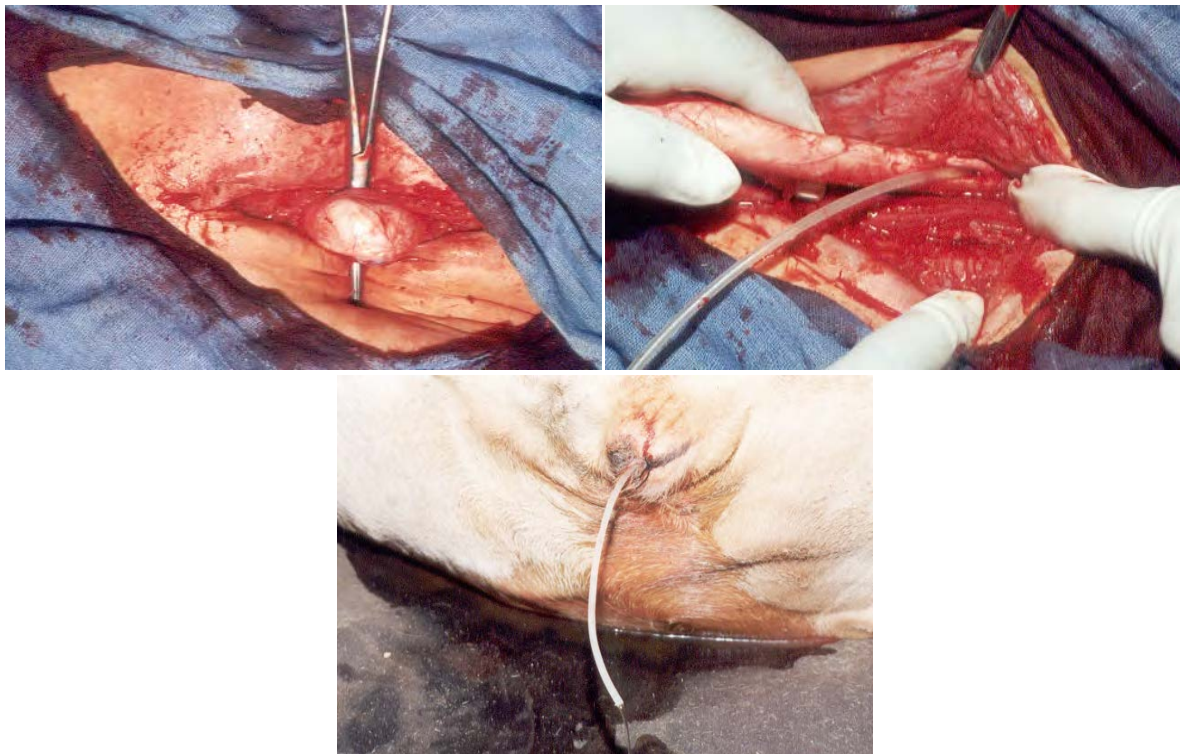
scrotum is prepared for aseptic surgery. A 2 cm long paramedian nick incision is given 5 cm lateral to midline and 2-3 cm cranial to rudimentary teats in prepubic region, so as to facilitate approach to the urinary bladder. A straight artery forceps is passed anteriorly from the incision to a distance of about 15 cm making subcutaneous tunnel, the tip of the artery forceps is brought out of the skin near preputial orifice by making another nick incision. A tract is thus formed for the fixation of Foley's catheter. A No. 14 French Foley's catheter is pulled through the tract with the help of the same artery forceps. Rectus abdominis muscle and its sheath are separated using pointed end scissors. The abdominal viscera are reflected aside, urinary bladder is palpated and is held in position with two fingers. Foley's catheter is then anchored to a K-wire by its eye and passed into the urinary bladder (just behind vertex in ventral midline) with a sudden thrust applied to the K-wire without exposing the abdominal organs. As soon as urine starts coming from the catheter, the balloon of Foley's catheter is inflated with 5 ml of sterile saline, the K-wire is then retracted slowly and then 10 ml of saline is infused in the balloon of catheter. A purse string suture using a monofilament, absorbable suture of 1/0-size is placed in the bladder wall to secure the catheter in place and prevent urine leakage. Care is taken to avoid puncturing of the catheter or its balloon during suture placement. The external

end of the catheter is then pulled gently to appose the bladder wall to the body wall at the interior aspect of the incision of the body wall. The abdominal muscle layer is sutured with No.1 catgut and skin with No.1 silk or nylon. The part of Foley's catheter outside the abdomen is fixed with abdominal wall with 5-6 stay stitches.

Ammonium chloride 250 mg/kg body wt is given as acidifier to the animals from 3rd day of surgery. Urethra is examined for the reestablishment of urethral patency by examining the signs of urination. Treatment is continued for at least 15 days so as to maintain urine pH within a range of 6.0-6.5. Clamping of Foley's catheter is started from day 5 to encourage urination through prepuce and animal is examined for the signs of urination. Cystotomy catheter is blocked when the urethral passage is clear of obstruction. Foley's catheter is removed by deflating its balloon and is pulled out of bladder and abdomen 3-4 days after clearance of urethral passage. The tract left by catheter is dressed until healing, which takes place without any complications.

7.6.4.2 Post-scrotal urethrotomy

In cases where the urinary bladder is intact post-scrotal urethrotomy alone may relieve the obstruction. The animal is restrained in right lateral recumbency and the midline area extending from the scrotum to the infra-anal arch is prepared for surgery. Local anaesthesia is achieved using line infiltration technique; caudal epidural analgesia should be discouraged for this surgery as it may reduce the tonicity of the bladder. A 10 to 15 cm long midline incision is given extending upward from the caudal border of scrotum. The skin and subcutaneous tissue are incised; the muscles are dissected bluntly; haemorrhage is generally minimal in this area. The penis in this area can be felt



Post-scrotal urethrotomy in a bullock: Note free flow of urine through the catheter.

as a hard cord like structure. A curved artery forceps is passed under the penis and it is levered. A gentle incision may be given over the penis to remove the fascial covering around the penis, while avoiding cutting the penile veins. Sigmoid flexure is straightened and an adequate length of the penis is exteriorized. The urethra lies in the urethral groove

on the ventral aspect of the penis. It passes between the insertions of the retractor penis muscle. The urethra is thoroughly examined by holding the penis in palm and palpating the urethra by passing the thumb over it. In bullocks the obstructing calculus can be felt as a hard and irregular bulging in the passage of urethra. A nick is given on the urethra at the site of the uroliths, which is then pressed out or removed by holding it with the help of a small artery forceps. When the calculus is located above the sigmoid flexure towards the ischial arch, it can be palpated in many cases by passing the index finger along the penis. The incision is extended up to the level of calculus lodgment.

After removing the calculus, a snugly fitting sterilized polyethylene catheter is passed into the urethra first to the proximal end as far as possible, as many times it is not possible to pass the catheter up to the bladder from this incision. The other end of the catheter is passed from the same incision to distal urethra so that it comes out through the preputial orifice. Flow of urine through the catheter indicates correct placement of the catheter and clearing of the obstruction. The outer end of the catheter is anchored with the preputial sheath to prevent its dislodgement. Some workers advocated that the urethral wound should not be sutured because if catheter is snugly fitted and there is no seepage of urine from the urethral wound, it heals without sutures. However, we recommend suturing of the urethra by simple continuous suture pattern using an absorbable suture material. Muscles are not unsutured. Subcutaneous tissue is closed with interrupted sutures using absorbable suture material and the skin with mattress sutures using nonabsorbable material like nylon 2-0. The catheter may be allowed to stay in the urethra up to 20 days.

7.6.4.3 Ischial urethrotomy

Ischial urethrotomy is performed with the bull in the standing position under epidural analgesia. The perineal region is prepared for aseptic surgery and a 15 cm long skin incision is made in the midline starting 5 cm below the anus. The dense fascial plane under the skin is incised to expose the retractor penis muscles. The incision is extended deeper between the muscles to expose the bulbospongiosus muscle. The terminal ventral portion of the muscle can be located and incision is made through it on the midline into the tunica albuginea of the penis near its ventral termination. The urethral groove is palpated for guidance, and a 3-cm incision is made in the bulbospongiosum penis. Haemorrhage may be controlled temporarily by digital pressure applied proximal to the incision. The external wall of the urethra can then be identified as a white membrane deep to the corpus spongiosum urethra. A 2-cm incision is made into the urethral lumen, which may be confirmed by inserting a catheter in both directions. A Foley's catheter is passed into the pelvic urethra, and subsequently into the bladder and the cuff of the catheter is inflated.

The wound around the catheter is closed by suturing the incision in the tunica albuginea using No. 0 catgut or PGA. The tunic of the bulbospongiosus muscle is closed, followed by the subcutaneous fascial plane, and finally the skin incision with nonabsorbable suture.

Unlike postscrotal site the penis cannot be pulled out of an incision in the ischial region. Ischial urethrotomy is considered useful in draining out urine from the atonic bladder but is free from complications. The technique is commonly used in western countries in steers to establish flow of urine by amputating distal end of the penis and then fixing proximal stump to the skin. After a few days animals are disposed off for meat purpose. The technique is of limited value in Indian conditions considering the economic status of the animal owners. Haemorrhage is usually more extensive in this procedure and careful

ligation of the bleeding vessels is needed. The chances of gravitational seepage of urine from the urethra into the surrounding tissues are also greater. Wound dehiscence due to seepage of urine and contamination are the common consequences.

7.6.4.4 Cystorrhaphy

Cystorrhhexis or rupture of the urinary bladder is very common in bullocks after urethral obstruction. Delayed diagnosis of the obstructive urolithiasis and delayed presentation of the case to the clinics equipped to carry out surgical operation in large animals frequently result in rupture of the urinary bladder and development of "water belly inches condition. It is reported that discrete dorsal tears may sometimes heal spontaneously and ventral tears require surgical intervention, however, once the abdomen has been open to locate the site of obstruction, it is advisable to carry out cystorrhaphy. The repair of the urinary bladder is preferably undertaken after removal of the calculus from the urethra because normograde urethral catheterization can be performed at the time of cystorrhaphy.



Evacuation of urine from abdomen and cystorrhaphy.

Cystorrhaphy has been reported in the literature through approaches like para-anal, infra-anal and even ventral approaches, however, left paralumber fossa approach is preferred as it provides sufficient space for manipulation of bladder in standing animal. The surgery can be done under paravertebral or local infiltration analgesia. After achieving local anaesthesia and preparation of the site for surgery, about 20 cm long skin incision is made in the most caudal part of paralumbar fossa. The abdominal fascia, muscles and the peritoneum are incised to enter the abdominal cavity. The laparotomy incision should be large enough to allow entry of both hands in the abdominal cavity. The urine present in the abdomen will gush out and the urine below the level of incision should be siphoned out as much as possible. The urinary bladder is identified and the tear in the urinary bladder is located and the bladder should be examined for the presence of any calculus, concretions or blood clots, which should be removed before undertaking the repair. Catheterization of the urethra should be attempted with a polyethylene catheter having a sterile stylet. The proximal end of the catheter should be fenestrated before attempting catheterization. The catheter is passed inside the bladder through the tear and introduced into the urethra up to the entire length of the urethra. The stylet is then pulled out from the proximal end. The catheter is held from the distal end and pulled slowly so that only 2-3 cm of the catheter remains in the urinary bladder. The distal end of the catheter is anchored to the preputial sheath using a non-absorbable suture.

The tear in the bladder ideally should be repaired by applying inverting sutures but may be repaired by applying continuous sutures using absorbable suture material. A second row of continuous suture should be applied to avoid leakage. The abdominal cavity should be copiously lavaged with saline to remove the traces of the urine before closing the abdominal incision in a routine manner.

7.6.5 Prevention of urolithiasis

1. Animals must be balanced diet with addition of salt (Sodium chloride) into the ration at the rate of 2 to 5 % (alternatively, ammonium chloride @ 0.5 to 1 %) to

promote water intake and production of dilute urine or acidify urine.

2. Castration should be avoided in too early age.
3. Sufficient amount of green fodder should be given to the animals.
4. Mineral mixture should be added in adequate amount to feed fed to the animals.

7.7 Common Affections of the Eye

Eyes are prone to many local or systemic problems. The description of some common surgical conditions of eyes and their treatment is being given below.

7.7.1 Keratoconjunctivitis

Infectious keratoconjunctivitis of cattle is characterized by infection and varying degrees of corneal opacity and ulceration. The disease usually affects one or both eyes. Plant awns, face flies, ultraviolet radiation from bright sunlight, dry and dusty environmental conditions, and stress are the risk factors for this condition. Young animals are affected most frequently, but animals of any age are susceptible. The clinical signs include photophobia, blepharospasm, and epiphora, and ocular discharge. The entire cornea may be opaque, blinding the animal. Blood vessels may invade the cornea from the limbus and move toward the ulcer.



Keratoconjunctivitis in a cow.

The common treatment is bulbar conjunctival injection with synthetic penicillin. Long-acting oxytetracycline (2 injections of 20 mg/kg, IM or SC, at a 48- to 72-hr interval) is effective in cattle. Other effective antibiotics include ceftiofur crystalline free acid (6.6 mg/kg, SC, at the base of the ear). Topical applications of ophthalmic preparations should be applied at least tid to be effective. Systemic NSAID may be used to provide relief from pain and secondary uveitis.

7.7.2 Corneal opacity

Corneal opacity is usually due to trauma of variable degree or penetrating injuries or foreign bodies such as awn or grass. It is identified by loss of transparency of the cornea in a localized area or extensive area. In delayed stage the cornea becomes opaque white due mainly to infiltration of leucocytes. In early stage, it can be treated by removal of the cause and antiinflammatory measures. Subconjunctival deposition of an antibiotic and long acting corticosteroid preparation (triamcinolone) at 12 o'clock position may be very helpful in reversing the opacification. Bilateral corneal opacifications are usually a manifestation of infectious keratoconjunctivitis or some systemic diseases. In



Corneal opacity in a cow.

such cases attention must be given on locating the underlying systemic causes such as trypanosomiasis, etc. and dealt accordingly.

7.7.3 Eye worms

In almost all species extra-ocular worms (*Theleazia* spp.) may be found in the lacrimal gland and its ducts. Superficial locations on the cornea, in the conjunctival sac, and under the eyelids and nictitating membrane are also seen. Worms may also be found on the periorbital hair or skin. *Thelazia* infections in cattle may produce mild conjunctivitis, excessive lacrimation, localized edema, corneal clouding, and occasionally, subconjunctival cysts. *Thelaziasis* is commonly associated with severe clinical manifestations, including conjunctivitis, photophobia, and keratitis. There is chronic conjunctivitis with lymphoid hyperplasia and a seromucoid exudate. In cattle, levamisole at 5 mg/kg, SC, and ivermectin and doramectin, both at 0.2 mg/kg, SC or IM, have shown activity against *Thelazia* spp. Pour-on formulations of ivermectin or doramectin, delivered to achieve a dosage of 0.5 mg/kg, have also proven highly effective.

7.7.4 Ocular dermoids

Ocular dermoids are skin or skin like appendage present on the limbus, conjunctiva and/or cornea. The condition may occur as unilateral or bilateral form. Hair from the lesion are predominantly responsible for irritation of cornea and conjunctiva resulting in chronic inflammation, at times, leading to impairment of vision. The condition is best managed by excision under sedation and local analgesia in early life. Delay may result in non-reparable damage to the cornea and globe. Corneal dermoids are excised after superficial lamellar keratotomy. After removal in early life, possibility of normal vision restoration is good.



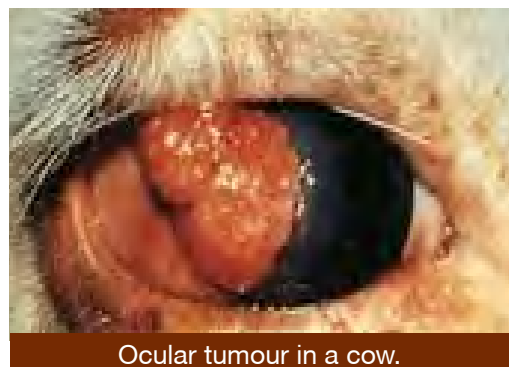
Ocular dermoid.

If the dermoid involves third eyelid or the upper or lower lid margin, during removal and reconstruction care must be exercised for possible post-operative deviation of the puncta or development of entropion or ectropion. Post-operative care includes a course of antibiotic, NSAID and ocular instillation of antibiotic drops and protective eye bandaging. Healing is good and eventless in majority of cases.

A retrobulbar abscess may develop at the base of the globe resulting in unilateral exophthalmos and subsequent uveitis. The clinical presentation is similar to any condition wherein a space-occupying lesion develops behind the globe. Abscess may also develop at the base of hair follicles of eye lashes which can be readily drained after maturation through a cutaneous incision and antiseptic lavage of the cavity.

7.7.5 Ocular tumors

Neoplastic growth at the eyelid may be encountered occasionally in cattle and buffaloes. Non-aggressive small benign lumps may be excised under sedation and local analgesia. The most frequent ophthalmic neoplasms in cattle are the squamous cell carcinoma



Ocular tumour in a cow.

complex and the orbital infiltration associated with lymphosarcoma. The latter, with extensive invasion of the orbital structures, results in progressive exophthalmia, reduced ocular mobility, exposure keratitis, and corneal ulcerations that can lead to perforation. Squamous cell carcinomas may respond to excision, cryotherapy, hyperthermia, radiation therapy, and immunotherapy, or a combination of these therapies. For advanced lesions confined to the globe, enucleation is recommended. When adjacent tissues are affected, removal of the globe and all orbital contents should be performed.

7.8 Foreign body syndrome in bovines

Ingestion of foreign bodies by large ruminants causes a variety of problems in digestive system. Traditionally, foreign body syndrome (FBS) is synonymous to traumatic reticuloperitonitis (TRP). Foreign bodies (like wire, nail, needle or any other sharp stiff metallic/ non-metallic object which are able to penetrate the GIT) cause TRP and its associated complications. The problem of FBS in bovines arises because of indifferent manners of prehension, little mastication and peculiar arrangement of gastric apparatus. Mechanization of agriculture and consequent increase in the metallic debris in the feed and fodder seems to increase the frequency of TRP each year. Adult dairy cattle and buffaloes are most commonly affected because of their longer exposure to foreign material with age. In India, incidence of TRP appears to be higher in buffaloes than in cattle however polythene menace is higher in cattle than in buffaloes.

7.8.1 Pathogenesis

Once a potential foreign body reaches the fore-stomach, it lodges in the honeycomb of the reticulum. The vigorous contractions of the reticulum aided by the movement of diaphragm make the sharp object to penetrate through the reticular wall. Perforation of the wall of reticulum is followed by contamination of peritoneal cavity with reticular contents causing an acute local peritonitis which may spread to cause diffuse peritonitis. Penetrating foreign bodies may proceed beyond peritoneum and cause involvement of other organs with several complications viz. reticular abscess, reticular fistula, diaphragmatic hernia, diaphragmatic abscess, traumatic pericarditis (TP), traumatic sternbrae, pyothorax, abscessation of liver and spleen, traumatic pneumonia and pleurisy.

The inflammatory changes in the peritoneal cavity lead to formation of adhesions which have an important role in causing symptoms of inappetance to anorexia. Extensive adhesions of reticulum and/or rumen with diaphragm and other organs or, abdominal Wall might interfere with their contraction, eructation process and the outflow of ingesta to the lower digestive tract. Due to digestive disorders and inappetance the metabolic profile of such animals get compromised.

7.8.2 Clinical signs

A wide variety of clinical signs may be exhibited by the affected animal depending on the extent of injury, duration of illness, anatomical and physiological consideration of the organs involved and pregnancy status of the animal. Most of the animals with TRP are dull, depressed and appear stiff. The temperature and heart rate may be increased. There is rapid drop in the milk yield, anorexia, ruminal and reticular atony leading to ruminal impaction with slight tympany and absence of cudging, protruding neck, disinclination to lie down; spontaneous grunting accentuated by movement, defecation, micturation and becomes very marked on pinching withers or applying pressure to Xiphisternal

region. Such animals have abducted elbows while hind limbs are held more under the body. Sometimes, trembling of muscles over left side on the back of elbow, occasionally over rumen and rarely on both side is noted. In chronic peritonitis, there is repeated attack of indigestion or reduced milk flow in the absence of any good reason. The tension of abdominal muscles leads to “gaunt” or, ‘tucked up’ appearance. Symptoms like short stepping and rarely, crouching and kicking at the belly may also occur.

7.8.3 Diagnosis

A plain radiograph of the reticular area is the best tool to diagnose traumatic reticuloperitonitis (TRP). Good quality radiographs of diagnostic value are easily obtained preferably in lateral recumbency. In early cases of TRP, TLC is in normal range while neutrophilia is there with an abnormal proportion of unsegmented neutrophils. In early acute diffuse peritonitis, the neutrophil: lymphocyte ratio is reversed and decreases as the lesion becomes more chronic and adhesions develop.

In affected animals the mean total plasma protein remains on the higher side of normal range i.e. > 80g/L with increase in total globulin. A relatively accurate diagnosis of peritonitis can be made if the nucleated cell count is >6000 cells/ul and a total protein concentration is > 3 g/dl. A more accurate diagnosis can be made by performing a differential cell count and if neutrophils account for >40% of the cells and eosinophils for < 10%, a diagnosis of peritonitis is indicated.

7.8.4 Treatment

Generally, two methods of treatment are

used for TRP, conservative treatment and surgery but combination may be used effectively. It is best option to treat the animal conservatively for 3 days and if marked improvement has not occurred by that time, perform laparorumenotomy. In Conservative treatment, the animal is immobilized for two weeks, no walking is permitted, front feet are elevated and broad spectrum antibiotics, analgesics and rumenototics are administered. A fasting for initial three days may be recommended. The chance for confusing the TRP with primary indigestion is also taken care of. If the laparorumenotomy is accomplished in early phase of the disease, 100% recovery is anticipated. Even reticular and perireticular abscesses, and extrareticular fibrous nodule can be treated during laparorumenotomy.

7.9 Polythene/Plastic menace

Plastic waste is a synthetic solid material formulated from natural gas and oil. Since its invention, plastic has become a significant part of our lives. On one hand the plastic provides an easy option to carry stuffs, on the other hand, it is harmful for the health of living beings. Its non-biodegradable nature makes it very dangerous substance specially for the stray animals, that can ingest plastics with food stuffs.

7.9.1 Ingestion of plastics

Many dairy and cattle owners allow their cows to stray and find food available in aste and debris lying in and around the city. Stray cows are generally seen on the roadsides eating away the plastic bags and their contents in search of food items. The ingested polythene hinders with the process of fermentation and mixing of contents leading to indigestion. They can also obstruct the orifice between reticulum and omasum. If not removed through surgery, polythenes may become fatal. The plastic bags cannot be digested or passed as such through faeces by an animal. The toxic contents of plastic

may also enter in human body through milk produced by such cows. The foreign bodies like hard metal needles, wires, nails, etc. are also disposed along with other house waste in polythene bags, which after being consumed by cows may settle in reticulum giving rise to a condition known as “traumatic reticulo-pericarditis (TRP)”.

7.9.2 Consequences of polythene ingestion

Several pathological conditions may be caused by the ingested plastic and polythene in animals. The polythenes and other plastic materials do not degrade in rumen/ reticulum. Due to the churning effects of the ruminal movements they get mixed with fibrous feed stuff making large bundles which become tight due to continuous movements in the rumen. These lumps destroy the rumen microflora leading to indigestion. They can also obstruct the rumino-reticular orifice. Rumen may become impacted due to presence of large quantities of polythene bags/ plastics accumulated over a period of time. This leads to rumen atony and decreases the rumen motility. If polythenes present in rumen and reticulum occlude the orifice of reticulum and omasum, gas gets accumulated in the rumen causing tympany or bloat. The condition may deteriorate fast if such animal is fed upon legumes or other gas forming feed/ concentrates and may be fatal. Polythene bags trapped in the feed in rumen may also occlude oesophageal orifice leading to hindrance in eructation of gases causing dyspnoea and death. Nails, wires and other metallic sharp objects may also be eaten up by cows alongwith food/feed items in polythene bags. These sharp objects may get trapped in reticulum and penetrate the wall of reticulum and diaphragm to invade heart causing traumatic pericarditis. Due to lack of proper nutrition, animal becomes weak and immunodeficient. The animals having polythenes in their rumen may become emaciated but may survive for long time by getting some energy from the carbohydrates from kitchen waste however, when such stray animals are brought to Gaushala, they are fed upon mainly fibrous grasses, which get trapped with polythene present in the rumen. The condition of such animals may deteriorate further and the animal may die fast.



Stray animal picking plastics from garbage.

7.9.3 Treatment

Early diagnosis and prompt surgery for removal of polythenes by rumenotomy may save such animals. Medical treatment in such cases yields disappointing results. Public



Plastics being removed from cows by rumenotomy.

awareness about careless disposal of plastic bags may prevent the undue suffering of the holy cow.

7.10 Paralysis in Cattle

Paralysis can be described as the loss of muscle functions due to disruption of messages between the brain and the muscles or muscles do not respond to nervous stimuli due to intrinsic or extrinsic causes. There could be several conditions in cattle that can lead to paralysis e.g. spinal cord injury, trauma, milk fever etc. A cow unable or unwilling to stand for four hours or more is known as Downer cow. A variety of metabolic, infectious, toxic, degenerative, and traumatic conditions may lead to Downers cow syndrome.



A Downers cow in a Gaushala.

7.10.1 Sciatic nerve paralysis:

It may be recorded immediately after calving. Pressure on sciatic nerve due to Feto-pelvic disproportion may cause this condition, occasionally it may be caused secondary to injection abscess. Clinical signs include knuckling of fetlock and slight “dropping” of the hock. Weight bearing may be affected. A prominent patellar reflex can be observed. Tail tone and anal sphincter tone may be noted and atonic bladder is found. There may be analgesia of hindlimb distal to stifle joint.

7.10.2 Obturator nerve paralysis

Etiology is the same as for sciatic nerve paralysis. Clinical Signs include inability to adduct the hind limbs, tendency for abduction when standing, particularly on concrete. Treatment should include hobbling the back legs to prevent splits.

7.10.3 Peroneal nerve paralysis

It may occur immediately after parturition or prolonged recumbency due to pressure ischemia over lateral stifle region. Clinical Signs include hyper flexion of fetlock joint, inability to extend digit and overextension of the hock. There may be skin analgesia at dorsal metatarsal area, fetlock, and digit. Treatment includes bandage, splint, or cast on fetlock to prevent abrasion

7.10.4 Radial nerve paralysis

It is primarily caused in adult cattle after prolonged lateral recumbency due to pressure ischemia over the lateral aspect of the humerus. Clinical signs include inability to extend the elbow, carpus, and digits. The leg is dragged, which may cause abrasion at the fetlock. Skin analgesia may be present on the lateral part of leg. Treatment includes bandage, splint, or cast leg (including carpal joint) to prevent fetlock abrasion.

7.10.5 General treatment principles for nerve injuries

The animal should be confined to dry, softly bedded box stall (sand stall is best). The animal should be shifted from side to side to prevent further nerve and muscle damage. Hip-lifters or slings should be used with caution to prevent additional injury. Perineural swelling should be controlled by administering dexamethasone or flunixin meglumine. Daily injections of methylcobalamine may be given.

7.10.6 General consideration for management of disabled animals in Gaushala

1. Separate wards should be constructed for keeping the disabled animals in Gaushala. The wards should be beyond the reach of wild/stray animals and birds. All the disabled animals should be segregated in such wards for proper care and treatment and to avoid fight injuries from the healthy animals.
2. The enclosures for disabled animals should also be made fly proof particularly those used for keeping the injured/wounded animals.
3. The wards for the disabled infirm animals should be non-slippery with soft bedding. A kuchcha floor with 20 cm thick layer of sand or straw would be appropriate as laying on the hard surface even for 1-2 hrs may cause damage to skin and superficial nerves.
4. The enclosures should be well ventilated with provision for clean potable water and protection from hot and cold weather.
5. Provide a balanced nutritive, but easily digestible feed based diet. The palatable green grasses should be preferred over the concentrate based diet. There must be availability of clean water ad lib. The water trough and feeding tray should be shallow with wide base.
6. If the animal is unable to get up, it should be maintained in sternal recumbency with the support of sand bags/straw bale etc. Prolonged lateral recumbency may lead to development of bloat, regurgitation and aspiration, which may be fatal.
7. The animal should be rolled from one side to other every 2-3 hours to minimize the tissue damage and development of decubital ulcers.
8. Recumbent animal should be encouraged to get up. There should be provisions for sling and hip clamps. However if hip clamps are used to support the animal they should be well padded.
9. Massaging and assisted locomotion will help to prevent ischemic myonecrosis.
10. Regular grooming and mild exercise will help to make the animal remain healthy.
11. Floating tanks should be available for disabled animals and animal should be allowed to swim in floating tank for 6-8 hrs daily.
12. Animals should be inspected by the veterinarian for early diagnosis and treatment of primary cause of the disability to minimize secondary trauma and suffering as early as possible. Pain management should be given due importance.
13. The animal should be assessed at 2-4 hour interval for improvement. If there is no improvement the diagnosis should be reassessed.
14. The lactating cow should be milked out regularly to prevent the development of mastitis.
15. The ample space should be provided for the disabled animals which are able to walk.

7.11 Hernia

Hernia is the protrusion of an organ or tissue through an opening covered by the skin. The hernia consists of 1) hernial ring, through which the contents have migrated, 2) hernial

sac which encloses the contents and 3) hernial contents.

7.11.1 Etiology

There may be several etiological causes for hernia, which include imperfect closure of an embryonic defect, weakness of the abdominal wall due to inflammation, contusion, etc., external violence with blunt objects, increase in the intraabdominal pressure due to straining – constipation, diarrhoea, parturition, tympany, and violent, coughing, etc.

7.11.2 Classification

Hernia may be congenital or acquired. According to the protrusion of hernia sac, it may be external (contents protruding through the abdominal wall close to the skin), internal (contents moving from one body cavity into another) or interstitial (contents situated between the abdominal muscles). According to the location, hernia may be called umbilical hernia, inguinal hernia, scrotal hernia, diaphragmatic hernia, ventral hernia, pelvic hernia (Gut tie). In cattle, umbilical and ventral hernia are more common. According to the hernial contents, it may be called as enterocele (intestine), epiplocele or omentocoele (omentum), enteroepiplocele (intestine and omentum), gastrocele (stomach), vesicocoele (bladder), hepatocoele (liver), hysterocoele (uterus). According to the reducibility of contents hernia may be called as reducible hernia or irreducible hernia (due to adhesions, incarceration or strangulation).

7.11.3 Clinical signs

Presence of hernial swelling in varying size, shape and consistency is the major clinical sign. The swelling may increase in size during straining or coughing. Severe pain, rise in body temperature and colic are more pronounced in strangulated hernia.

7.11.3.1 Umbilical hernia

Discrete round swelling at the umbilicus is seen.

7.11.3.2 Ventral hernia

Reducible or irreducible hernial swelling on abdominal wall usually with omentum, intestine or rumen is observed.

7.11.3.3 Inguinal / scrotal hernia

Swelling in the inguinal / scrotal region with abduction of hind limbs (broad stepping). Colic may be recorded in acute cases. The affected testicle becomes atrophied in chronic cases of scrotal hernia.

7.11.3.4 Pelvic hernia (GUT-TIE)

Abdominal pain characterized by restlessness, frequent lying down and getting up, looking towards the flank and passing small quantity of faeces mixed with mucus.

7.11.3.5 Diaphragmatic hernia

Weight loss, reduced production, colic, partial anorexia with suspended rumination, scanty faeces, recurrent tympany and respiratory difficulty, muffled thoracic auscultation with borborygmi sounds from the thorax can be observed.

7.11.4 Diagnosis

Based on history (presence of hernia at birth or history of trauma) and clinical signs, the hernia can be suspected. Inspection and palpation of hernial swelling is recommended. External hernia should be differentiated from abscess, cyst, tumour and hematoma. Palpation of hernial ring is done easily in reducible hernia. Plain and contrast radiography may be helpful. Ultrasonography can also be used to know the nature of the hernia contents. If ultrasonography is not available exploratory puncture may be performed to ascertain the nature of the contents. Exploratory laparotomy/rumenotomy is the reliable method in diagnosis of diaphragmatic hernia.



Umbilical hernia in a calf.

7.11.5 Treatment

In most calves below one year of age, spontaneous disappearance of congenital umbilical hernia occurs as the animal grows.

7.11.5.1 Conservative treatment

Reduction of hernia by local manipulation and bandage application around the abdomen is used to prevent its return. This method is effective in some cases of umbilical hernia. Local injection of irritant solution around the hernial ring causes inflammation which is sometimes used to prevent recurrence of small hernia and closure of orifice.

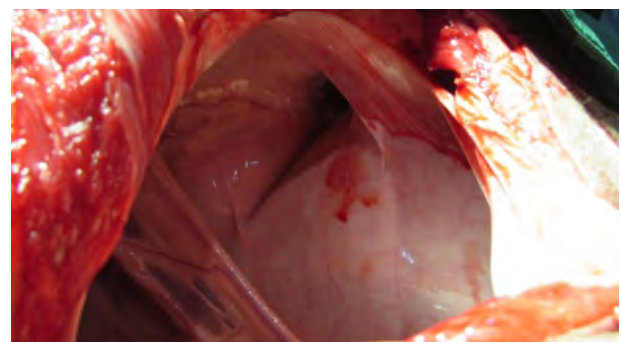
7.11.5.2 Surgical approach

Surgical correction of hernia is done under local or general anaesthesia based on the type of hernia and the treatment comprises of reduction of herniated contents and closure of the hernial ring. Local analgesia is sufficient for correction of umbilical hernia. For general anaesthesia, animal is kept off feed for 2-3 days and maintained with adequate intravenous fluid therapy. In case of diaphragmatic hernia, general anaesthesia and positive pressure ventilation of the lungs are the prerequisites in both thoracic and abdominal approaches. Prior evacuation of the rumen and assisted ventilation during herniorrhaphy are needed for successful surgical outcome.

7.11.5.2.1 Restraining of animal

Umbilical hernia - Dorsal recumbency, ventral hernia - lateral or ventral recumbency, inguinal or scrotal hernia - lateral recumbency with the affected side up, Gut-tie - left lateral recumbency, diaphragmatic hernia - supine position (abdominal approach) or lateral recumbency (thoracic approach).

Make a linear incision over the skin and subcutaneous tissue to expose the hernial sac. In case of diaphragmatic hernia, make a linear skin incision between 6th and 7th intercostal space (thoracic approach) or through linea alba 5cm caudal to the xiphoid cartilage and extending about 25-35 cm parallel to the costal arch. Separate the sac from the ring by blunt dissection, the viscera is freed of any adhesion and returned to the abdominal cavity.



Diaphragmatic hernia showing vent.

The thick fibrous mass of hernial swelling may be resected at the level of hernial ring and discarded. The borders of the hernial ring are then freshened to provide irregular surface to initiate healing. If the hernial ring is circular, suturing is made easier by removing a triangular piece of tissue from either end and converting it into an elliptical shape (Kelotomy).

Close the ring in the abdominal wall by placing overlapping sutures at the the edges of the ring and the diaphragmatic ring with continuous lock stitch pattern with thick non absorbable suture material (e.g. Silk). After all the sutures are placed, the ends of the sutures are pulled, tightened and secured starting from the center towards each of the commissures. Suturing of the hernial ring is called herniorraphy. Interrupted sutures may be place between the overlapping sutures for reinforcement. When the hernial ring is excessively large, biomaterials like nylon mesh may be anchored over the defect for satisfactory closure (Hernioplasty).

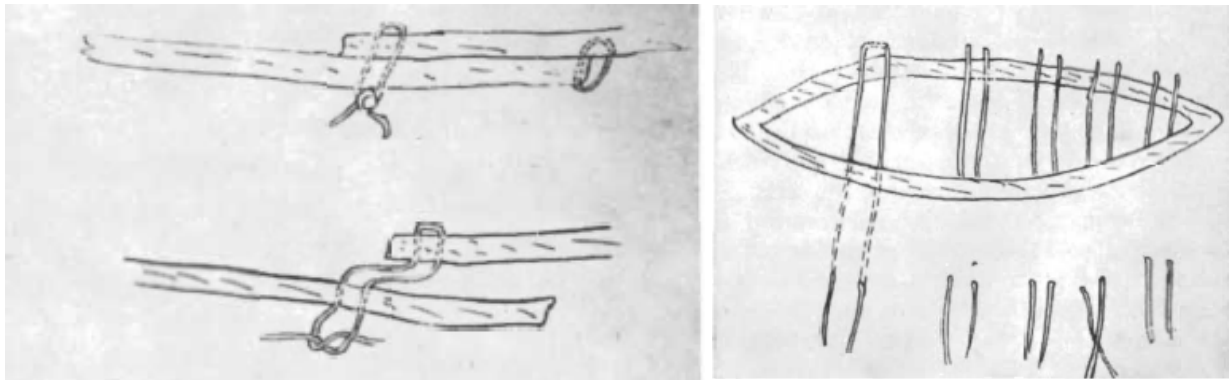


Diagram of overlapping suture technique in hernia.

In case of diaphragmatic hernia, the negative pressure in the pleural cavity is established by inflating the lungs to its full capacity immediately before tying the last intercostal suture (thoracic approach) or the complete closure of the diaphragmatic ring (abdominal approach).

Close the skin and subcutaneous tissue with simple continuous and horizontal mattress sutures respectively after trimming the excess skin margins.

7.11.5.2.2 Postoperative care

Reduce the volume of feed to avoid distension of abdomen, adequate fluid therapy, broad spectrum antibiotic therapy for 5-7 days, analgesics for 3-5 days, daily wound dressing till removal of skin stitches, controlled exercise.

7.12 Udder and Teat affections

Mammary glands are modified sebaceous glands. They are highly developed in cattle having four quarters. The development of the mammary gland starts early in the fetal life. Already in the second month of gestation teat formation starts and the development continues up to the sixth month of gestation. When the calf fetus is six months old, the udder is almost fully developed with four separate glands and a median ligament, teat and gland cisterns.

The mammary gland consists of secreting tissue and connective tissue. The amount of secreting tissue, or the number of secreting cells is the limiting factor for the milk producing capacity of the udder. The milk is synthesized in the secretory cells, which are arranged as a single layer on a basal membrane in a spherical structure called alveoli. The diameter

of each alveoli is about 50-250 mm. Several alveoli together form a lobule. The milk which is continuously synthesized in the alveolar area, is stored in the alveoli, milk ducts, udder and teat cistern between milkings. 60-80% of the milk is stored in the alveoli and small milk ducts, while the cistern only contains 20-40%. The teat consists of a teat cistern and a teat canal. Where the teat cistern and teat canal meet, 6-10 longitudinal folds form the so called Fürstenberg's rosette, which is involved in the local defense against mastitis. The teat canal is surrounded by bundles of smooth muscle fibers, longitudinal as well as circular. Between milkings the smooth muscles function to keep the teat canal closed. The teat canal is also provided with keratin or keratin like substances which between milkings act as a barrier for the pathogenic bacteria. The arterial supply is from the branches of external pudic and perineal arteries, venous drainage is through external pudic, perineal and subcutaneous abdominal veins. The nerve supply is through inguinal nerves and caudal mesenteric plexus of sympathetic system. The common surgical conditions of teat and udder are discussed in the following text.

7.12.1 Supernumerary teats

These teats are often present in between the normal teats. They interfere with normal milking. They may be excised under local anesthesia by making two elliptical incisions at the base of teat and proper debridement. Skin may be sutured by interrupted sutures using non absorbable suture like nylon, silk or polyamide.



Supernumerary teats in a cow.

7.12.2 Teat lacerations

Superficial wounds are treated as standard with other tissues. Large wound involving skin and muscularis may require suturing. Deep wound involving mucosa is best sutured with the animal in lateral recumbency after deep sedation. A ring block is produced and a tourniquet is applied at the base of the teat to check haemorrhage and to prevent milk flow into the cistern. After preparation of the affected teat, a sterilized teat siphon is inserted and debridement is done to remove the dead tissue. The mucosa is closed with simple continuous/ interrupted suture with absorbable suture material. The submucosa and muscularis are then closed together using simple continuous suture and finally the skin is closed. Postoperatively antibiotics are infused into the affected teat for 4-5 days. Milk is removed after insertion of a sterilized teat siphon for a few days for smooth healing.

7.12.3 Teat fistula

Teat fistula is an abnormal opening between the teat cistern and the teat surface through which milk flows out in lactating animals. If the fistula is very small, mild chemical cauterization or electric cautery may be helpful. Large fistula needs reconstructive surgery. Surgery should be delayed if the teat is highly inflamed. For repair, two elliptical incisions are given on the skin edges for debridement and undermining. The wound is then closed as mentioned earlier for deep lacerations.

7.12.4 Teat spider (Membranous obstruction)

It may be congenital or acquired. The obstructing membrane may be thick or thin and located high at the base of the teat or lower down in the cistern. Palpation shows fluctuating milk above the obstructions but milking is not possible. The teat is prepared for surgery under local analgesia. A Hudson's teat spiral is introduced up to the

membrane for deep penetration with 3-4 revolutions. The instrument is then withdrawn. Alternatively, the membrane can be slit in 3-4 directions using a small teat bistoury. Flow of the milk generally keeps the teat cistern patent. It is recommended that during milking the affected quarter should not be milked completely to avoid a stricture.

7.12.5 Contracted sphincter (Hard milker)

It may be congenital or acquired. There is a small stream of milk leading to prolonged milking time and trauma to the teat. Under local analgesia, the enlarging procedure may be accomplished by inserting a Litchy teat knife, ringed teat splitter or Stoll teat bistoury. The opening in the sphincter is maintained at the desired size by inserting a Larson teat tube and leaving it in place for 5-7 days. Milking is accomplished by removing the cap of the tube.

7.12.6 Free milker or Leaker (Enlarged teat orifice)

Milk leaks from the teat at times other than milking due to a relaxed or traumatized sphincter. Injection of minute amount of sterile mineral oil or Lugol's solution using a 22-26 gauge hypodermic needle around the orifice may help to reduce its size to the desired level. This may have to be done more than once to obtain the optimal size for milk flow.

7.12.7 Imperforate teat (Occlusion of teat orifice)

It may also be congenital or acquired. For treatment, an 18 gauge hypodermic needle is forced through into the teat cistern under local analgesia. Once the milk starts coming out, the teat orifice is treated as for contracted orifice mentioned.

7.12.8 Lactolith (Milk stone)

Lactoliths in the teat cistern form due to mineral deposits and may interfere in milking. Small lactoliths can be removed by milking them out through the teat orifice. A mosquito forceps can be used to crush a large lactolith and then small pieces can be removed by milking. If the lactoliths are hard and large, the sphincter may be slit to remove the lactolith.

7.12.9 Papilloma or warts

They are finger like projections originating from the skin surface of the teat. A tight ligature at the base of the wart is applied to drop off it or surgically removed.

7.12.10 Polyps

Generally pea sized growth attached to the wall of the teat cistern and interferes with milk flow. A teat tumour extractor, a curette or a teat polyp extractor may be used to remove the growth.

7.12.11 Thelitis

Acute or per acute inflammatory condition of one or more teats which is distinct from infectious mastitis where culture of milk samples not found any pathological bacteria. Intralesional methylprednisolone and hyaluronidase along with systemic antibiotic and antihistamine provides superior results.

7.12.12 Amputation of mammary gland

It may be indicated in gangrenous mastitis. General anaesthesia or epidural block is

used. For unilateral gland amputation, the incision is placed at the superiolateral aspect of the gland about 2-3 cm away from the intermammary groove. For bilateral amputation, incision should start at the midline caudally near the base of the udder to extend cranially along the base. The skin is resected from both edges. One of the gland is dissected away from the line of cutaneous incision to expose the external pudic artery and vein located near the external inguinal ring. Similarly, reflection of the cranial part of the gland will expose the perineal artery and large subcutaneous vein. All the vessels should be doubly ligated with strong absorbable suture material. If both glands need removal, the procedure is repeated on the other gland. The skin flaps are closed in standard manner.

7.13 Caesarean Section

Caesarean section is indicated in cases of dystocia when a calf cannot be delivered by foetal manipulation and extraction. Uterine torsion is one of the commonest cause of dystocia. In cases of failure of cervical dilatation after successful detorsion, caesarean section becomes necessary.

7.13.1 Surgical approaches and general guidelines for caesarean section in cattle

For caesarean section the uterus can be approached in various ways either in standing or recumbent positions. Care should be taken to limit the contamination of the peritoneal cavity with uterine contents in caesarean section. Peritoneal cavity contamination, particularly in cattle with dead, emphysematous fetuses, greatly enhances the risk of peritonitis, limits the cow's chances of survival, and reduces the surviving cow's productivity. There are 8 available surgical approaches for surgery i.e., left paralumbar celiotomy, left oblique celiotomy and right paralumbar celiotomy in standing position and ventral midline celiotomy, paramedian ventral celiotomy, left paralumbar celiotomy, right paralumbar celiotomy and ventrolateral celiotomy in recumbent position. But, caesarean section in large ruminants is mostly done in right lateral recumbency. Before surgery, the physical status of the animal must be assessed. The animal must receive adequate fluid therapy. A 5% dextrose and normal saline solution should be administered to avoid hypoglycaemia and hypochloraemia.



Caesarean section in a cow.

For this surgery, the left lower flank incision begins 10 cm ventral to the transverse process of lumbar vertebrae and may extend 30 to 40 cm cranio-ventrally. The gravid uterus may lie directly up on the right abdominal floor or within the supraomental space with the intestine concealed on the right by Superficial and deep parts of greater omentum. After giving the incision at the left lower flank site, the uterus is usually brought outside by grasping and feeling the fetal parts. The uterus may be exposed for caesarean Section by simply drawing the greater omentum forward. If the fetus is mummified, instead of giving a lower flank incision, upper flank incision is usually preferred whereas in full term gestation because the uterus due to its weight is found on the ventral floor of the abdomen it is better to go for the lower flank incision.

The uterine incision should follow the longitudinal line of greater curvature of the uterus. Forelimbs or hind limbs are grasped depending upon the presentation and the fetus is

taken out from the uterus. The calf should be cleaned, dried, cleared off the mucus from the nostrils. The umbilical cord is ligated far enough from the navel and cut so that it contracts. Antiseptic solution like povidone iodine or Tr. Iodine is then applied over it to prevent the infection. The placenta is removed by gentle traction. It should not be pulled with force since chances of caruncular bleeding is strong which may be fatal to the dam. If such bleeding is encountered in the dam, oxytocin may be given, which largely shrinks the uterus and stops the bleeding. Antibiotics can be instilled into the uterus as common procedure for all the species before closure. The uterine incision is cleaned with gauze and closed by a double row of Lamberts sutures using chromic catgut size 2-0 or 3-0 in bitch and size 2 in cattle and buffaloes. Abdominal incisions are sutured in the usual manner, closing the peritoneum, muscle and skin respectively.

Utmost care should be taken to avoid the spillage of uterine contents into the peritoneal/ abdominal cavity for the successful outcome of surgery. In case such spillage occurs, it should be lavaged with sterile normal saline containing non-irritant antibiotics to counteract the infection, reduce the chances of postoperative adhesions and infection. The uterine torsion in case of cattle and buffaloes should be then corrected. 50-60 units of oxytocin hasten the uterine involution. A 5% solution of dextrose and normal saline solution should be invariably included in the schedule as most deaths have hypoglycemia and hypochloraemia.

7.13.2 Postoperative care

The mother and the new born should be returned to clean and comfortable environment. The new born calf should also be allowed to suckle and stand on its legs. It not only provides the nourishment to the puppies but will also stimulate the uterine contractions thereby reducing any risk of placental retention or endometritis. Postoperative antibiotics and dressing of the incisional wound generally result in satisfactory healing. The skin sutures should be removed in 10-12 days after surgery or after the healing is complete.

7.14 Congenital Anomalies

7.14.1 Atresia Ani

Atresia ani is defined as the presence of a very small opening or no opening at all at the anus due to a failure of the anal membrane to break down. It is a congenital abnormality, manifested clinically by an absence of feces, dullness, anorexia with abdominal distension, discomfort and straining at an attempt to defecate. Atresia coli is a similar condition where a segment of colon is missing. Both of these conditions can be present either alone or in combination with other congenital disorders like rectovaginal fistula. *Atresia ani* may be a condition on its own or associated with atresia or agenesis of other parts like *atresia recti*, *atresia coli*, different fistula etc. Some of the common conditions developing due to atresia of intestinal segment are listed below.

Type		Anatomical features	Clinical signs and diagnosis
I	Atresia ani	Congenital stenosis of anus.	Normal until weaning, thereafter constipation and tenesmus.
II	Atresia ani	Persistent anal membrane, rectum ends cranial to imperforate anus as blind anus.	Anorexia, abdominal distension, no defecation, perianal bulging during straining is seen if rectum is fully developed.

III	Atresia ani et recti	Anus closed, blind end of rectum situated further cranially.	Blind end does not buldge out on the applying abdominal pressure and defect is located near pelvic brim.
IV	Atresia ani et recti et coli	Anus and terminal rectum may be normal, cranial rectum ends as blind pouch or colon as blind pouch.	Anorexia, abdominal distension, defecation absent, calves develops acute abdominal pain 12-24 hours after colostrum consumption which subsides in 24 hours.

7.14.1.1 Etiology

Both atresia ani and atresia coli are congenital defects which arise due to insult during fetal development and it is thought that atresia ani is an inheritable defect in cattle. There are reports of breed predisposition related to incidence of this condition and Holstein Friesian calves are at greater risk for this condition than all other breeds. Another possible etiological factor includes damage to the amniotic vesicle during early pregnancy palpation leading to damage to the blood supply to the fetal intestine. Symptoms

Calves with atresia ani can show severe signs within hours of birth while symptoms of atresia coli usually do not appear until 24–48 hours after birth. The affected calf will be unable to pass any feces so it takes some time for feces to build up and cause signs. Typical signs of intestinal atresia include decreased appetite, progressive bilateral abdominal distention, the absence of feces, episodes of straining to defecate, and occasionally, bloodtinged mucous can be found around the rectum. The most characteristic clinical sign is bulging of rectal lumen usually subcutaneously at normal site of the anus when the abdomen is compressed.

7.14.1.2 Diagnosis

Lateral abdominal radiograph in calves affected with atresia ani will show a distended, feces-filled colon with an abrupt end at the level of the rectum. However, abdominal radiographs of calves with atresia coli will show enlarged loops of bowel and absence of faeces in the rectum. Sometimes, giving a barium enema prior to radiography of the abdomen can help determine the level of the defect in cases of atresia coli. Animals with atresia ani are usually easier to diagnose since they will show signs early on and sometimes the imperforate membrane can be palpated.

7.14.1.3 Surgical Treatment

Treating atresia ani and atresia coli involves surgically opening of the blocked orifice. The defect in atresia coli is usually at the level of the spiral loop of the ascending colon. So correction involves removing the defective section of bowel and reattaching the normal Sections. Unfortunately, Surgical correction of atresia coli has a poor overall success rate, with a short-term survival rate of less than 50% and a long-term survival rate of less than 35%. For surgical correction, 2-3 ml of 1% lignocaine solution is injected epidurally, and the hind parts of the calf are directed toward the edge of the surgery table in sternal recumbency with the hind feet pulled in a slightly cranial direction. After routine aseptic preparation of the surgical field, a 1-2 cm diameter circular incision is made through the skin and subcutaneous tissue at the site where the anus would normally be located. The skin edges are retracted with Allis forceps held by assistant. A distended blind-ended rectum is easily located by digital exploration in pelvic midline. Careful blunt dissection in a cranial direction is carried out followed by gentle pulling of the rectal pouch with a pair of tissue forceps (rectal pull-through procedure) in a caudal direction. If this does not

allow the rectum to be identified, it may be grasped via left flank exploratory celiotomy and moved in a caudal direction by simultaneous traction through the pelvic canal and manipulation in the abdomen. The rectum is sutured to the subcutaneous tissue with four interrupted sutures placed dorsally, ventrally and bilaterally into the rectum to maintain it in position and then rectal pouch is incised vertically for 1-2 cm length which will lead to spurting of meconium from the lumen. The extra-rectal meconium should be removed with damp swabs and wound should not be irrigated as it could flush infection cranially. Maintaining a lumen of minimum 2 cm diameter may require dilatation for several weeks because surgical wound healing results in localized fibrosis.

Intraoperatively, the presence of anal sphincter muscles is rarely evident. Fecal incontinence is therefore a frequent complication of surgical correction of atresia ani. A single stab incision through the perineum into the rectum is not successful, as stricture and obstruction are likely to occur. If a sizable portion of rectum (and descending colon) is missing, surgery is exceedingly difficult because the short mesocolon does not readily stretch. In these cases, surgery should be discouraged. Before suturing the rectum to the perineal skin, any rectovaginal or urethral fistula needs to be located and transected in the female. This is usually done most easily by exploring the vaginal opening and fistula with a blunt instrument.

7.14.1.4 Postoperative care

Broad spectrum antibiotics can be advised for 3-5 days to prevent surgical wound infection. Topical application of povidone iodine solution as well as fly repellent cream around the wound region is applied. Dilatation of the anal opening by insertion of finger to prevent stricture formation due to wound contraction may be required at several occasions.

7.14.2 Rectovaginal Fistula

Rectovaginal fistula is a fistulous tract that connects the vagina and rectum. Rectovaginal fistula has been reported to occur in many species of the domestic animals. During parturition, the front foot of the calf in an anterior, dorsosacral presentation typically perforates the dorsal aspect of the vestibule and enters the rectum. The foot is withdrawn and leaves a defect between rectum and vagina. Rectovaginal fistula has also been reported to be seen usually in conjunction with imperforate anus (atresia ani) in neonatal animals. In newborn animals, there may be clinical signs of passage of feces through the vulva and even feces and urine may come through a common vaginal opening. Diagnosis may be confirmed by barium enema, which outlines the extension of the defect into the vagina.

7.14.2.1 Surgical management

Identification of the fistula, surgical correction, and reestablishment of the normal anatomic structures are imperative. The surgical management is dividing into two parts: immediate treatment and delayed surgical repair. Repair in the acute stage should be avoided as far as possible because the tissue is very edematous and contaminated with feces, and some tissues may not be viable. Repair can be delayed for 4 to 6 weeks to allow healing of the injured tissues because the defect size can be reduced markedly as a result of wound contraction. Some smaller defects have been reported to heal completely. Initial therapy should include daily wound care and cleaning of the contaminated tissues.

For surgical repair, animal is restrained in standing stocks; the rectum is evacuated of feces; and the tail is retracted to one side. Some surgeons like to construct a rectal

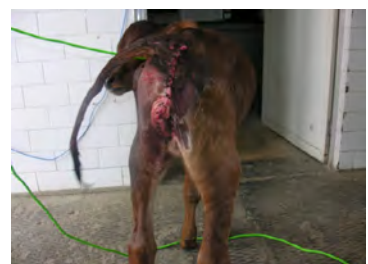
tampon from an orthopedic stockinette filled with cotton and secured at the ends with umbilical tape. After an epidural lignocaine is administered, the rectum is evacuated and the perineum prepared for aseptic surgery. A transverse incision is made between the rectum and vagina. By using a combination of sharp and blunt dissection in a horizontal plane, the fistula is exposed. Ideally 2/3 of the thickness of the shelf should be with the rectum and 1/3 with the vaginal shelf. Dissection is continued 3-4 cm rostral to the fistula. The rectal defect is closed transversely by using number 0 or 1 absorbable Sutures in a simple interrupted pattern placed in the submucosa, with care taken not to penetrate the rectal mucosa. Successful repairs have also been reported with longitudinal closure of the rectum. Either technique is adequate if there is good tissue apposition with little tension. The vaginal defect is closed in next step. Many surgeons advocate a continuous horizontal mattress pattern in a longitudinal direction. So that the two suture rows (rectal and vaginal Suture layer) are at right angles to each other and the vaginal mucosa is everted. The incised skin of the perineal body is closed with interrupted non-absorbable monofilament sutures, which are removed 10 to 14 days later.

7.14.2.2 Postoperative care

Postoperative treatment after repair of a rectovaginal fistula usually includes administration of broad-spectrum antimicrobial drugs and non-steroidal anti-inflammatory drugs (NSAID), for 7 days. Postoperatively, temporary atony of the rectum, pain, or solid feces can cause constipation and increased exertion for defecation may cause dehiscence. To prevent this, it is important to manage diet, administer analgesic therapy and if needed careful manual evacuation of the rectum. Hence, faeces should be kept soft and scanty for at least 10 days by modification of diet and administration of a fecal softener (e.g., mineral oil or raw linseed oil).

7.14.3 Contracted tendon (knuckling):

An excessively flexed condition of the fetlock joint is called *knuckling*. It is due to contraction (shortening) of the flexor tendon. It may occur congenitally. In adult it is due to cicatricial contraction of the flexor tendon following tendinitis. Various degree of contraction observed in newborns are:



Congenital polymelia in a calf and its surgical treatment

- A. If the contraction is slight the pastern assumes a somewhat vertical position.
- B. In more severe type the fetlock is pushed forward almost in level with the hoof.
- C. In the extreme degree of knuckling the pastern is pushed forward and may even touch the ground.

Treatment of Knuckling

For the treatment of this condition in young animals the correction can be tried by putting a plaster cast for some time. The plaster cast is applied in such a way that the foot is

allowed to touch the ground and bear weight. Otherwise tenotomy of the deep flexor tendon may be tried, in some cases both of the flexor tendons (superficial and deep) may be cut to restore the foot position.

7.15 Dental Affection of Cattle

Cattle have 32 permanent teeth with a dental formula of 2(incisors 0/4, premolars 3/3, and molars 3/3). There may be several conditions of teeth that may require veterinary surgical intervention.

7.15.1 Abnormal number of teeth :

It is uncommon congenital condition associated with splitting of dental bud. Supernumerary incisors and molars are most frequently seen. There may be one or two extra teeth or complete double rows of incisors may be present (Dental crowding). Clinical signs are not apparent until malocclusion occurs and tooth grows up into the soft palate or cause ulceration of the tongue.



7.15.1.1 Treatment:

If tooth is lost, the extraction can be performed otherwise tooth rasping should be indicated at regular interval.

7.15.2 Irregular and sharp molars

This is a common clinical condition in cattle, the sharpness is seen on the outer border of the upper molars and inner border of lower molars. Last molars are more predisposed. Upper jaw is wider than lower jaw and inner border of the lower molars extends beyond the tables of the opposing teeth. Under normal condition, there is more or less uniform wear of the tables because of side to side movement of the jaw during mastication. The side to side movement of the jaw is restricted due to weakness of masseter muscles, painful lesion in the mouth. Then, the wear becomes diminished and they become extra sharp.



7.15.2.1 Symptoms :

Injury to the tongue during mastication, holding the head on one side during chewing, accumulation and impaction of feed materials between cheek and molars, dropping

partially chewed food materials with saliva during mastication, foaming saliva at the borders of the mouth, ulcers in the inner aspect of cheek and tongue, loss of general condition of the animal due to improper feeding are common symptoms.

7.15.2.2 Treatment:

Rasping of the sharp teeth should be done. Sedation may be required for vicious animal. Make mouth open using mouth gag. Clean the mouth thoroughly. Then introduce tooth rasp into the mouth after withdrawing and holding the tongue in the direction opposite to the side where rasping is to be done. Apply firm and controlled strokes of rasping over the sharp edges of tooth. An emollient like glycerin may be applied in oral cavity. A second rasping of molars may be required after one week to achieve desired results. If degree of irregularity is high, then first cut the sharp projection by teeth cutter and then carry out rasping.

7.15.3 Dental Caries

This condition is uncommon in cattle but is characterized by salivation, difficulty in mastication, simple indigestion, characteristic foul smelling can be experienced on examination of mouth, pain in lateral stages.

7.15.3.1 Treatment:

Tooth extraction under anesthesia followed by daily cleaning of the oral cavity with light potassium permanganate (1:1000).

7.16 Miscellaneous surgical conditions/procedures

In addition to the conditions described in the above text there may be other many conditions that require minor surgical interventions or there are some elective surgeries that are part of routine farm practices. Some of them are described below.

7.16.1 Umbilical or Navel abscess

An abscess is an abnormal cavity containing pus. The cavity is formed in tissues, due to local suppurative inflammation. Tissue reaction against the invading organism or foreign body as well as degenerative changes are evident in the zone of tissue surrounding the pus. This zone is called "*pyogenic membrane*" even though there is no membrane as such.

7.16.1.1 Symptoms

Acute abscesses developing superficially appear at first as a localized, painful, inflammatory swelling. The centre of the swelling gradually becomes soft and the skin at this point becomes thin when the abscess is said to be 'pointing' or 'maturing' or 'ripening'. Later, the abscess ruptures at this point and discharges pus. Febrile disturbances are usually absent in superficial abscesses. Deep abscesses developing under thick layers of tissue (like fascia, muscle) give rise to pyrexia and pain on manipulation of the part. After such an abscess ruptures the pus migrates along the line of least resistance.



Umbilical abscess in a calf.

7.16.1.2 Treatment

Fomentation and/or application of blisters are advised to bring about early maturation of the abscess. It is not ordinarily advisable to open an abscess which is not fully ripe as secondary abscess may form afterwards. However abscesses situated close to joint or peritoneum may have to be opened before fully mature, to avoid the chance of rupture into the joint or peritoneal cavity.

The site where it is proposed to open and the surrounding areas should be cleaned and prepared for a surgical operation: after saving and washing the area with soap and water, drying and applying suitable antiseptic like tincture iodine or povidone iodine.

A scalpel may be used to open the abscess. The opening should be at the site where it "points". It should as far as possible be in the "dependent portion" to facilitate the drainage. If the abscess is not pointing at the dependent portion it is sometime necessary to make another opening in the dependent portion to provide drainage. This is called a "counter opening". In order to make a counter-opening, a seton needle may be passed through the dependent portion. Afterwards a "seton" (antiseptic gauze) may be passed through eye of the seton needle and carried through the openings and tied, in order to keep the opening patent. The seton is changed each day after cleaning the abscess cavity. After opening the abscess cavity should be irrigated with hypertonic saline. Afterwards it is stuffed with gauze dipped in tincture iodine. This is intended to destroy any infection remaining therein and also to exert a mild irritant action to stimulate the healing process.

7.16.2 Castration

Castration is one of the most frequently performed surgical procedures in veterinary practice. The common indications of castration include: 1) to make the animal docile, 2) for easy management in the presence of female animals, 3) to prevent unwanted animals from breeding. 4) malignant disease or irreparable injury to the testes, 5) to promote weight gain in meat animals, and 6) correction of scrotal hernia.

Younger animals are generally easier to restrain, have lesser risk of incisional complications and show decreased aggressive behavior after castration. Bulls castrated prior to puberty grow to a greater height because castration delays closure of the growth plates of their long bones, and the same may be true for other animal species. The preferable ages of castration in cattle is 1-2 months. But in actual practice the animals may be castrated at any age. Under field conditions, the owner's choice, ease of procedure and intended use of the animal may affect this decision. Whenever possible the extreme climates and the heavy fly seasons should be avoided. Adequate fasting of the animal preoperatively in all elective surgeries is an important prerequisite for successful outcome. The surgeon should always ensure that the correct animal is to be castrated and obtain a medical history. The scrotum should be examined to confirm the presence of both testes and to determine whether inguinal herniation is present or not. Under field conditions most clinically normal animals can be safely subjected to routine elective surgery without the need of laboratory tests. However, the procedure should not be performed on sick animals. Perioperative antibiotics are also necessary particularly under field conditions.

All techniques of castration in animals have several principles in common like adequate restraint, safety, good anaesthesia, clean surgery, control of haemorrhage, and adequate postoperative drainage. The various techniques of castration in animals could be divided into the following categories:

7.16.2.1 Burdizzo Castration

It is a blood less technique used in bulls. In this method care should be taken to avoid the

testicle, epididymis or urethra which can get damaged accidentally. Each cord is crushed at 2 points 1 inch apart by the use of burdizzo castrator.

7.16.2.2 Using rubber ring elastator

In young calf an elastic ring is slipped over the base of scrotum to block the blood supply which lead to sloughing of the scrotum. Scrotum and testes is slough out with in 3 wks.

7.16.2.3 Open Castration

Animal sedated and secured in lateral recumbancy with upper limb pull forward to expose the testes. After local anesthesia 12-15 cm long vertical incision is placed at the lateral aspect of median raphe. After separating the dartos and fascia by blunt dissection the testicle is freed of scrotal fascia and exteriorized along with the spermatic cord through a 10-12cm long incision in the parietal vaginal tunic. The contents of the cord are then separated and doubly ligated and severed in between ligatures. Alternatively the testicle can be exteriorized still enclosed in the vaginal tunic and the entire cord is doubly ligated with chromic catgut.

7.16.2.4 Complications of castration

Complications can occur within hours or take many days to develop, and owners should be advised to monitor the patient closely over this period of time. If presented with a patient post castration, a full history should be obtained.

7.16.3 Disbudding

Disbudding is indicated to improve stock management, prevent potential aggressive behaviour towards other members of herd and stock personnel, reduce traumatic damage to such persons and other individuals and stock, especially udder and skin injury resulting in eventual lowered hide value

7.16.3.1 Technique

Very young calves (<1 week old) may be disbudded by application of a local caustic compound (NaOH, KOH, collodion). Clip hair from horn buttons. Protect the surrounding skin with petrolatum, and apply thin film of paste. Confine calves for 30 minutes. Another method of disbudding may be hot iron method.

The ideal age for disbudding with hot iron is one to two weeks old, when horn buds project 5-10 mm, are easily palpable, and a disbudding iron can be used alone. Cornual nerve block using 2% lignocaine is indicated for disbudding.

7.16.4 Dehorning

Dehorning is a common surgical procedure done in cattle. It is indicated to make the animal safer for handlers and to other cattle. Apart from cattle welfare, this procedure is recommended in horn cancer in cattle. Horns are in the form of horn buds in the newborn which is an outward growth of modified epithelium. Up to 2 months of age, horn buds are not attached to the skull. After two months, the outgrowth of cornual process of the frontal bone connects the buds to the skull. The frontal sinus also opens to the horn after 4-6 months of age. During dehorning it is important to remove a skin tissue of 1-1.5 cm around the base of horn since there lies the germinal epithelium. If this area is also removed, the haired skin will replace the defect without re-growth of horn.



Horn cancer in a cow.

Horn is supplied by cornual nerve, a branch of zygomatic temporal nerve, which is a branch of the trigeminal nerve. This nerve has to be desensitized for dehorning. Anesthesia is performed by infiltrating 5-10 ml of 5% of lidocaine in fan shape, under the frontal ridge half way between the lateral canthus of the eye and base of horn. All the animals require a hemicircumferential infiltration of local anesthetic on the caudal aspect of horn base to anesthetize cutaneous branches of second cervical spinal nerve. Administration of xylazine 0.05 mg/kg IV help to sedate the animal.

Hair around a wider area of horn base and pole are clipped. Elliptical incisions are made leaving more than 1 cm margin around the base of horn, leaving 5-7 cm dorsal to and 5-7 cm ventral to the base of horn. The skin is dissected sharply from the underlying tissue in the ventral incision. An obstetrical wire is placed against the frontal bone at the ventral incision and directed towards the pole and saw off the horn as to close the base of the horn as possible. The surgical area is lavaged with saline. The exposed blood vessels are ligated for haemostasis. The skin is undermined to appose the wound edges. The skin edges are sutured by a series of simple interrupted sutures or mattress suture with silk or nylon.

7.16.4.2 Complications

There may be severe bleeding from the cut vessels, which may require reopening and ligating the blood vessels. A cotton pad soaked with tincture benzoin can be placed over the wound and kept until it is shed by its own. Sinusitis is a common complication leading to infection and even osteomyelitis. In such cases, the sinus has to be lavaged thoroughly with normal saline. Systemic antibiotics and anti-inflammatory drugs should be given.

7.16.5 Amputaion of Tail

Amputation of tail is indicated in cases of sacral fracture, fracture of caudal vertebrae, necrosis or gangrene or complete paralysis of tail. The gangrene may occur at any part of the tail.

For doing amputation of tail, the anaesthetic should be injected to the animal by epidural route i.e the first inter coccygeal space using 2% lignocaine (1 ml/100 kg or 5-7 ml/adult cow). Before injecting anaesthesia the site should be sterilized with spirit Swab. The anaesthetic should always be injected in standing position of the animal. The effect of anaesthesia comes after 5 minute of injection.

After onset of the anaesthesia, bandage the tail leaving the area for surgery, clip and shave the surgical site. Place a tourniquet at the base of the tail to prevent bleeding. The site where amputation has to be done should properly sterilized with chlorhexidine. There should be 4-5 scrubbing at the site of amputation. A 'V' shaped skin incision made on the dorsal and ventral surface of the tail to raise two triangular flaps of skin, the basis of which flap should correspond to the intervertebral space. The intervertebral space is disarticulated bluntly with a blade, the coccygeal artery and vein are identified at the ventral aspect and ligated. The skin flaps are sutured by a series of simple interrupted sutures or mattress sutures with silk or nylon. Proper regular dressing along with antibiotic and analgesic therapy should be administered.

7.16.6 Wound

Successful surgical treatment of wounds depends on thorough debridement, meticulous, haemostasis, elimination of dead space, proper use of instruments, judicious insertion

of drains and proper placement of sutures. Bovine wounds fortunately heal without production of exuberant granulation tissue which is commonly seen in the horse. Debridement is essential, especially when the wound (e.g. teat) is to be sutured and in areas when gross contamination is commonplace. Haemostasis prevents haematoma formation in dead space which would potentially offer an ideal culture medium for bacterial growth. Dead space may be packed with sterile gauze swabs for 24–48 hours to prevent haematoma formation. Drains are rarely indicated in cattle except for certain long bone fractures, the thorax or subcutaneous or deep infected wounds (e.g. laparotomy incisions). Do not suture infected wounds.



Large wound over the neck of a bull due barbed wire injury.

The horned animals have in fights entangling their horns in each others or hitting/ striking the horns on walls, mangers, trees or malicious throwing stones or beating with sticks, causes degloving of the horn periople or fracture causing severe pain and profuse bleeding which invites the flies and crows which in turn lead to infection, maggot infestation and mutilation. The bleeding has to be check by local application of tincture benzoin, pressure bandage and limiting the pain by painkillers.

7.16.7 Hemorrhage

It is mandatory to control the blood loss occurring from any body part of the cattle otherwise it may prove fatal. If the bleeding is from any flat surface, cotton gauge bandage soaked in any styptic like Tr. Benzoin, Tr. ferric per chloride or chilled alum solution may be placed over the wound. If possible pressure bandage may be applied or checked by applying palm/digital pressure. In an attempt to check the hemorrhage of limb, tail etc. it can be controlled by applying a tourniquet of string/latex tubing or umbilical tape to obliterate the blood supply. Cold water or icepack application causes constriction of arteries, ligation of blood vessels may be opted. If the loss is in excess then blood transfusion may be done. First blood transfusion does not need the blood group matching.

7.16.8 Laceration

A lacerated wound on the cattle's body may be as a result of friction, slip, infight or entangling in barbed/blade fence wire injury. The wound has to be cleaned with water pressure jets followed by antiseptic dressing with povidone iodine. Skin edges may be apposed and sutured, if possible. If the swelling is excessive or haematoma has formed then it needs to be treated accordingly.



Deep laceration in a bull.

7.16.9 Evisceration

Invariably long sharp horned dominant cattle gore the submissive heard mates as a result of this injury vital visceral organ pops/protrudes or comes out of the abdominal/ thoracic cavity. The eviscerated organ which is hanging out should be flushed/cleaned

with sterile or antibiotic added normal saline solution. The wound margins out should be shaved clipped and the eviscerated structure should be replaced in the body cavity. The wound is sutured in different layers, which is followed by administration of antibiotics and analgesics.

7.16.10 Dislocation of joint

Fall from height or due to fall in trench/pit/dung channel may cause dislocation of joint (union of two bones) leading to displacement of two bones, continuous pain and swelling, inability or reduced flexion/extension of joint due to which animal is unable to move, it is more common in carpal, tarsal, shoulder, elbow, hip, stifle joint. In dislocation of the shoulder and hip joint shortening of limb appears. On the distal end of the limb traction can be applied and counter traction to the proximal end if required sedation/epidural analgesia to bring the displace bone together in position which produces a “Thud” noise confirming a probable assurance that the bones are replaced back properly into the joint. After this the movement of the joint has to be restricted (immobilised) and NSAIDs to be administered. Swimming is a good exercise/ physiotherapy to correct the dislocation of joints of appendicular skeleton.

7.16.11 Burns

In case of fire the cattle are to be shifted from the place of incidence and the body to be covered with woolen blanket, water soaked gunnybag or thick cloth or normal tap water to be sprinkled all over the body of the animal to extinguish the fire. The burn wounds are to be gently cleaned and emollients like lime (slaked) water and coconut oil and neem oil (1:3:1) to be applied as an emollient. If the burns are extensive than pain killers, antibiotics and antihistaminics, i/v fluids and metronidazole or liquid mixture of calendula (homeopathy) and glycerine (1:8) may be applied which will avoid blistering. The animal may be provided clean environment.



Burn injuries in a cow.

8. Ethnoveterinary Recipes

Veterinary and animal husbandry practices of the ancient India find mentions in *Rigveda* and *Atharvaveda*. Books written by *Salihotra* (1800 BC) and *Charak* (2300 BC), and *Palikapaya* (1000 BC) describe treatment of animal diseases using medicinal plants. Use of traditional veterinary medicine (Ethnoveterinary medicine) is an important option to address the veterinary healthcare and welfare of animals. The traditional medicines are easily accessible, cost-effective, eco-friendly solution to health and production problems in huge livestock population of the country. The Ethnoveterinary medicine (EVM) is a holistic interdisciplinary science of local knowledge and associated skills, practices, beliefs, and social structures pertaining to the healthcare. It provides healthy husbandry of foods, work, and other means of income to farmers from animal husbandry, always with an eye to sustainable development and providing safe food to human.

Herbs are products of nature; they are not synthetic chemicals manufactured in the laboratories or chemical plants. According to a report nearly 750 medicinal plants are used by traditional healers for treatment of animal and human diseases in India and several

current studies have underlined the beneficial effects of medicinal plants in medical and veterinary practices. Herbs are used either as green or in dried powder form or as water extract, decoction and infusion. They can also be refined into tablets, capsules, powder, tinctures and other supplement formulations.

Polypharmacy is the essence of EVM and herbal preparations are made by combining of two or more herbs, with some formulations containing more than a dozen different plants. In EVM the whole plant or its parts are used, which often contains thousands of chemical compounds, giving the balancing effects. This is thought to be the reason why the herbal products are less toxic or have no side effects. In other words, one compound may exert an effect and another, either within the same or from a different plant, may have a supporting effect which possibly results in, for example, balance of any side effect(s) or increases absorption into the system. The best example is *Trifolia*.

The knowledge and validation of EVM has good potential for farmers' welfare. It is well known fact that despite availability of the modern allopathic medicines, herbal medicines are still used on a very large scale throughout the world.

Herbs and other natural products, which form the majority of ingredients in EVM, are generally recognized as safe (GRAS), cost effective and are considered without any risk, if used with allopathic medicines and other drugs.

8.1 Medicinal Plants; Collection, Storing and Processing:

8.1.1 Identification of medicinal plants

Before processing, identification and authentication of the medicinal plant is a pre-requisite. It can be authenticated from Botanical Survey of India. It should be made sure that right plant is used to treat a problem. The names of plants vary from one place to another. Different plant species may have the same local name. The botanical name should be used for proper documentation.

8.1.2 Collection

In ethnoveterinary practice certain parts of medicinal plant are used for treatment of diseases. During collection of medicinal plant the following facts should be kept in mind

- Which part of the plants to be collected
- Specified time for harvesting the samples, as the active ingredient content may vary depending upon the plant part, stage of growth, season of harvest, method of handling during collection, physical condition of its collection place and storage.
- Leaves and stems are best collected during daytime and when the plant is about to bloom.
- Flowers that have a smell are best collected when the flower buds are just about to open and in the morning when the sun is still low. Other flowers should be collected when they are in full bloom. Sometimes, collection should be done in batches since flowers do not bloom all at the same time.
- Fruits should be collected when they are ripe, unless the recipe states clearly for unripe fruits. Fleshy fruits which deteriorate rapidly should be gathered when they are somewhat ripe, preferably in the early morning or at nightfall.

- Seeds are usually collected from thoroughly ripened fruits. Some dry-textured fruits fall off the plant or split open easily when fully ripened. As a result, seeds are easily scattered and lost. It is advisable to collect such fruits as soon as they start ripening.
- Barks should be collected when the plants are in bloom or in vigorous growth. Barks should be collected from the trunk and branches.
- Roots and other underground parts (e. g. rhizome, rootstock, stem tuber, bulb and stolon) are best collected when the plant is in full growth.

8.1.3 Sorting and cleaning

- Clean soil and dust from the plant parts.
- Plants that may have been exposed to pesticides should not be used.
- Wash plants with clean water as quickly as possible to avoid damaging them.
- Sorting of the required plant part (as a part of quality control).

8.1.4 Drying

Plant material should be washed and dried under shed. Drying at high temperature may destroy plant ingredients. The plant materials should be spread thinly and evenly over tissue paper/ bamboo mat or chicken-wire screen and be put in the shade until the materials become dry.

8.1.5 Cutting, trimming, grinding, and chopping

These are done for various reasons

- To increase the efficacy of the plant materials.
- To allow more active ingredients to go into the preparation.
- To reduce the toxicity or adverse effects of certain drugs.
- To shorten the duration of drying.
- To make the plant material more convenient to store.

8.1.6 Storing

Medicinal plants should be properly stored to ensure preserve their quality. Otherwise, they may be attacked by insects, mites and fungus. Proper storage also ensures the continuous supply and availability of the materials, whenever needed. Dried plants should be kept in sealed plastic containers or bottles. These should be covered tightly and kept in a cool, dry place away from sunlight. The container must be labelled properly with the name of the plant on it and the date of collection.

Plant materials can be either fresh or dry, depending on the need and type of preparation. If dried plants are to be used as a substitute for fresh parts, the quantity or the weight may be adjusted, in order to compensate water loss during drying.

8.2 Forms of medicine and processing

Some plants are used in raw natural form as medicines. The active ingredients of plants

are extracted through different processes. Such as; levitation, evaporation, distillation, straining, decoction, infusion, filtration, drying, churning or its extraction in ether, oil, alcohol etc. The primary processing and purification of plants are necessary before preparing different plant medicines.

8.2.1 Forms of Medicine

8.2.1 Liquid form

8.2.1.1 Mixtures

Two or more liquid medicines are mixed and mixtures are prepared. The mixtures are usually sweetened by adding sugar (syrup) especially when prepared in alcohol.

8.2.1.2 Boiling

Plant parts, leaves etc., are boiled in water to get active ingredients released in solution. The solution is filtered and used in proper doses.

8.2.1.3 Infusion

The plant medicine, in powder form is kept in cold or hot water for some hours, filter and use as medicine. Such medicinal solution is known as infusion.

8.2.1.4 Decoction

Decoctions are generally made by simmering the medicinal plant materials in boiling water. Both fresh and dried plant material could be used

8.2.1.5 Tincture

Tinctures are made by soaking medicinal plants in alcohol. The active constituents are dissolved and generally stronger in action than infusions or decoctions the permissible limit of alcohol is up to 10%. A tincture may last (storage time) even up to two years and it is an important part in most herbal traditions across the world. Precautions to be taken for quality of alcohol (industrial grade alcohol methylated spirit should be avoided in making tincture). Tincture should be avoided during pregnancy or gastritis.

8.2.1.6 Extract

The liquid extract of medicine in water or alcohol is further processed and liquid is evaporated and powder is obtained which is two or four times powerful than liquid medicine.

8.2.1.7 Juice

Fresh plant parts like leaves, bark root etc., are taken and pounded in a pulp. When juice starts coming out of the pulp, the same is taken in a thin cloth and juice is expressed out.

8.2.2 Solid Medicines

8.2.2.1 Powder

The practice of pulverizing plant medicine is age old. Such powders are mixed with sugar, gelatine etc., to be given orally. The powder can be given as a bolus or electuary

or suspended in water as a drench.

8.2.2.2 Electuary

Medicine powder is prepared as a paste in sugar syrup or molasses or honey. This sweet semisolid medicine is applied on the tongue.

8.2.2.3 Bolus

It is prepared by grinding fresh material or dried plant powder with some binding agent such as honey or molasses and rolled in a shape of oval ball with the hand. This form of medicine is easy to administer.

8.2.3 Medicines for external use

8.2.3.1 Lotions

Solutions of medicines, either prepared in water or alcohol are known as lotions. They are usually applied over skin. They are not massaged. Lotions used for eyes are called eye lotions-gutta.

8.2.3.2 Ointments

The ointments are prepared using butter fats, oils, bees wax etc. The medicine powder is mixed in the base butter or petroleum jelly and thoroughly incorporated to prepare uniform ointment. Such ointments are very popular and effective.

8.2.3.3 Poultices

Medicinal ingredient is made semisolid or viscous using water, glycerine etc., as base and applied hot. The wheat dough poultice is commonly used in villages.

Different ethno veterinary practices that may be used in Gaushala according to symptoms are described below:

Lack of appetite

Appetizer for prevention

1. Grind 5 kg mature Harad (*Terminalia chebula*), 5 kg mature Amla (*Phyllanthus emblica*) fruits and 600 g salt.
2. Pour 15 litres of bovine urine over the mixture and keep it for 20 days for fermentation.
1. Give half litre once a day until it regains its appetite.

Treatment

1. Mix 500 ml juice of Imli / tamarind fruit pulp with 10 g dried Harad (*Terminalia chebula*) fruit. Feed this to a large ruminant once a day until it regains appetite. For a small ruminant, use 200 ml tamarind pulp juice.
2. Mix 60 g each of powdered ginger / adrak, powdered fennel / saunf (*Foeniculum vulgare*) seeds, brown sugar/ shakkar and 20 g black salt. Take enough of the mixture on your finger and rub on the animal's tongue. Repeat it every day until the animal regains appetite.
3. Mix together 10 g salt and 10 g Ajwain (*Trachyspermum amli*) seeds. Mix with 20 g

molasses and feed to the animal twice a day for 2-3 days.

4. Grind together 10 g salt and 10 g *Trachyspermum ammi* seeds. Mix with 1/4 litre coconut water. Drench twice a day for 2-3 days.
1. 5 Drench 1 litre buttermilk twice a day for 2 days.

Fever

1. Boil a handful of *Tamarindus indica* leaves and 1/4 kg of fruit pulp in 1/2 bucket of water for 15 minutes. Collect the fluid and give to the animals as the only source of drinking water.
2. Boil a handful of *Eucalyptus globules* leaves in 1 litre of water for 15 minutes. Give 1 litre as a drench twice a day.
3. Boil a handful of fresh neem leaves in 1 litre of water for 15 minutes. Give this amount as a drench twice a day.
4. Boil two handfuls of Nirgundi (*Vitex negundo*) leaves for 15 minutes in 1 litre of water. Give 1-2 cups of the liquid 3 times a day as a drench.
5. Sponge animal with vinegar all over the body as often as possible.

Constipation

1. Drench 500 ml to 1 litre vegetable oil for 3 days.
2. Magnesium sulphate powder can be given in the dose of 250-500 g.
3. Soap enema can be tried.
4. Laxatives like castor oil, liquid paraffin oil, raw linseed oil (500 ml) can be given for 1-2 days as a drench for 2-3 days.
5. A decoction of 100 g of turmeric in one litre of water may be given once daily for 1-3 days to cows.
6. Laxative powder containing Senna leaves are also given alone or along with *Carum coplicum* and black salt in equal proportion (50-60g) as drench or electuary for 2-3 days.

Tympany

(Asafoetida 10 g + Black salt 20g + Ocimum seeds 5g + ginger powder 5g)

Following gas powder can be prepared on the farm: Adrak (15%), Hing (10%), Sowa (10%), Ajuwan (10%), Bhangra (10%), Dikamali (5%), Mitha Soda (30%) and Namak (10%). Nearly 30g of this powder is given with electuary (mixed with honey or another sweet substance) or with 300ml of water, 2-3 times a day for the first day and then once a day for next 2 days. It is an ideal ant frothing, carminative and anti-flatulent preparation for ruminants. It is indicated in gaseous tympanites (swelling of the abdomen), frothy bloat, colic, indigestion, and impaction. It is also indicated in cases of recurrent anorexia.

Digestive disorders / Indigestion

Tonic powder is indicated in cases of anorexia, dyspepsia, indigestion, atony (a condition

in which muscles cannot expand and retract normally) of rumen, impaction, mild colic, off feed due to recovery. It is given to cattle, cows, calves, etc., administered to dairy animal in milk, twice a week to maintain health.

Take *Swertia chirata* (chirayata), *Aistonia scholaris* (datyuni), *Zingiber officinale* (adrak) and *Veronica cinerea* (sahadevi) in equal proportion, and sodium bicarbonate (baking powder), sodium chloride (common salt / namak), *Vernonia anthelmintica* (kaliziri), *Hollarrhena antidysenterica* (Indrajab), *Carum capticum* (ajawain), *Peucedenum graveolens* (sowa), *Trigonella foenuingraecum* (katkaraja) and *Brassica juncea* (sarson) in half proportion and prepare tonic and give in the dose of 20- 50 g cattle, 10- calves and administer twice a day as bolus or electuary or suspended in water and drench . Treat for 5-6 days or as necessary.

Mouth Ulcers

1. Boro-glycerine prepared by mixing 1-2% boric acid powder in glycerine, honey also can be used.
2. Turmeric mixed with oil or ghee can be applied.
3. Apply alum powder (*Fitkari*) or catechu powder (*Khair / katha*) on the ulcers twice a day.
4. Apply to fresh pulp of the inner bark of Mango or Jammon (*Eugenia jambolia*) on the ulcers twice a day

Wounds

- *Annona squamosa* (Sitafal), *Azadirachta indica* (Neem), *Ocimum sanctum* (Tulsi), *Typha lat* (Bull-rush Ghabajariya), etc. can be used as fresh pulp or can be used as dry powder.
- The wound healing dressing powder prepared from *Azadirachta indica* (Neem) and *Annona squamosa* (Sitafal) leaves in 2:1 proportion diluted with jack leaf powder.
- If powder does not stick on the wound, prepare a paste in butter or apply oil twice a day.
- If maggots are seen, prepare fresh juice of *Annona squamosa* (Sitafal).

Other antiseptic ointment is zinc oxide (Jasad Rhasma) 8% in Vaseline or butter or oil.

Burns

- Splash cold water immediately. If available, apply ice. Use carron oil for dressing.
- To prepare Carron oil: lime (calcium hydroxide) is mixed with water in a container, the top watery portion is then decanted in another container and the mixed and an emulsion is prepared called Carron oil, which is effective in the treatment of burns and scalds.
- Vegetable oil alone or fresh *Aloe Vera* pulp with a turmeric can also be applied on a burn. Application should be done thrice a day.
- Immediate first aid is to washing the wound with cold water. In the follow up

treatment, also washing of the wound with cold water removes the cellular debris tissue, dilute the toxins present and lead to increased blood supply to the area for rapid healing to occur.

Bleeding

- Crush the leaves of Tulsi or Neem and apply the pulp over the wound and fix a tight bandage.
- Apply 5% potassium permanganate solution.
- Apply tincture benzoin and seal the wound with cotton.

Respiratory Diseases / distress:

1. Massage of chest and nearby region with turpentine oil (250ml) with camphor(50g).
2. Fomentation: Both the side of chest can be given dry heat fomentations with warm cloth / gunny bags.
3. Mix 5-6 handful of chopped fresh leaves each of *Adhatoda vasica* (Adusha), *Moringa oleifera* (Drumstick tree), *Ocimum sanctum* (Tulsi), whole plant of *Curcuma longa* (Haldi) and make 3 equal cloth pouches. Warm the pouches with steam and put each warm pouch one by one on the animal's chest for half an hour. Do this twice a day for 2 days. The juice of these leaves is prepared and given twice a day for 5 days.

Internal treatment

1. Dried leaf powder of tulsi and haldi may be given 3-5 g for 5-6 days which will act as expectorant and anti-infective both.
2. Dried leaf powder of Pipal tree and haldi may be given twice a day, which is also very effective in chronic cough and pharyngitis.
3. Dried powder of *Picrorhiza kurroa* (Kutaki) powder along with above two preparations is also reported with encouraging results in respiratory distress like in heaves and bronchitis.
4. Mixture of Saunthi, Tulsi, Haldi, Mulathi and Ajwainand in equal proportions may also be used in respiratory diseases at dosage of 20-30 g two times a day.

Reproductive disorders

Retention of Placenta

Mixture of Adrak / sunthi, Ajwain, Methi, Kali jiri, Shatavar, gokhuru and ashoka tree bark in jaggery may be used as uterine tonic powder to be given just after parturition in dosage of 20 g per animal for 3-5 days twice a day.

Generalised therapy for different reproductive disorders:

Prepare mixture of dried triturated plant material of Adrak (15%), Sowa (10%), Ajowan (5%), Methi (10%), Kala-jira (10%), Shatavar (10%), Bans (15%), Ashoka (15%) and Bara gokhru (10%). It is designed to give quick results in treatment of retained placenta, uterine inertia, and gynaecological cases. Give 20g to cows, as a routine therapy for 3to

5 days after parturition

Urinary disorders

Prepare a decoction of triturated (reduce to fine particles or powder by rubbing, grinding or bruising) dried or fresh plant of the following: Gokhru (15%), Punernena (20%), Vaivarna (20%), Khursaniajma (4%), Khaneka Soda (28%) and Shora (10%). Administer twice or thrice a day for large animals, 20-30g cattle and 5-10g to calves.

Decrease in milk

1. Mixture of Satavari, ashwagandha and Kalijiri in equal proportions may be given to increase milk yield in dosage of 10 g twice a day for 10-25 days.
2. Harvest *Leptadenia reticulata* (Dodi-Jivanti) after monsoon, wash and dry in shade. Prepare powder. Strain through sieve. Store in jar. Feed one matchbox tray full powder as top dressing on feed or as bolus. In cases of decrease in milk, increase of milk will be noted on 5th day. Treat for 15 days or one month. Withdrawing of drug does not cause decrease in milk once gained.
3. In case of cessation of milk due to death of new borne, give mixture of *Asperagus racemosus* in equal part in *Leptadenia reticulata* and half the part of *Withania sornnifera*. This will induce lactation in such cases also.
4. In case of hard milkers, this treatment is also effective.

Udder care

1. Take leaves of *Ocimum basilicum* / *sanctum* and *Margosa* in equal proportion- (200 g) and boil in 500 ml of vegetable oil (coconut oil can be used) for half an hour on slow fire. Strain this through clean cloth oiled in water) and store in clean bottle previously boiled in hot water. Inject 5 to 10 ml of this oil per teat through the milk siphon in the udder. Remove the siphon and massage upwards. Treat twice a day after complete milking (stripping). Prolonged treatment may be required.
2. A fomentation with bucketful hot water containing handful guava or neem leaves may be carried out.
3. *Saluadbros persica* (Piludi-Bada Pilu) leaves and tender stem are used as a paste to be applied on the udder.
4. *Euphorbia tirucalli* (Kharsani-Barki thohar) is used as a paste to be applied on the udder.
5. *Terninalia arjuna* (Sadad-arjuna) inner bark is taken and fresh decoction is prepared. 100 ml decoction is given as a drench twice daily as required.

Treatment and Management of fracture

Any kind of crack or break in continuity usually due to accidents or severe injury to the bony tissue is referred as fracture. Fracture, being an emergency surgical ailment, is required to be handled on priority. Painful swelling of the affected part is the earliest sign exhibited by the animal. Fracture of the limb is manifested by severe lameness and presence of crackling sound on palpation. Try to avoid accidents or sudden falls. Also, it

is essential that the animal houses are not slippery.

The animal under treatment must be kept in an open area, surrounded and fully covered by a 2-inch-thick mesh to prevent crows from pecking at the animal under treatment.

The first aid in fracture cases is to immediately immobilize the affected limb by splint age using a dry bamboo splint if possible to avoid further complications due to movement of the animal and soiling with dirt. Painkillers must be administered immediately.

Ethno Veterinary treatment / management of fractures consists of the following steps




- Reducing pain by feeding fresh mature roots of *Mimosa pudica* (Chui Mui). Take 4-7 table spoons of the root and boil it for 10 minutes in 500 ml water. In adult cattle the decoction is drenched once daily for 3 consecutive days.
- In cases of cracks or minor fractures in the long bones of the limbs, hot poultice of *Litsea sebifera*, turmeric (*Curcuma domestica*) and soda bicarbonate is applied once a week.
- *Cissus quadrangularis* (Hadjodi) decoction 100 ml is given orally for 100 days and the powder or green paste can be added to the above mention poultice or can be used alone.
- Before the fracture repair, it is advisable to drench the animal with the decoction (kadha) prepared from fresh leaves of *Cissampelos pareira* (laghupatha) to relax the muscles (200ml) in cattle and buffalo and 100 ml in the young calves)
- Animal is then allowed to lie down in comfortable position and with affected side facing upward.
- The fractured ends of the bone are aligned using a rope or by stretching the limb without causing undue pain to the patient
- The fractured bone site is then wrapped with a clean cloth to protect the skin and other soft tissue.
- The fractured site is kept immobilized with the help of splints.
- Usually four splints are prepared from stiff material such as bamboo sticks, stalk of coconut or Palmyra Palm leaves or the bark of *Areca catechu* (Supari).
- A plaster prepared by smearing strip of clean cloth in a paste of brick powder and egg white is wrapped tightly but carefully to avoid hindrance to blood supply.
- One should be able to insert finger under it. The cast is left 2-4 weeks depending upon the location of the fracture and the age of animal.
- Complete healing takes up to 6 weeks. In young animals healing takes less time.
- Avoid movement of animal as far as possible for early and complete healing. During recovery phase easily digestible and nutritious food is given.
- It is advisable to mix a handful of powered limestone and eggshell in about 10kg of feed to supplement calcium, which accelerates the healing process.









Ethno Veterinary treatment to take out plastic gone to stomach of a cow:








Mustard Oil	:	100 ml
Sesame Oil	:	100 ml
Neem Oil	:	100 ml
Castrol Oil	:	100 ml
Fresh cow's buttermilk	:	500 ml
Rock Salt	:	50 gm
Alumen	:	50 gm
Rye or mustard	:	25 gm







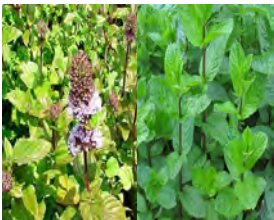
Make mixture of above all items and should be given twice, morning and evening, to cow for three days. At the same time, while taking these measures, cow should not be given green grass fodder.








(The documented medicinal uses for various plants mentioned in this presentation do not constitute an approval by the authors for their usage or efficacy. No product, preparation, or consumption of plant products for medicinal purposes should be undertaken without the advice of a veterinarian.)



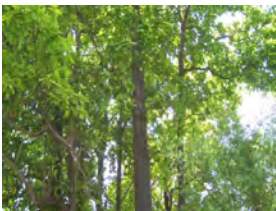




Sl. No.	Plant name	Hindi name Plant part used Indications	Recipe preparation and administration/ application
1.	 <i>Adhatoda vasica</i>	Adusha Leaf and Flowers: Cough cold and bronchitis.	Decoction: Take 5 handfuls of leaves and flowers, wash properly and remove water. Boil in 1 litre of clean water and continue slow boiling till water becomes 1/3 rd of initial volume. Remove leaves/ flowers. Carefully drench the animal with decoction (Twice daily for 2-3 days)
2.	 <i>Aegle marmelos</i>	Bel Fruit: Chronic dysentery and dyspepsia	Mash 2-3 fruits, remove the seeds, add the mashed fruit in water and drench (Twice daily for 3-5 days)
3.	 <i>Allium sativum</i>	Lahsun Bulb: Ringworm	Take garlic cloves (number of cloves depends on the area of ringworm), grind with water to make fine semisolid paste, apply on the affected area twice daily till recovery



4.	 <p><i>Annona Squamosa</i></p>	Shareefa Leaf: Dressing on small cuts/ bruises	Take 10 leaves, grind with water to make fine semisolid paste, apply on the affected area twice daily till recovery
5.	 <p><i>Asparagus racemosus</i></p>	Shatawar Roots: Galactagogue, tonic	Take 50 to 60 g dried root, finely grind it with water and drench the liquid once daily during milch period
6.	 <p><i>Azadirachta indica</i></p>	Neem Leaf, fruit and Bark: Skin diseases	Take leaves, fruits or bark (amount depends on the area of affected skin), grind with water to make semisolid paste, apply on the affected area twice daily till recovery
7.	 <p><i>Bryophyllum calycinum</i></p>	Ghav Patta Leaf-juice: Bruised wounds	Take leaves (amount depends on the area of affected skin), grind, squeeze the ground leaves to extract juice and apply on the wound area twice daily till recovery
8.	 <p><i>Butea frondosa</i></p>	Palas Seed: Anthelmintic	Take 10-15 seeds, finely grind with water and drench once daily for 3-5 days. Repeat after 21 days
9.	 <p><i>Caesalpinia bonducella</i></p>	Karanj Seed: Inflammation	Take 10-15 seeds, grind with water to make semisolid paste, apply on the affected area twice daily till recovery
10.	 <p><i>Cassia tora</i></p>	Panwar Seed Skin diseases/ ring worm	Take 10-15 seeds, finely grind and mix in castor oil to make semisolid paste. Apply on the affected area twice daily till recovery
11.	 <p><i>Cedrus deodara</i></p>	Deodar oil: Mange	Oil of deodar (15%) is thoroughly mixed in castor oil. The formulation is applied once daily for 3-5 days after clipping the hair of the affected part(s) and removing the crust with brush.

12.	 <p><i>Chenopodium album</i></p>	<p>Bathua Plant: Anthelmintic</p>	<p>Take 2-3 handfuls of aerial plants, wash properly and remove water. Boil in 1 litre of clean water and continue slow boiling till water becomes 1/3rd of initial volume. Remove plants. Carefully drench the animal with decoction (Twice daily for 2-3 days)</p>
13.	 <p><i>Curcuma longa</i></p>	<p>Haldi Rhizome: Bronchitis, respiratory disorders, cough, cold</p>	<p>Decoction: Take 5-10 pieces rhizomes, wash properly and boil in 1 litre of clean water and continue boiling till water becomes 1/3rd of initial volume. Remove the rhizome, carefully drench the animal with decoction (Twice daily for 3-5 days)</p>
14.	 <p><i>Dalbergia sissoo</i></p>	<p>Sheesham Leaves: Diarrhoea</p>	<p>Decoction: Take 3-4 handfuls of mature leaves, wash properly and remove water. Boil in 1 litre of clean water and continue slow boiling till water becomes 1/3rd of initial volume. Remove leaves. Carefully drench the animal with decoction (Twice daily for 2-3 days)</p>
15.	 <p><i>Elettaria major</i></p>	<p>Badi Elaichi Seeds: Stomachic and carminative</p>	<p>Take 5-6 dry fruits, powder, mix with 500 ml water and drench it once daily for 3-5 days</p>
16.	 <p><i>Embelia ribes</i></p>	<p>Baibidang Seeds: Anthelmintic</p>	<p>Take 10-15 seeds, grind it with water and drench the liquid once daily for 7-10 days</p>
17.	 <p><i>Eucalyptus globulus</i></p>	<p>Eucalyptus/Safeda Eucalyptus: Mange</p>	<p>Oil of Eucalyptus (15%) is thoroughly mixed in castor oil. The formulation is applied once daily for 3-5 days after clipping the hair of the affected part(s) and removing the crust with brush.</p>
18.	 <p><i>Eugenia jambolana</i></p>	<p>Jaamun Bark: Antiseptic</p>	<p>Decoction: Take dried handful pieces of bark, wash properly, Boil in 1 litre of clean water and continue boiling till water becomes 1/3rd of initial volume. Remove the bark pieces, apply decoction with cotton gauge on the desired area</p>

19.	 <p><i>Ferula foetida</i></p>	<p>Heeng Gum resin (Aesafoetida): Antispasmodic, expectorant and slightly laxative and carminative used in bloats</p>	<p>Take 2 table spoon of hing powder and mix with 200 grams of jaggery (powdered) and feed to animal once daily for 2-3 days</p>
20.	 <p><i>Foeniculum vulgare</i></p>	<p>Bari-saunf Seeds: Carminative</p>	<p>Take 2-3 table spoon of seeds and mix with 200 grams of jiggery powder and feed to animal once daily for 3-5 days</p>
21.	 <p><i>Glycyrrhiza glabra</i></p>	<p>Mulaithi Root: Cough, sore-throat</p>	<p>Decoction: Take 5-6 dried root slips, wash properly, dry and powder it. Boil in 1 litre of clean water and continue boiling till water becomes 1/3rd of initial volume. Filter and carefully drench the animal with decoction (Twice daily for 5-7 days)</p>
22.	 <p><i>Gossypium herbaceum</i></p>	<p>Kapas Seeds: In ration for increasing fat in milk.</p>	<p>Can be added to ration as a source of energy and fat.</p>
23.	 <p><i>Holarrhena antidysenterica</i></p>	<p>Kutaj Leaf: Dysentery, intestinal worms, amoebiasis, mucus colitis</p>	<p>Decoction: Take 3-4 handfuls of mature leaves, wash properly and remove water. Boil in 1 litre of clean water and continue slow boiling till water becomes 1/3rd of initial volume. Remove leaves. Carefully drench the animal with decoction (Twice daily for 2-3 days)</p>
24.	 <p><i>Lawsonia inermis</i></p>	<p>Mehandi Leaves: Cooling of mild burn</p>	<p>Take 20-25 leaves, grind with water to make fine semisolid paste, apply on the affected area twice daily till recovery</p>
25.	 <p><i>Mentha species</i></p>	<p>Pudina Leaves/aerial plant: Stomachic, antispasmodic, carminative, anthelmintic</p>	<p>Take 3-4 handfuls of mature leaves/aerial plant, wash properly, make fine semisolid paste and feed to animal with 300 g jaggery (Twice daily for 2-3 days)</p>

26.	 <i>Nigella sativa</i>	Kali Jeeri Seeds: Stomachic, stimulant, carminative, digestive, anthelmintic	Take 2-3 table spoon of seeds and mix with 200 grams of jaggery powder and feed to animal once daily for 2-3 days
27.	 <i>Ocimum sanctum</i>	Tulsi Leaf: Cough, cold	Decoction: Take 1-2 handfuls of mature leaves, wash properly and remove water. Boil in 1 litre of clean water and continue slow boiling till water becomes 1/3rd of initial volume. Remove leaves. Carefully drench the animal with decoction (Twice daily for 3-4 days)
28.	 <i>Phyllanthus niruri</i>	Bhuiyaonla Aerial plant: Hepatostimulant	Decoction: Take 2-3 handfuls of aerial plant, wash properly and remove water. Boil in 1 litre of clean water and continue slow boiling till water becomes 1/3rd of initial volume. Remove plant. Carefully drench the animal with decoction (once daily for 40 days)
29.	 <i>Picrorhiza kurroa</i>	Kutki Rhizome: Stomachic	Decoction: Take 5-10 clean rhizomes, powder and boil in 1 litre of clean water and continue boiling till water becomes 1/3rd of initial volume. Remove the rhizome, carefully drench the animal with decoction (Twice daily for 2-3 days)
30.	 <i>Piper longum</i>	Peepali Berries: Respiratory disorder, cough, cold	Decoction: Take 20-25 berries, pound and boil in 1 litre of clean water and continue boiling till water becomes 1/3rd of initial volume. Remove berries, carefully drench the animal with decoction (Twice daily for 5-7 days)
31.	 <i>Piper nigrum</i>	Kali mirch Seeds: Carminative, mild antipyretic	Take 1 table spoon of seeds, finely powder and mix with 200 grams of jaggery powder and feed to animal once daily for 3-5 days
32.	 <i>Ricinus communis</i>	Arandi Seed oil: Purgative	Drench pure 500 ml oil to the animal once daily for 1-2 days

33.	 <i>Saccharum officinarum</i>	Ganna Gur: Digestant	Feed 250 gram jaggery everyday twice daily for 15 days
34.	 <i>Sesamum indicum</i>	Til Oil: Constipation, tympany	Drench pure 500 ml oil to the animal once daily for 2-3 days
35.	 <i>Shorea robusta</i>	Sal Resin: Mild burn	Make ointment of highly finely powdered (kaparcchan) resin (5%) in pure coconut oil and apply twice daily till recovery
36.	 <i>Swertia chirata</i>	Chireta Plant: Bitter tonic, Stomachic	Decoction: Take 150 g dry plant, pound and boil in 1 litre of clean water and continue boiling till water becomes 1/3rd of initial volume. Remove plant material, carefully drench the animal with decoction once daily for 15 days
37.	 <i>Tinospora cardifolia</i>	Amrita/Giloy Stem: Bitter tonic, antipyretic, febrifuge	Decoction: Take giloy stem (150 g), cut it into small pieces pound boil in 1 litre of clean water and continue slow boiling till water becomes 1/3rd of initial volume. Remove plant material, carefully drench the animal with decoction once daily for 3-5 days.
38.	 <i>Tribulus terrestris</i>	Goksharu Plant: Burning micturition	Decoction: Take 2 handfuls of plants, grind it boil in 1 litre of clean water and continue slow boiling till water becomes 1/3rd of initial volume. Remove plant material, carefully drench the animal with decoction once daily for 5-7 days
39.	 <i>Trachyspermum ammi</i>	Ajwain Seeds: Bronchitis, flatulence indigestion, colic	Take 2 table spoon of seeds and mix with 200 grams of jaggery powder and feed to animal once daily for 3-5 days

40.	 <i>Withania somnifera</i>	Ashwagandha Leaves/aerial plant: Tonic	Decoction: Take 3-4 handfuls dried aerial plant and powder it. Boil in 1 litre of clean water and continue boiling till water becomes 1/3rd of initial volume. Filter and carefully drench the animal with decoction (Twice daily for 15 days)
41.	 <i>Zingiber officinale</i>	Adarak Rhizome: Carminative, stimulant, stomachic	Decoction: Take 5-6 rhizomes, cut them into small pieces pound and boil in 1 litre of clean water and continue slow boiling till water becomes 1/3rd of initial volume. Remove plant material. Carefully drench the animal with decoction once daily for 3-5 days.

9. How to Stop Spread of Zoonotic Diseases from Cows

The major zoonotic diseases of cattle include anthrax, brucellosis, leptospirosis, listeriosis, Q fever, salmonellosis, and tuberculosis. Livestock handlers, veterinarians, abattoir workers, laboratory staff handling biological samples from infected cattle, and persons consuming unpasteurized milk or other dairy products are at an increased risk of contracting zoonotic diseases from cattle.

9.1 Control strategies

9.1.1 Prompt diagnosis and segregation of the diseased animals

Unless zoonotic infections are controlled in animals, it is not possible to prevent human infections. An ideal approach to control any zoonotic infection is to develop infection free cattle farms. Prompt diagnosis of common zoonotic diseases and isolation of sick animals can prevent transmission of the disease.

- **Tuberculosis:** Bovine tuberculosis can be controlled by routine test and segregation method and by proper postmortem inspection.
- **Brucellosis:** Brucellosis presents typically as abortion in animals and all abortions should be treated as suspected cases of brucellosis and should be investigated. Periodic surveillance of herds should be done using simple screening procedures like Rose Bengal Plate test and Abortus Bang Ring test (at least four times per year).
- **Leptospirosis:** Infection in human result from accidental contact with carrier animals or environment contaminated with leptospire and is primarily associated as an occupational disease. Serological tests like microscopic agglutination test and enzyme-linked immunosorbent assay are widely used for diagnosis.
- **Anthrax:** There are 3 forms of anthrax found in humans. The most common one is cutaneous anthrax which accounts for 95 per cent of human cases followed by intestinal and pulmonary anthrax. Intestinal anthrax results due to consumption of under-cooked meat and also by direct contact of infected animal. Proper ante-mortem examination is the key for prevention of this disease.

9.1.2 Disease identification and surveillance

Active surveillance is essential for protecting human health by early detection of zoonotic

diseases in animals and for providing basis for certification regarding the health status of a country or zone.

9.1.3 Environment and hygiene

Utmost care should be given to the hygienic and sanitary measures at Gaushala. Effective control of vectors like mosquitoes, flies, fleas and synanthropic animals like rodents, strict hygienic and sanitary measures including proper storage, collection and disposal of garbage and hygienic processing, storage and retailing of the animal products right up to the consumer level will ultimately aid in the control of zoonotic diseases, especially the enteric infections like salmonellosis and listeriosis.

9.1.4 Precautions to be taken for clean milk production

Unhygienic handling may introduce disease-causing bacteria into the milk adversely affecting human health. Relevant knowledge and skills to handle milk hygienically are a pre-requisite for clean and safe milk production.

9.1.5 Practices that should be desisted in order to maintain quality at the farm

- Never milk unclean animals
- Du^ring milking, the milker should not sneeze, cough or smoke. Milkers should desist from having long nails
- Always use metal (e.g. aluminium) containers and not plastic containers for milk collection/storage.
- Never leave milk in open containers.
- Milk needs to be cooled to 4°C as soon as possible, preferably within an hour of milking.
- The bulk tank at the farm is the beginning of the “cold chain”. For optimal preservation of the milk quality, the milk should be cooled as quickly as possible and kept cool during transportation, storage and use.
- For large quantities of milk, bulk milk tanks are designed to cool the milk properly within one hour. For small quantities of milk, an ice water bath with a stirring mechanism works well.
- Containers that maintain proper temperature are needed all the way to the delivery point.

9.1.6 Education and training

Well-educated professionals are essential for the control of zoonotic emergencies. Since the farmers or health personnel at the village level are the first to observe the deviation from normalcy, they should be trained enough in reporting such cases. To achieve this goal, experts from various disciplines should educate the health personnel and public.

9.1.7 Public awareness

It is necessary to re-emphasize that the zoonotic disease problem is a public health problem and all the managemental strategies adopted to control zoonotic infections would fail without active participation of the population. Education of people about the risks from zoonotic infections and preventive measures taken thereon can reduce the

risk of spread of zoonotic infections. Awareness among the public regarding zoonotic diseases should be the priority of veterinarians. Diseases like tuberculosis, and brucellosis can be controlled to greater extent by spreading the simple but important messages like 'Always drink boiled milk' and 'Call veterinarian in case of abortion', respectively.

10. Disinfection of Premises

As a general precaution, persons handling carcasses and disinfectants should wear protective clothing and be properly equipped to complete the tasks of disposition and disinfection. The method of disposal should preclude contamination of soil, air, and water. Hides and other parts of animals that have succumbed to infectious diseases or toxins should be safely disposed of and not retained for use. A cleaning agent such as trisodium phosphate or sodium carbonate dissolved in hot water can be used for cleaning. Removal and safe disposal of manure, feed, and debris by burial or burning, followed by thorough scraping and cleaning of all buildings and equipment, must precede the application of chemical disinfectant. All traces of the cleaning agent must be rinsed away with clear water before disinfectant is applied. Provision must be made to contain and safely dispose of cleaning solutions, rinse water, and disinfectant. Disinfectants recommended for general use on surfaces free of organic matter are sodium or calcium hypochlorite, iodine, phenol, and quaternary ammonium compounds. Newer disinfectants use a combination of products to enhance efficacy.

10.12.1 Biomedical waste management

(Ministry of Environment and Forests; Notification, New Delhi, 20th July, 1998)

Categories of bio-medical waste

Option	Waste category	Treatment and Disposal
Category 1	Human Anatomical Waste: human tissues, organs, body parts	Incineration/deep burial*
Category 2	Animal Waste: animal tissues, organs, body parts carcasses, bleeding parts, fluid, blood and experimental animals used in research, waste generated by veterinary hospitals colleges, discharge from hospitals, animal houses	Incineration/deep burial*
Category 3	Microbiology and Biotechnology Waste: wastes from laboratory cultures, stocks or specimens of micro-organisms live or attenuated vaccines, human and animal cell culture used in research and infectious agents from research and industrial laboratories, wastes from production of biologicals, toxins, dishes and devices used for transfer of cultures	Local autoclaving / microwaving/ incineration
Category 4	Waste sharps: needles, syringes, scalpels, blades, glass, etc. that may cause puncture and cuts. This includes both used and unused sharps	Disinfection (chemical treatment/autoclaving/ microwaving and mutilation/ shredding inches
Category 5	Discarded Medicines and Cytotoxic drugs: wastes comprising of outdated, contaminated and discarded medicines	Incineration/destruction and drugs disposal in secured landfills
Category 6	Solid Waste: Items contaminated with blood, and body fluids including cotton, dressings, soiled plaster casts, lines, beddings, other material contaminated with blood	Incineration/ autoclaving/ microwaving

Category 7	Solid Waste: wastes generated from disposable items other than the waste [sharps] such as tubings, catheters, intravenous sets etc.	Disinfection by chemical Treatment/autoclaving/ microwaving and mutilation/ shredding#
Category 8	Liquid Waste: waste generated from laboratory and washing, cleaning, housekeeping and disinfecting activities	Disinfection by chemical treatment and discharge
Category 9	Incineration Ash: ash from incineration of any bio-medical waste	Disposal in municipal landfill
Category 10	Chemical Waste: chemicals used in production of biologicals, chemicals used indisinfection, as insecticides, etc.	Chemical treatment and discharge into drains for liquids and secured landfill for solids.

Chemicals treatment using at least 1% hypochlorite solution or any other equivalent chemical reagent. It must be ensured that chemical treatment ensures disinfection.

Mutilation/shredding must be such so as to prevent unauthorised reuse.

There will be no chemical pretreatment before incineration. Chlorinated plastics shall not be incinerated.

Deep burial shall be an option available only in towns with population less than five lakhs and in rural areas.

10.12.2 Colour coding and type of container for disposal of bio-medical wastes

Colour Coding	Type of Container -I Waste Category	Treatment options as per Schedule I
Yellow	Plastic bag Cat. 1, Cat. 2, and Cat. 3, Cat. 6.	Incineration/deep burial
Red	Disinfected container/plastic bag Cat. 3, Cat. 6, Cat.7.	Autoclaving/Microwaving/ Chemical Treatment
Blue/White translucent	Plastic bag/puncture proof Cat. 4, Cat. 7.	Autoclaving/Microwaving/ Chemical Treatment and destruction/shredding
Black	Plastic bag Cat. 5 and Cat. 9 and Cat. 10.	Disposal in secured landfill

Notes

1. Colour coding of waste categories with multiple treatment options as defined in Schedule I, shall be selected depending on treatment option chosen, which shall be as specified in Schedule I.
2. Waste collection bags for waste types needing incineration shall not be made of chlorinated plastics.
3. Categories 8 and 10 (liquid) do not require containers/bags.
4. Category 3 if disinfected locally need not be put in container

10.Sanitation in Gaushala

It is the processes of adopting hygienic measures which nullifies the factors of health deterioration and create conditions of secure health and ensure production of good quality dairy products. Following steps are necessary for optimum sanitation of Gaushalas.

- Foot bath is important in protecting animals from contagious diseases and pets. Tank for foot bath to be filled with germicidal solutions.

- Physical removal of urine, fecal material and other organic material from the environment.
- Traffic control should be stopped to minimize contamination of milk, cattle, feed, feed handling equipment and equipment used on cattle or to process milk. The only equipment allowed should be the loader used for handling the feedstuff.
- Sanitary quality of water is determined by microbiologic testing for coli form and other microorganisms. Water supplies (well area, ponds and streams) should be protected from fecal contamination where possible. Watering cups, tanks and troughs should be designed and located for ease of cleaning and reducing contamination of feed and water.
- Sprayer for spraying germicidal solutions on animals for controlling pests, fly and bacteria to be used.
- Commonly used sanitizer includes Hypochlorite, Quaternary ammonium compound, Potassium permanganate, Carbolic acid and Hydrogen peroxide.

Appendix

Table 1: Respiratory rate, pulse rate and rectal temperature in healthy cattle

Name of animal	Respiratory Rate per minute	Pulse Rate per minute	Temperature °F
Calf	27-56	80-100	101.5-103.5
Cow (adult)	10-30	60-70	101.5 (100.4-102.8)
Ox (adult)	12-16	35-70	101.5 (100.4-102.8)

Generally younger animals have higher respiratory and pulse rates and body temperature

Table 2: Age of eruption of teeth in cattle

Eruption of deciduous teeth	Eruption of Permanent teeth
Di 1: before birth	I1: 1.5 to 2.0 years
Di 2: before birth	I2: 2.0 to 2.5 years
Di 3: birth to 1 week	I3: 3.0 years
Di 4: birth to 2 week	I4: 3.5 to 4.0 years
Dp 1: birth to 3 week	P1: 2.0 to 2.5 years
Dp 2: birth to 3 week	P2: 1.5 to 2.5 years
Dp 3: birth to 3 week	P3: 2.5 to 3.0 years
	M1: 5.0 to 6.0 months
	M2: 1.0 to 1.5 years
	M3: 2.0 to 2.5 years

The Dental Formula of Cattle

Deciduous teeth: $2 \times \{Di \ 0/4 \ Dc \ 0/0 \ Dp \ 3/3\} = 20$ (Di-Deciduous incisor; Dc-Deciduous canine; Dp-Deciduous premolar)

Permanent teeth: $2 \times \{I 0/4 C 0/0 P 3/3 M 3/3\} = 32$ (I-Incisor; C-Canine; P-Premolar; M-Molar)

Table 3: Reproductive indices in indigenous cow

Age at first estrus (months)	Age best to breed (months)	Duration of estrus/heat (hr)	Length of estrous cycle (days)	Best time to serve (hr)	Occurrence of estrus after parturition (days)	Gestation period (days)
18-24	24-30	24-36	Every 20-21	12-24 (mid to late heat)	60-90	272-291 (280)

Table 4: Daily Feed requirements for cattle

Sl. No.	Item	Bullock	Milch Cow
1.	Balanced cattle feed (concentrate) (kg)	2 to 3	3 to 4
2.	Leguminous (kg)	6 to 7	7 to 10
3.	Cereal green (kg)	15 to 17	15 to 17
4.	Dry Fodder	Ad lib	Ad lib

Table 5: Composition of balanced concentrate ration for cattle

Sl. No.	Item	Quantity in percent (%)
1.	Good protein oil seed cake	20%
2.	Guar-meal or chuni	15%
3.	Maize Gluten	15%
4.	Rice polished crushed	15%
5.	Wheat or Maize	17%
6.	Molasses	10%
7.	Grain/pulse husk	5%
8.	Mineral mixture	2%
9.	Salt	1%

Table 6: Common feed stuffs available for cattle

Concentrates		Roughages	
Protein Supplement	Energy Feeds	Dry	Succulent
Groundnut cake, cottonseed cake, Pulses, soyabean, etc.	Grain and seeds (maize, barley, sorghum, wheat etc.)	Tree leave Hay	Green Fodder

Mineral supplement Common salt, Rocksalt, Black Salt etc.	Mill by products (Arhar chuni, wheat bran, rice bran, gram chuni) Roots (Tapioca tubers, turnip, potatoes)	Legumes (Hays of Lucerne etc.) Non- legume (Sorghum, maize etc) Straw Straws like Oat, Rice, sorghum, Wheat, Barley, cenchras, dicanthiu etc	Legume Lucea N, Berseem, Cowpea, Pulses etc (Cowpea, cluster bean, green pea, berseem Lucerne) Non Legume (Fodders of jowar maize, bajra, oat etc. and grasses of sudan, napier, guinea etc)
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Table 7: Girth and corresponding weight (approximate) in cattle

Girth in cm	Weight in kg	Girth in cm	Weight in kg
68	35	130	190
70	40	135	210
75	45	140	230
80	50	145	252
85	59	150	272
90	69	155	295
95	79	160	325
100	89	165	360
105	103	170	392
110	118	175	427
115	134	180	467
120	150	185	508
125	170	--	--

Table 8 : Normal Blood Values for Indian Hill Bulls (Somvanshi, 1994) and other cattle

Blood parametres	Range		Average Values		Merck's Manual
	Somvanshi (1994)	Jain (1986)	Somvanshi (1994)	Jain (1986)	range
Erythrocyte Series					
Erythrocytes ($\times 10^6/\mu\text{l}$)	4.8 – 11.20	5.0-10.0	8.15	7.0	$5-10 \times 10^{12} / \text{L}$
Haemoglobin (g/dl)	8.0 – 14.0	8.0-15.0	10.60	11.0	80-150 g/L
PCV (%)	30.0 – 51.0	24.0-46.0	38.70	35.0	24-46%
MCV (fl)	35.2 – 68.6	24.0-46.0	48.89	35.0	40-60 fL
MCH (pg)	9.8 – 18.7	11.0-17.0	13.32	14	
MCHC (%)	20.9-35.3	--	27.53	--	
Leukocyte Series					
Leukocyte (ml)	5100 – 15550	4000-12000	8877	8000	$4-12 \times 10^9 / \text{L}$
Neutrophil (ml)	1625 – 3875	600-4120	2732.3	8020	
Lymphocyte (ml)	3565 – 10375	2500-7500	5572.1	4500	

Monocyte (ml)	71.5 – 710	25-840	343.5	400	
Eosinophil (ml)	0 – 918	0.0-2400	223.7	700	
Basophil (ml)	0 – 63	0.0-200	5.3	50	
Percentage Distribution					
Neutrophils	13 –50	--	30.78	--	15-45
Lymphocytes	48 – 83	--	62.77	--	45-75
Monocytes	1 – 10	--	3.87	--	2-7
Eosinophils	1 – 12	--	2.52	--	2-20
Basophils	0 – 10	--	0.06	--	0-2

Table 9: Normal Serum biochemical values

S.No.	Parametre	Reference Range
1	ALT (u/L)	7-35
2	Amylase (u/L)	41-98
3	Alkaline Phosphatase (u/L)	18-153
4	Creatinine kinase (u/L)	0-350
5	GGT (u/L)	6-18
6	Bicarbonate (mEq/L)	20-30
7	Bilirubin (mg/dl)	0-1.6
8	Calcium (mg/dl)	8.5-10.4
9	Phosphorus (mg/dl)	4.5-6
10	Magnesium (mg/dl)	1.2-3
11	Protein (g/dl)	6.7-7.5
12	Glucose (mg/dl)	40-100
13	Cholesterol (mg/dl)	70-190
14	Sodium (mEq/L)	136-144
15	Chloride (mEq/L)	99-107
16	Potassium (mEq/L)	3.6-4.9

(u/L = unit / litre)

Glossary

Acaricide: A substance poisonous to mites or ticks.
Acidosis: An excessively acid condition of the body fluids or tissues in animals.
Agalactia: Decrease in milk production.
Anemia: It is defined as a decrease in the total amount of red blood cells (RBCs) or hemoglobin in the blood.
Anthelmintic: Drug that can kill helminth parasitic worms.
Antibiotic: It is a medicine that inhibits the growth of or destroys microorganisms.
Antibody: An antibody, also known as an immunoglobulin used by the immune system to neutralize pathogens such as bacteria and viruses.
Anticoagulant: Substances that prevent or reduce coagulation of blood, prolonging the clotting time.
Antifoaming: The agent is used to prevent formation of foam or is added to break a foam already formed.
Antiseptic: Drug that can prevent the growth of disease-causing microorganisms.
Antispasmodic: Drug that can relieve spasm of involuntary muscle.
Anuria: Failure of urine formation.

Autoclave: An Autoclave is a device to sterilize equipment and supplies by subjecting them to high pressure saturated steam at 121 °C or more, typically for 15-20 minutes.
Bacteriology: The study of bacteria is known as bacteriology.
Bio-security: Procedures or measures designed to protect the population against harmful biological or biochemical substances.
Bloats: Accumulation of gas in rumen or any part of digestive system.
Bruises: Discoloured skin on the body, caused by rupture of underlying blood vessels.
Carminative: Drug that relieves flatulence.
Castration: Removal of the testicles of a male animal.
Cathartics: Agents that quicken the evacuation of content from the gastrointestinal tract.
Centrifuge machine: A laboratory centrifuge is a piece of laboratory equipment, driven by a motor, which spins liquid samples at high speed.
Colic: Severe pain in the abdomen.
Colitis: Inflammation of the inner lining of the colon.
Colostrum: Colostrum is also known as first milk produced by the mammary glands in late pregnancy and the few days after giving birth.
Conjunctivitis: It is also known as pinkeye and it, is the inflammation of the conjunctiva.
Constipation: It is a condition of the digestive system where an animal's has hard feces that are difficult to expel.
Contagious disease: Disease spread from one animal to another animal, typically by direct contact.
Convalescent: Convalescence is the gradual recovery of health and strength after illness or injury.
Crystalloids: Substance when dissolved forms a true solution and is able to pass through a semi-permeable membrane
Cyanosis: Cyanosis is defined as a bluish discoloration, especially of the skin and mucous membranes, due to reduced concentration of oxygen in the blood.
Decoction: Simmering medicinal plants in boiling water.
Dehorning: It is the removal of horns from an animal.
Dehydration: Dehydration means water and fluids are exiting than entering the body
Deworming: Administration of anthelmintics drug to an animal to kill the parasites such as roundworm, flukes and tapeworm.
Diarrhoea: Frequent discharge of faeces from the bowels in a liquid form.
Disinfectant: It is the chemical agent used chiefly on inanimate objects to destroy or inhibit the growth of harmful organisms.
Dysentery: Infection of the intestines resulting in severe diarrhoea with the presence of blood and mucus in the faeces.
Dyspepsia: Digestive disturbance accompanied nausea and vomiting, heartburn, and stomach discomfort.
Dyspnea: Disturbed breathing is known as dyspnea.
Dystocia: Difficult birth.
Ectoparasite: A parasite, such as a flea, that lives on the outside of its host.
Edema: Edema is swelling or puffiness caused by fluid in body's tissues.
Electuary: Semisolid medicine prepared as a paste in sugar syrup or molasses or honey. Bolus: Oval/ball shaped powdered medicinal plant with some binding agent.
Emaciation: It is the state of being abnormally thin or weak.
Encephalitis: Encephalitis is a sudden onset inflammation of the brain.
Endoparasite: A parasite, such as a tapeworm, that lives inside its host.
Expectorant: Drug which promotes the secretion of the air passages relief coughs.
Extract: The liquid extract of medicine in water or alcohol is further processed and liquid is evaporated and powder is obtained which is two or four times powerful than liquid medicine.

Febrifuge: Druga medicine used to reduce fever.
Galactagogue: Food or drug that promotes or increases the milk production.
GRAS: Generally recognized as safe.
Grunting: Forceful exhalation of air due to blockage in the respiratory tract
Haemostatic: Drug which can stop bleeding.
Hematuria: Presence of blood in the urine.
Hemoglobinuria: Presence of free hemoglobin in the urine
Hemolysis: Rupture or destruction of red blood cells or RBC.
Hemorrhage: Hemorrhage is escape of blood from ruptured blood vessels.
Hot air oven: Hot air ovens are electrical devices which use dry heat to sterilize
Hypocalcaemia: Reduced amount of calcium in the blood
Hypophosphatemia: Reduced amount of phosphorus in the blood
Incoordination: Lack of coordination, especially the inability to use different parts of the body together smoothly and efficiently.
Incubation period: It is the period between exposure to an infection and the appearance of the first symptoms.
Infertility: inability to conceive and give birth of calves in cows.
Inflammation: Reaction of body to injury or infection characterized by redness, swollen, hot, and pain.
Infusion: Method of preparation of relaxing herbal preparation in boiling water like tea
Jaundice: Jaundice, also known as icterus, is a yellowish or greenish pigmentation of the skin and eyes due to high bilirubin levels. It is commonly associated with liver failure.
Lameness: Lameness is an abnormal gait or stance of an animal that is the result of dysfunction of the locomotors system (muscle and limbs).
Lotions: Solutions of medicines, either prepared in water or alcohol.
Mastitis: Inflammation of Mammary tissue.
Mastitis: Mastitis is an infection of the udder tissue that results in pain, swelling, warmth and redness.
Microscope: It is an instrument used to obtain an enlarged image of small objects and reveal details of structure not otherwise distinguishable.
Morbidity: A diseased state, disability, or poor health.
Mortality: A measure of the number of deaths in a given population.
Ointments: The medicine prepared in petroleum jelly and used externally.
Ophthalmoscope: An ophthalmoscope is a medical device which is used to look into the eyes.
Otoscope: An otoscope or auriscope is a medical device which is used to look into the ear.
Paralumbar fossa: The paralumbar fossa is an area on the left side of the cattle just in front of the hip bone in the sunken space.
Paralysis: Loss of muscle function in part of the body.
Paraplegia: Paralysis of hind limbs.
Parasitology: The study of Parasite is known as Parasitology.
pH Metre: A pH Metre is a scientific instrument that measures the hydrogen-ion activity in water-based solutions, indicating its acidity or alkalinity expressed as pH.
Plasma expander: Plasma expanders are agents that have relatively high molecular weight and boost the plasma volume by increasing the osmotic pressure. They are used to treat patients who have suffered hemorrhage or shock.
Pneumonia: Inflammation of lung is known as pneumonia.
Polydipsia: Polydipsia is excessive thirst or excess drinking.
Polypharmacy: Preparations are made by combining of four or more herbs.

Poultices: Medicinal ingredient is made semisolid or viscous using water, glycerine as base and applied hot.
Powder: Pulverized medicinal plant.
Purgative: Medicine used for evacuation of the bowels.
Pyuria: Presence of pus in the urine.
Resistance: Ability of some animals to withstand the attack of pathogen and remain virtually unaffected.
Ringworm: A contagious fungal itching skin disease with itching.
Rumenotomy: Surgical opening of rumen in cattle is called as rumenotomy.
Rumenotorics: Substances causes stimulation and improvement in general functioning of rumen are called Rumenotorics.
Sanitizer: It is the alcohol-based chemical agent preferably for hand washing.
Specific gravity: It is the ratio of the mass of a substance to the mass of a reference substance for the same given volume.
Sporadic: Disease occurring at irregular intervals or only in a few places; scattered or isolated.
Sprains: Twist of the ligaments leading to cause pain and swelling
Stethoscope: It is a medical device for auscultation, or listening to the internal sounds of an animal. It typically has a small disc-shaped chest piece that is placed against the chest, and two tubes connected to earpieces.
Stomachic: Drug that can promote the appetite and improve digestion.
Surfactant: Surfactants are compounds that lower the surface tension (or interfacial tension) between two liquids or between a liquid and a solid.
Tachycardia: Increase in the heart rate.
Thermometre: An instrument for measuring and indicating temperature, sealed glass tube marked with graduations and having one end a bulb containing mercury or alcohol which extends along the tube as it expands.
Tinctures: Extraction of active principles using Ethanol.
Toxicology: It is the study of the adverse effects of chemicals on living organisms.
Transplantation: Substance or organ is removed from one animal and placed in the body of other animal.
Tremor: Tremor is an unintentional, rhythmic muscle movement involving to-and-fro movements (oscillations) of one or more parts of the body.
Trocar: It is a medical device used to relieve excessive gas in the stomach.
Urticaria: It is a raised, itchy rash that appears on the skin.
Vaccination: It is the administration of antigenic material (a vaccine) to stimulate an individual's immune system to develop adaptive immunity to a pathogen.
Veneral transmission: Disease transmitted by sexual route.
Water bath: A container of water heated to a given temperature, used for heating substances placed in smaller containers.
Weaning: The calves are removed from their mothers and placed on a man-made feeding system.
Zoonosis: Zoonosis is infectious diseases of animals that can naturally be transmitted to humans.

List of surgical instruments

Artery forceps 6 inches st (2)
Artery forceps Crile 6 inchesst cum curved (6)
Artery forceps Crile 8 inches (6)
Babcock Forceps (1)
Allies Forceps 8 inches (1)
Intestinal Clamp St and Curved (4)
Fine Scissor St curvedand St. cum Curved (1)
Castrator big size (1)
Firing Iron set (1)
Bone separator (1)
Hammer plaxi (1)
Drip stand (2)
Infra red lamp (1)
Bone cutting forceps (1)
Bone Hammer 500gm (1)
Bone Nibbler D/A (1)
Electric drill with box (1)
Lanes Screw Driver (1)
Bone holding forceps (2)
Drill Guide (2)
Drill Sleeve (2)
Needle holder 10 inches (1)
Needle holder 7 inches (2)
Scissor Metzen. St. cum curved 6 inches (2)
Shadowless lamp with stand (1)
Sponge forceps (1)
Spring Towel Clip (4)
SS Self locking Screw holder (2)
Suction pump Gastric lavage (1)
Tooth Cutter (1)
Tooth Forceps 8 inches (2)
Towel Clip Backner 5 inches (4)
Towel Clip Backner 6 inches (8)
Vaginal speculum 14 inches (1)
Vaginal Speculum 8 inches (1)
Vaginoscope metal (1)
Vaginoscope plastic (1)
Laryngoscope with 3 blades (1)
A.I pipette (10) plastic (1)
A.I Gun (2)
Allies forceps (1)
Allies Forceps 6 inches (4)
Artery forceps 8 inches (2)
Artery forceps Angle (2)
B. P. Handle (3)

Bone clamp (3)
Bone cutting forceps D/A (1)
Calculus stone Forceps (1)
Chuck with Key (1)
Depth Gauge (1)
Drill Bit 1.1,1.5mm (2)
Drill Bit 2.0mm (2)
Drill Bit 2.5, 3.2 mm (2)
Drunching bottle (1)
Fine forceps St. cum curved (2)
Flessa's sutures (1)
Haemostatic Forceps (6)
Irrigator SS complete (2)
K-Nail Guide (1)
Nail cutter (1)
Obstetrical hook (1)
Ovum Forceps Curved (1)
Prolapse clamps 3 inches (1)
Prolapse clamps 7 inches (1)
Scissor Mayo's 6 inches curved (1)
Scissor Metzenbalm curved 8 inches (2)
Scissor Metzenbalm St 8 inches (1)
Self centering Forceps (1)
Scissors Mayo 8 inches SS Curved (2)
Scissors Mayo 7 inches SS St (2)
Scissors Mayo 6 inches SS Curved (2)
Scissors Metzenbaum 8 inches Cur (2)
Scissors Metzenbaum 8 inches St (2)
Scissors Metzenbaum 7 inches St and Cur (2)
Scissors Metzenbaum 6 inches St and Cur (2)
Scissors Suture Cutting (4)
Dressing Scissor St Blunt 8 inches
Micro Needle Holder (1)
Sponge Holding Forceps (1)
Needle Holder 10 inches (1)
Needle Holder 7 inches (3)
Needle Holder 8 inches (3)
Needle Holder with Scissors (4)
Artery Crile Forceps 8 inches (4)
Artery Crile Forceps St Curved 6 inches (4)
Artery Forceps 8 inches (4)
Artery Forceps St Cur 6 inches (4)
Artery Forceps 10 inches (4)
Artery Agile Forceps (4)
Forceps Haemostatic (4)
Forceps Allis 6 inches (4)

ForcepAllis s 8 inches (4)
Babcock Forceps 8 inches (10)
Spring Towel clips (10)
Intestinal Clamps (4)
B P Handle 3 no (6)
Eye Speculum (1)
Scissors Fine St Cur (4)
Scissors Fine St Cur (4)
Forceps Calculus Stone (2)
Eyelid Dilator (2)
Teat instruments
Wire Saw
Calving chains
Embryotom with Insertion wire scleaning
Wire saw handle pair
Saw hock 21cm
Mouth gag



Companies for purchase of equipments

Golden Star Surgical Industries

Plot No 2 Village Warayana, Sangal Sohal Road
Jalandhar-144002. Punjab
Mobile :+919888632327/ +919888232718

Dairy Farm Solutions India

G 1, Plot No 54, Rajendar Nagar, Sec 5, Sahibabad - 201005, Uttar Pradesh, India
Mobile :+918071805636

Sumangalam Dairy Farm Solutions (India) Private Limited

Plot No. 4/42, Site 4, Sahibabad Industrial Area In front Of Anand Vihar Terminal, Sahibabad
- 201010, Uttar Pradesh, India
Mobile :+918071678741

Jullundur Enterprises

1568- A, G-22-23, Bhagirath Palace Chandni Chowk, Delhi - 110006, India
Mobile :+918079463660
Classic Veterinary and Surgical Udyog
No. 1520/3, Jagson Pal Building, Bhagirath Palace, Chandni Chowk, Delhi - 110006, India
Nagpur Agro (Cattle feeding bottle)
8, New Balaji Nagar, Nagpur, Maharashtra, 440027, India
Mobile :+918983390088

Everest Industries Limited

Asbestos Roofing/Walls/Ceiling Material
Everest Industries Limited
Everest Technopolis
D-206 Sector 63
Noida 201301
Ph: 0120-4791800 Mobile : 9717494777

12 | SELF-SUSTAINABLE GAUSHALAS

The economic structure of Gaushalas has been changing rapidly in recent years. There is a steep increase in number of unproductive cows in Gaushalas.

As per a report published in a national daily Somnath, manager of Shri Krishna Gaushala Ladwa of Kurukshetra district quoted “We have a total of 602 cattle against a capacity of 250. But there are only four cows that produce milk and we do not have other sources of income. For salaries of the 22 employees and fodder and medicines for the cattle, we depend on donations,”

Similarly, there are 375 cattle in the Badhawa Rama Gaushala in Damla of Yamunanagar district and it is also overcrowded. The management depends on donations from farmers, who donate wheat fodder, grass, feed and cash for cows.

Economics have never been emphasised in these organisations. Assuming them charity organisations, profit and loss was neither calculated nor questioned. They depended on donations but the need of the hour is to reconsider the nature of functioning of Gaushalas and role of economic analysis should be added as a means of enhancing Gaushala quality.

For many decades, people have donated to Gaushalas. With changing times, many of the original donors have passed away and the next generation is less interested in continuing the tradition of donating to Gaushalas. Gaushalas now face challenges to keep themselves functional due to a shortage of funds.

In order to survive they require business models with a wide array of revenue generating activities.

First, the Gaushalas have to reconsider their own priorities. A new set of objectives for various revenue generating projects have been discussed earlier, resulting in a greater emphasis on projects producing outputs along with meeting the needs and welfare requirements of cows directly.

Key features (also discussed in detail earlier) of these projects for holistic development of Gaushalas as a business model are:

1. Self-reliant local energy generation from cow dung (biogas for cooking, lighting and electricity generation)
2. Production of organic manure via vermi-compost unit and encouraging shifting from chemical agriculture towards organic agriculture.
3. Panchgavya production unit for local health care along with increasing fertility of soil.
4. Supply of cow milk and its products after value addition and prevention of malnutrition in the area.
5. Production of renewable electricity source from bull/oxen power.

Economics of Setting up a Gaushala

A Gaushala unit requires proper space for keeping calves, heifers, adult cows, dams and bulls in health. Apart from this a Gaushala unit also has quarantine unit, sick unit ward for cows, feed and fodder storage area, office and record keeping unit, chaffing area, Gobar gas plant unit, Vermi-compost unit, Panchgavya unit, having cow urine distillation unit and other manufacturing units as per decision and scope of product made from cow dung and cow urine. The cost of construction material for shed and feeding materials is mentioned as per market survey.

Cost of roofing materials

Asbestos cement sheet	:	₹ 15/ feet ²
Fibre polymer sheets	:	₹100-200/ feet ²
Galvanised iron sheet	:	₹ 25/ feet ²
Mild steel sheet	:	₹ 40/ feet ²
Thatch and bamboo roof	:	₹ 10/ feet ²
Tin sheet	:	₹ 20/ feet ²

Cost of flooring materials

Bituminous floor	:	₹ 30/ feet ²
Brick lined floor	:	₹ 20/ feet ²
Concrete floor	:	₹ 35/ feet ²
Concrete grooved floor	:	₹ 36/ feet ²
Kankar floor	:	₹ 10/ feet ²
Slatted floor	:	₹ 90-100/ feet ²
Stone slab floor	:	₹ 15/ feet ²

For a Loose house shed of 80-100 animals

Length of shed	:	30 metre
Breadth of shed	:	15 metre
Total area of shed	:	450 metre ² = 4843.76 feet ²
Covered area	:	150 metre ² = 1614.59 feet ²
Open area	:	300 metre ² = 3229.17 feet ²

Total cost of roofing the covered area of shed in loose housing system with different materials has been calculated as under:

Asbestos cement sheet	:	₹ 24,218.85
Fibre profiled sheets	:	₹ 161459.00

Galvanised iron sheet	:	₹ 40,364.75
Mild steel sheet	:	₹ 64,583.60
Thatch and bamboo roof	:	₹ 16,145.90
Tin sheet	:	₹ 32,291.80

While the cost of thatch and bamboo roof is lowest (₹ 16,145.90), the cost of fibre-profiled sheets is highest (₹ 161459.00). Asbestos cement sheets are recommended for roofing in Gaushalas out of their comparatively lower cost (₹ 24,218.85) along with higher durability (30-35 years).

Total cost of constructing floor of the covered area of shed with different flooring method has been calculated as under:

Bituminous floor	:	₹ 48,437.70
Brick lined floor	:	₹ 32,291.80
Concrete floor	:	₹ 56,510.65
Concrete grooved floor	:	₹ 58,125.24
Kankar floor	:	₹ 16,145.90
Slatted floor	:	₹ 1,61,459.00
Stone slab floor	:	₹ 24,218.85

Total cost of constructing floor of the open area of loose house with different flooring method has been calculated as under:

Bituminous floor	:	₹ 96,875.10
Brick lined floor	:	₹ 64,583.40
Concrete floor	:	₹ 1,13,020.95
Concrete grooved floor	:	₹ 1,16,250.12
Kankar floor	:	₹ 32,291.70
Slatted floor	:	₹ 3,22,917.00
Stone slab floor	:	₹ 48,437.55

Although the cost of kankar floor is lowest, and brick lined floor low, these are not recommended for flooring because of difficulty in manure removal and maintaining hygienic conditions inside the shed. However, these may be used for flooring the open area of loose house, only because of their cost effectiveness. While concrete floor and concrete grooved floor have comparable cost of construction. The benefits of concrete grooved floor over concrete floor along with cost economics over slatted floor makes it a floor of choice for covered area of shed.

Total cost of cattle sheds can further be calculated with miscellaneous cost of construction running 140-150 rupees per square feet for covered area or area under shed and 40-50 rupees per square feet for open area or area not under shed

Cost of feed and water

The cost of feeding and watering in Gaushalas can further be calculated on the basis of assumption of average daily intake and cost based on the market survey.

- Green fodder = 20 kg/day/cow X 100 cows
= 2000 kg @ ₹ 250/quintal
- Dry fodder = 8-10 kg/day/cow X 100 cows
= 800-1000 kg@ ₹ 500/quintal
- Concentrate = 1-5 kg/day/cow X 100 cows
= 100-500 kg/day@ ₹ 2000/quintal
- Drinking water = 30-40 litre/day/cow X 100 cows
= 3000-4000 litre/day
- Water for cleaning = 25-30 litre/day/cow X 100 cows
= 2500-3000 litre/day

Labour requirement

4-5 labourers are required to manage 100 cows (@ ₹ 9,000/ labour)

Different Strategies for Making Gaushalas Self-Sustainable

Gaushalas are shelters for unproductive cows and their progeny, especially males. A self-sustainable Gaushala model for management of unproductive cattle includes the following activities:

- Running a shop: Having a shop just outside the Gaushala or just as you enter. This should be given to a bhoosa/green fodder/vegetable/salt lick Supplier. He should have jute bags, a chaff cutter and a 'thela' or word wooden vehicle for supply.

Many people come to feed cows. If they bring food from home it is usually very little. But if they can buy it at the Gaushala and have it transported to the feeding area, then it is large amounts. The shop man should have a contract that specifies the rent and a clause that says, that when the feed runs low, he will supplement it free or at a normal rate. Well run shops can be a way to get at least half the daily returns from donors.

You can have another shop which sells all the products made at the Gaushala.

- Using cow urine to make medicines and products for agriculture
- Large-scale production of organic manure based on an aerobic composting microbes or vermicompost for use and sale to farmers/individuals/organisations undertaking organic farming, public etc.
- Employing novel methodologies for using cow dung for production of bio-gas to meet energy and fuel requirements in the Gaushala as well as for sale.
- Preparation of Panchgavya medicines.

- Preparation of herbal pesticides using herbs and cow urine for sale.
- Preparation of bio-pesticides and bio-insecticides to be used in agriculture
- Preparation of products like mosquito repellent coils, detergents, floor cleaner etc.
- Generation of solar power in the Gaushala compound.
- Production of cow dung cakes on a large scale for sale as bricks, logs, etc.

Cow urine

The use of cow urine or gomutra in India can be traced back to the prevedic period. It is natural, eco-friendly with no residual effects. Cow urine is 95% water, 2.5% urea and the remaining 2.5%, a mixture of minerals, salts, hormones and enzymes. The biochemical estimation of cow urine has shown that it contains sodium, nitrogen, sulphur, Vitamin A, B, C, D, E, minerals, manganese, iron, silicon, chlorine, magnesium, citric, calcium salts, phosphate, lactose, carbolic acid, enzymes, creatinine and hormones. Any deficiency or excess of these substances inside the body causes disorders. It has been observed that cow urine enhances the phagocytic activity of macrophages and thus helpful against bacterial infections.

Scientists have found that cow urine is a rich source of essential elements, nutrients and hormones and has antimicrobial properties. A lot of research has been conducted in Cow Urine Treatment and Research Center, Indore over the past few years and it has been reported that gomutra is capable of curing blood pressure, blockage in arteries, arthritis, diabetes, heart attack, cancer, thyroid, asthma, psoriasis, eczema, prostrate, fits, AIDS, piles, migraine, ulcer, acidity, constipation, gynecological problems, ear and nose problems and several other diseases. Externally it has been used as lotion, ointments and bath.

The following effects on human health have been observed during trial with cow urine:

1. It increases cellular and humoral immunity (antibodies circulating in body fluids).
2. It acts as antioxidant.
3. It reduces blood sugar levels and enhances sensitivity of insulin receptors.
4. It has diuretic properties and prevents stones in urinary tract.
5. It has germicidal properties.
6. It assists wound healing.
7. It can be used to destroy internal worms.
8. It helps increase digestive powers.
9. It has a positive effect on the functioning of the liver.
10. It has anti-fungal properties.
11. In case of piles, warm gomutra should be applied on the hemorrhoids or tub-bath with gomutra to be done or enema with gomutra is beneficial.
12. In obesity, 10 ml gomutra along with lukewarm water or with 50 g honey should

be consumed.

13. Regular consumption of gomutra decreases the level of cholesterol. Hence it is very beneficial in Heart/Cardiac disorders.
14. In worm infection, gomutra should be consumed in a quantity of 10-20 ml along with 4-6 gm Nadi Hinga powder.
15. Consumption of gomutra cures constipation.
16. Massage using gomutra cures various skin disorders.
17. In skin disorders like eczema, psoriasis etc, the use of gomutra is very useful.
18. 20 ml gomutra with 4 gm yavakshar, if consumed for 3 months, decreases condition of ascites (For preparing yavakshara, whole barley plant *Hordeum vulgare* is dried, burnt in open air, ash is added to water and kept over night. Sediment portion is discarded and upper clear portion is filtered many times. The clear liquid obtained is heated and solid powder leftover at the bottom of vessel is Yavashara).
19. Administration of 2-4 drops of Gomutra in the nostrils or consumption of Gomutra twice a day is also beneficial in cold.
20. In case there is a swelling on a part of the body due to trauma or sprain, Gomutra should be warmed and applied on the affected part or a cloth dipped in Gomutra should be placed on the affected part.
21. Wounds (boils) should be cleaned with Gomutra.
22. Consumption of fresh 20 ml Gomutra twice a day for 21 days is very effective in jaundice.

Collection of cow urine

Cow urine may be collected in earthen, glass, china clay or steel pot. The most appropriate time for collection of cow urine is during morning hours when the animal wakes up and has great urge to urinate. Urine can also be collected during the milking of milch animals. When the udder or vulva of the animals is massaged, conditioned reflex can also be developed to make them urinate.

For collection of the cow urine a healthy cow is selected that fulfills the following 3 criteria.

- The cow should be healthy and disease free.
- The cow which drinks clean water and eats grass and medicinal herbs is suitable for urine collection.
- Jersey and crossbred cows are not suitable. Only Indian traditional cows are suitable.

Preservation of cow urine

Cow urine does not deteriorate when stored for a long period of time. The colour of the cow urine may change to either black or red due to copper and iron. After collection of cow urine, it should be exposed to sunlight for 72 to 144 hours. Purified cow urine is



stored at 4° C. Presence from dust cow urine should be covered with a clean cloth and cotton.

Cow urine distillation process

Gaumutra Arka (Distilled Cow urine)

It is distilled cow urine. It is used to reduce the cholesterol level in the blood. It is used in the treatment of cough, urinary disorder, gall stone, obesity, skin diseases, anaemia, and indigestion. Dose: 12 millilitres after food with honey.

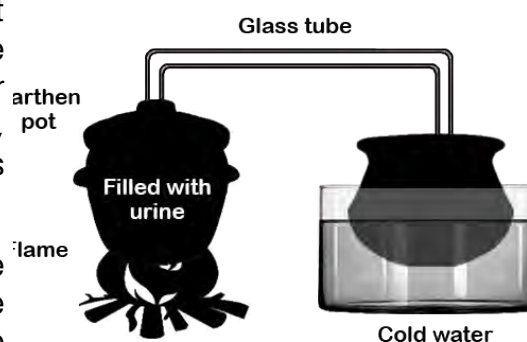
The preparation of gomutra arka is so easy that it can be prepared at home. It does not have any smell. It is more effective when combined with honey and warm water.



Go Ark (Distilled cow urine)

An earthen or iron pot with a cover having tube for vapour outlet is filled with cow urine and put over fire for heating. The vapour, which comes out from this device through the tube, is collected in another pot. This pot is put over cold water, to cool the vapour and let it condense. The water under the pot should be changed regularly to keep the pot and water cool. The tube of device should be transparent, so that the vapour is visible. If smoke starts coming out, reduce flame or fire.

If you use a pressure cooker, remove the whistle part of cooker and attach a tube there. The vapour should be taken through tube to the collection pot.



Gaumutrasav (Fermented preparation)

Ingredients:

Cow urine 10 kg, old organic jaggery 2 kg.

Only an earthen or glass pot must be used. First boil cow urine so that ammonia gas is removed. The odour of cow urine will be removed. Filter it, add jaggery and dissolve. Then boil again. Filter it again. Keep this mixture for 15 days without disturbing.

Then decant the liquid part cautiously from top, without shaking, so that the thick part containing urea remains at the bottom and the decanted liquid part is transparent.

25 ml should be taken twice a day after meals.

Gau Arc Making Machine is also available in the market with an approximate price of

38,000/Piece. The address of company manufacturing Gau Arc making machine is:

Dip Technologies 10-11, Umiya Estate, Near Bharat Party Plot Rabari Colony, Amraiwadi,



Gomutra Ghanwati (tablets)

These are tablets prepared from cow urine. An iron pan is used. Cow urine is boiled until it becomes concentrated. Remove the concentrate from the stove and let it cool. From one kilogram cow urine about 50g concentrate is obtained. The concentrated product will have to be scratched from the pan. Make round tablets of the concentrate. To make the tablets non sticky, burn some dried cow dung, mix with a little water and filter it through a cloth or sieve. Mix the cow dung with the concentrate. Cow dung powder imparts the colour to the tablet. The tablets are packed in plastic bags. The tablets should keep away from sunlight. They are used in case of bronchial asthma, cough and cold, skin disease, hypertension, diabetes, rheumatoid arthritis and cancer. One to two tablets are prescribed by the physician daily.

Adverse effects

Common side effects of urine therapy include diarrhoea, itch, pain, fatigue, soreness of the shoulder and fever. Each episode may last 3-7 days. If one persists however, all the health problems will be addressed.

- Use of gomutra In agriculture

Research in Cow urine shows that its use in fields boosts the annual rye/clover grass yield by causing an increase in nitrogen (N) component of the soil. The effects on yield last 2-3 harvests. When it stops the rye yield decreases. Total Nitrogen content in the cow urine is very high ranging from 6.8 to 21.6 g N/ litre, out of which an average of 69% is urea. Urine increases the potassium concentration of grass and clover. Increased pasture growth from urine patches has also been observed.



- Bioinsecticide/biopesticide nature of cow urine:

Chemical pesticides eliminate even the beneficial carnivorous insects that feed on herbivorous insects (harmful and cause economic loss to farmers by feeding on crop plants). These carnivorous insects are beneficial for the farmers and reduce the pest damage to the crops by eating the herbivorous insects.

The aim of bioinsecticide/biopesticide prepared from cow urine is not to kill insects, but to repel them from our crop plants. The biopesticide prepared should emit bad odour (to drive away the pests from the crop fields) and bitter taste (to avoid worms from eating crop plants).

Herbs or plants selected for preparation of bioinsecticides/biopesticides should be bitter in taste, bad in odour and not consumed by animals. Plants with latex and poisonous plants (tobacco having nicotine and Nux vomica having strychnine) may also be selected.

Some ingredients for the preparation of biopesticide are:

1. Leaves of *Vitex negundo* (*Chinese chastetree, five-leaved chaste tree*)

2. Leaves of *Calotropis gigantea* (*Crown Flower*)
3. Leaves of *Aloe vera* (*Aloe plant*)
4. Leaves of *Azadiracta indica* (*Neem*)
5. Leaves of *Adhatoda vasica* (*Malabar nut*)
6. Leaves of *Jatropha curcus* (*Physic nut*)
7. Leaves and seeds of *Pongamia* (*Indian beech, Pongam oiltree, Karanj*)
8. Leaves and seeds of *Oleander* (*Kaner*)
9. Leaves and unripe fruits of *Nux vomica* (*Poison Nut*)
10. Leaves and unripe fruits of *Annona squamosa* (*Sugar Apple, Custard apple*)
11. Leaves of *Carica papaya* (*Papaya*)
12. Leaves of *Nicotiana tabacum* (*Tobacco*)
13. Leaves of *Lantana camara* (*Raimuniya*)
14. Leaves of *Aegle marmelose* (*Bael*)
15. All parts of *Cissus quadrangularis* (*Hadjod*)
16. Turmeric powder

Preparation:

- Select a minimum of 10 ingredients available and pound 2 kg of each ingredient using mortar.
- Mix it with 30 litres of cow urine and 2 kg of cow dung in a non metallic vessel.
- The contents in the vessel is stirred twice a day and allowed to ferment for 10-15 days.
- Filter the solution and use as foliar spray.

For better rearing of honeybees

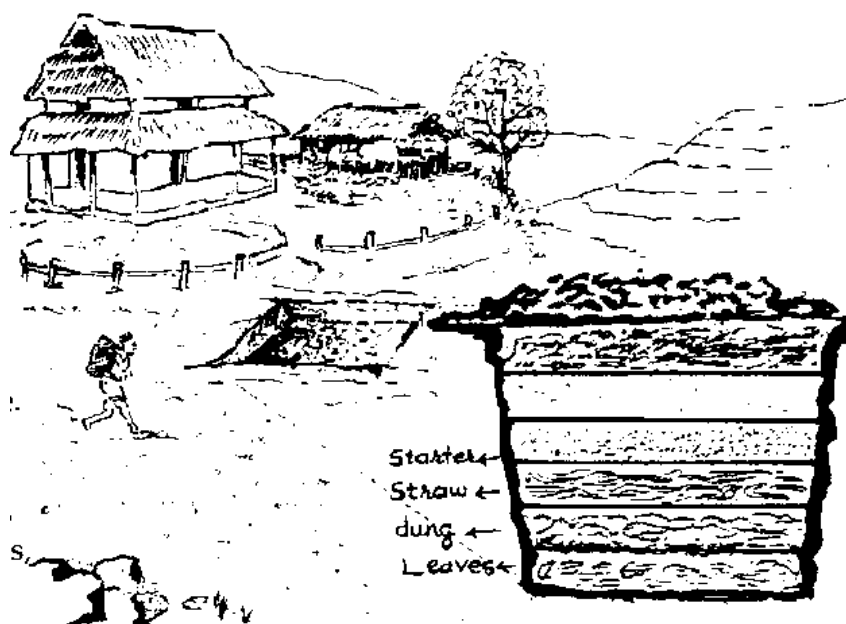
Scientists are using cow urine to save bees from microbial diseases during the rearing process. When cow urine is sprayed on them, it facilitates rapid and holistic recovery in disease infected combs, promotes growth of the brood (egg, larvae and pupa stage of bees), enhances the efficiency of worker bees in the colonies, manages European foulbrood (EFB), a serious, bacterial disease of honeybee brood found throughout the world in honeybee colonies and also indirectly controls mite diseases in colonies.

Organic Manure

Biomass resources such as cow dung and agricultural wastes have been the main energy sources for Indians since the dawn of civilization. Organic manure should be produced in the Gaushalas for sale.

The method of producing organic manure involves digging a pit (360 cm long x 180 cm wide x 90 cm deep) in a shaded area (length can vary according to the volume of waste

materials available). Farm wastes such as straw, vegetable refuse, weeds and leaves are spread to a thickness of 15-20 cm. Wet animal dung is spread over this layer to a thickness of 5 cm. Water is sprinkled to moisten the material (50-60 percent of mass). This procedure is repeated until the whole mass reaches a height of 60 cm above ground. It is then plastered with mud, and anaerobic decomposition commences. In four weeks, the mass becomes reduced and the heap flattens. The mud plaster is removed and the entire mass is turned. Aerobic decomposition commences in at this stage. Water is sprinkled to keep the material moist. The compost is ready for use after four months. Farm yard manure produced contains about 0.32 per cent nitrogen, 0.05 per cent phosphorous (P), 0.25 per cent potassium (K), 1.20 per cent calcium (Ca) and 0.33 per cent magnesium (Mg).



It applied to the fodder fields or where other crops are sown. Partially rotten manure should generally be applied 3 to 4 weeks before sowing the crops. This manure will decompose in moist soil to improve the soil structure and release nutrients contained in it, in the soluble form for growth of the crop.

If it is applied long before sowing the crop, the nutrients are lost by leaching in rain water. The manure should be thoroughly mixed in the soil by deep ploughing and must be applied just before the crop is sown.

Advantages of organic manure

- The compost benefits the soil by recycling nutrients into it.
- It improves the soil structure, texture and aeration along with its water holding capacity.
- It loosens the clayey soil and increases water retention in sandy soil.
- It encourages healthy and abundant root development and plants grow with more resistance to diseases and pests.
- It supplies all essential nutrients and micronutrients.
- It is safe as it does not contain any pathogens, termites, weed, seeds, white grub and no foul smell is present.

- It results in minimum ground water contamination, minimum environmental pollution and reduces time for preparation of soil for sowing the crops

Preparation of Vermicompost

The term vermicomposting means the use of earthworms for composting organic residues. Earthworms can consume practically all kinds of organic matter and they eat their own body weight per day, e.g. 1 kg of worms can consume 1kg of residues every day.



Vermicompost setup.

The excreta (casting) of worms is rich in Nitrate, Phosphorous, Potassium, Calcium and Magnesium. The passage of earthworms through soil further promotes the growth of bacteria and actinomycetes.

Many Gaushalas are earning handsome amounts from sale of vermicompost. Vermicompost should be introduced using breeder worms, a wooden bed and organic wastes.

The bed of desired length and about 75 cm high x 120 cm wide should be used and worms are applied to every part of waste. Other steps which can enhance the process include:

- **Sieving and shredding:** Decomposition can be accelerated by shredding raw material into small pieces and removing large pieces by sieving.
- **Blending:** Carbonaceous substances such as sawdust, paper and straw can be mixed with Nitrogen-rich materials such as sewage sludge, biogas slurry and vegetable scraps to obtain a near optimum Carbon:Nitrogen ratio. A varied mixture of substances produces good quality compost rich in macronutrients and micronutrients.
- **Half digestion:** The raw materials should be kept in piles and the temperature should be allowed to reach 50-55°C. The piles should remain at this temperature for seven to ten days.
- **Maintaining moisture, temperature and pH:** The optimum moisture level for maintaining aerobic conditions is 40-45 percent. Proper moisture and aeration can be maintained by mixing fibrous substances with N-rich materials. The temperature of the piles should be 28-30°C. Higher or lower temperatures reduce the activity of microflora and earthworms. The height of the bed can help control the rise in temperature. The pH of the raw material should not exceed 6.5-7.0.

The excess water, which have leached along with earthworm's extracts, is also collected from the concrete flooring and recirculated. This ensures high Nitrogen content in the

finished product and better quality because of the preserved worm extracts. The steps involved in vermicompost process are:

- Cattle dung is collected from cow shelters/Gaushalas.
- The dung is kept for about 7-10 days in piles (as discussed before)
- Beds/rows of dung and crop residues/leaves, etc. are made about 1.6 m wide, 75 cm high and a distance of 75 cm is kept between two rows.
- In the beds/rows, crop waste such as leaves, straw etc. are layered alternatively with the dung to make a height of about 75 cm. The beds are kept as such for 4-5 days.
- Water is sprinkled to let the compostable matter cool down.
- Earthworms are put on top of the manure row/bed (1 kg worms in a metre-long manure row).
- It is left undisturbed for 2-3 days after covering with banana leaves or husk. Covering with jute bags or sacks is not recommended as it heats the manure bed.
- The bed is opened after 2-3 days. The upper portion of about 10 cm of manure is loosened with the help of a suitable hand tool.
- The bed is covered again. The worms feed on an upper bed of about 10 cm. This portion becomes vermicasted in about 7-10 days.
- This portion (vermicasted manure) is removed and collected near the bed. Another upper portion of 10 cm is loosened and covered again with the leaves.
- Moisture is maintained in the bed by regular sprinkling of water.
- The loosened portion of the manure is vermicasted in another 7-10 days and is removed again.
- Thus, in about 40 days, about 60 cm of the bed is converted into vermicompost and is collected on 3-4 occasions.
- The remaining bed of about 10 cm in height contains earthworm mixed manure.
- Fresh manure mixture/organic residues, etc. are again put on the residual bed containing earthworms of about 10 cm and the composting process is restarted.
- The manure collected from the bed is freed of worms through sieving. Uncomposted or foreign matter is also removed in this way.
- The screened manure is bagged and can be used or sold as required.

The vermicompost production can be enhanced effectively by supplementing organic wastes used for vermicomposting with cow urine. Undiluted urine can be used for moistening organic wastes during the preliminary composting period (before the addition of worms).

After the initiation of worm activity, urine can be diluted with an equal quantity of water. No problems have been observed with daily use of diluted cow urine for moistening the vermicomposting bed. This simple technique can yield vermicompost with a higher N

content. Moreover, worms have been found to become very active and vermicompost can be harvested at least 10 days early.

The compost is ready for use after one month. It is black, granular, lightweight and humus-rich. In order to facilitate the separating of the worms from the compost, watering should cease two to three days before emptying the beds. This forces about 80 percent of the worms to the bottom of the bed. The remaining worms can be removed by hand. The vermicompost is then ready for application.

Some entrepreneurs have made modifications, e.g. making the floor leak proof, and providing a covered shade in order to ensure temperature regulation and protection against accumulation of excessive water in the rainy season. Although this adds to the cost, the improved efficiency of vermicomposting and faster growth of earthworms more than offsets this additional cost.

Biodynamic fertilizer:

Seengh khad: Seengh Khad, also known as cow horn manure is prepared by filling cow's horn with cow dung, and burying it in soil during the cooler months of year i.e. November to February.

Only cow horns should be used and not bull horns. Cow horn differs from a bull horn in that it has a series of rings at the base and has a solid tip. The dung from lactating cows is preferred due to increased calcium content in it. The cow should also be fed with good quality fodder two days before collecting manure for filling the horns to ensure the dung is of good quality.



The horns should be buried in 16-18 inches deep pit and covered with soil that has been enriched with good quality compost. Weeds should not be allowed to grow on the pit as the roots of weed can grow into the cow horn manure preparation. Also avoid contact of trees roots with the buried horns.



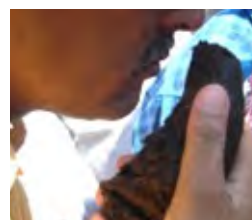
The horns should be buried with open end down to prevent them from becoming water logged if the pit is over watered.

The pit should be kept cool by covering the top of soil with paddy straw and shaded with a low thatching of coconut leaves.



The preparation when ready after 4 months turns into dark humus, and should be sweet smelling.

It should be stored in a cool place and in glazed pots or in glass jars surrounded by damp coir pith as insulation.



It is used in small quantities at the rate of 20 grams

in 10 litres of water per acre after mixing it properly.

It is sprayed up to four times a year. The best times are in October and November and then again in February and March. It is important to apply in the late afternoon.

The stirred preparation can then be sprinkled with a brush/broom over the land.

Larger volume of liquid can also be stirred in a 200 litre drum and applied with a spray nozzle, when the area of application is large.



Benefits

- Strong humus formation
- Increase in all soil bacteria, such as rhizobacter activity (nodulation) on all legumes, eg dals, etc.
- Increase in the mycorrhizal fungi and their hyphae
- Improved crumb structure and resultant improvement in soil
- Earthworm activity is increased
- Absorption and retention of water is greater
- Deep rooting system is developed in all plants
- It will work equally well in any soil type, clays, volcanic, peat, silt or weathered silica

Samadhi khad: Samadhi manure is when a dead cow is buried and the soil is extracted after the monsoon. After removing the bones of dead cows, they can be crushed to spray in the field for calcium support in weaker soils.

Economics of setting up a Vermi-compost unit

Fixed cost incurred

Shovels, spades, crowbars, iron baskets, dung fork, buckets, trowel (10 sets), power operated shredder (2 sets), sieving machine (3 sets), weighing machine of 200 kg (2 sets), bag sealing machine (2 sets), culture tray (20 sets), wheel barrow (5 sets) are required which may cost nearly 1.75 lakhs.

Water and electricity connection

Bore well with submersible pump and installation of electricity may cost ₹ 1.20 lakhs.

Total cost of fixed assets for vermi-vompost unit

₹ 3.00 lakhs

(Including bore well with submersible pump)

Recurring expenditure

A. Depreciation of fixed assets	₹ 0.30 lakhs
B. Salary	
Manager- 1 @ ₹ 15,000 per month	₹ 1.80 lakhs
Clerical staff- 1 @ ₹ 10,000 per month	₹ 1.20 lakhs
Labour- 5 @ ₹ 9,000 per month	₹ 5.40 lakhs
C. Cow feed and health	
Green fodder 20 kg/day/cow X 100 cows (730 MT annually@₹ 2500/ MT)	₹ 18.25 lakhs
Dry fodder 8-10 kg/day/cow X 100 cows (300 MT annually@ ₹ 5000/ MT)	₹ 15.00 lakhs
Health management cost @ ₹ 500 per animal per annum	₹ 0.50 lakh

Operational cost

Earthworm seed required @ 1 kg per m ³	₹ 2.00 lakh
Labour required @ ₹ 8000/month (8 no.)	₹ 7.68 lakh
Cost of bags and marketing	₹ 1.00 lakh
Electricity bills	₹ 1.00 lakh
Total expenditure	₹ 54.13 lakh

Expected income from vermi-compost

Sale of vermi-compost (1,000 MT @ 4,500 ₹/MT)	₹ 45 lakh
Sale of earthworm (5,000 kg @ 200 ₹/MT)	₹ 10 lakh

Total income ₹ 55.00 lakh

Net income ₹ 0.87 lakh

Installation of solar panels

The solar panels are made up of photovoltaic (PV) cells, which convert sunlight into direct current (DC) electricity throughout the day. There is an inverter which converts the DC electricity generated by the solar panels into the alternating current (AC) electricity. The AC electricity is sent from the inverter to electrical panel to power lights and appliances with solar energy. The electrical panel is often called a "breaker box".

The power utilized can be measured by a utility meter. It actually goes backward when system generates more power than immediately required. This excess solar



Stand-alone solar system.

energy offsets the energy you use at night. The power supply will still be connected to the power grid required during night. But the cost is offset by any excess solar energy that is generated and put into the grid during the day.

Solar PV Systems

There are basically two solar PV systems:

1. Stand-alone

Stand-alone solar PV systems work with batteries. These systems are generally used in remote areas without grid supply or with unreliable grid supply. The disadvantage of these systems is that the batteries require replacement once in every 3-5 years.

2. Grid-connected

Grid-connected solar PV systems feed solar energy directly into the building loads without battery storage.

System components

- Solar PV (photo-voltaic) array
- Solar PV array support structure
- Solar grid inverter
- Protection devices
- Cables

Rooftop and installation requirements

The shadow-free area required for installation of a rooftop solar PV system is about 12 metre² per kW (kilowatt). This number includes provision for clearances between solar PV array rows. The solar panels may be installed on the roof of the building with a south facing tilt angle that varies from 1-13 degrees depending on the latitude of the location. Sufficient area shall be available for servicing the system.

The minimum clearance required for cleaning and servicing of the panels is 0.6 metre from the wall and in between rows of panels. In between the rows of solar panels, sufficient gap need to be provided to avoid the shading of a row by an adjacent row. The solar grid inverter shall be placed indoor in a safe and easily accessible place.



Rooftop grid connected solar system.

Solar PV system capacity sizing

The size of a solar PV system depends on the 90% energy consumption of the building and the shade-free rooftop (or other) area available.

- The roof (or elevated structure) area requirement per kW of solar PV modules is about 2 metre².
- The typical average annual energy generation per installed kW of solar PV capacity is 1,500 kwh.

Step 1 Calculate the maximum system capacity on the basis of the shade free rooftop area.

Formula: Capacity = shade-free rooftop area (in square metres) divided by 12.

Example: The shade-free rooftop area is 60 metre².

The maximum solar PV capacity that can be installed on this rooftop area would be $60/12 = 5$ kWp

Step 2 Calculate the system capacity based on annual energy consumption

Formula: Capacity = 90% of annual energy consumption (in kWh) divided by 1,500.

Example: The (estimated) annual energy consumption is 15,000 kwh. The solar PV system capacity based on annual energy consumption would be $(90\% \times 15,000) / 1,500 = 9$ kWp

Recommended Capacity

Take the lowest of the above two capacity calculation results. In this example: 5 kWp

Solar Grid Inverter Capacity

The recommended solar grid inverter capacity in kW shall be in a range of 95-110% of the solar PV array capacity. In the above example, the solar array capacity was calculated to be 5 kW. The solar grid inverter required for this array would be in a range of 4.75-5 kW.

Economics of setting up a solar unit

Approximate cost of various components

S. No.	Description	Cost (₹)
1	Solar panels, 200W	35/W
2	Mounting structure	8000/KW
3	Inverter	50000/KW
4	Cables	2000/KW
5	Battery, 12V/200Ah	12000
6	Combiner box	10000
7	Main junction box	8000
8	Fuses & disconnects	3000
9	Protection switches	500
10	Energy monitoring meter	4000
11	Remote control and monitoring system	200000
12	Transportation and installation	10% of above total
	Total	

Solar Rooftop Calculator (by MNRE)

An online application for calculating solar photovoltaic installation (Grid connected Rooftop) is available on official website of Ministry of New and Renewable Energy.

Your state is UTTAR PRADESH

Average solar irradiation in your state is 1156.39 W / sq.m

1kWp solar rooftop plant will generate 4.6 kWh of electricity per day (considering 5.5 sunshine hours)

1) Enter any one of the following	
<input type="checkbox"/> Total Roof Top Area : % of Roof Top Area available	<input type="text" value="25"/> Sq. m. <input checked="" type="radio"/> Sq. Feet 25 %
<input type="checkbox"/> Capacity you want to install :	<input type="text" value="1"/> Kw
<input type="checkbox"/> Your budget :	<input type="text" value="100000"/> ₹

2) Category of Customer :	<input type="text" value="Residential"/>
3) What is your average Electricity Cost? : Annual Escalation Rate of Conventional Tariff	<input type="text" value="4"/> ₹ / kwh 4 % 4 % (Based on CERC data)

Cost of the solar plant :	<input type="text" value="75000"/> ₹ / kw ₹ 75000/kw (Based on MNRE benchmark)
Subsidy :	<input type="text" value="30"/> % 30 % (Based on MNRE scheme)
Debt-Equity Ratio :	<input type="text" value="70"/> : <input type="text" value="30"/>
Down-payment :	<input type="text" value="22500"/> ₹
Loan amount :	<input type="text" value="52500"/> ₹
Loan Interest Rate :	<input type="text" value="12"/> %
Loan Period :	<input type="text" value="10"/> years
Discount Rate :	<input type="text" value="10.81"/> % 10.81 % (Based on CERC data)

Grants/subsidies from Government

1. MNRE under Jawaharlal Nehru national solar mission provides capital subsidy (Central Financial Assistance) up to 30% for grid connected rooftop and small solar power plant programme. While upto 70 % for special category states like Sikkim, Uttarakhand, Himachal Pradesh, Jammu and Kashmir, Lakshadweep, Andaman

and Nicobar.

Financial support as per below will be available to different categories of beneficiaries:

- i) General category states for all types of beneficiaries: 30% capital subsidy or loan at 5% interest on 80% of the benchmark cost
 - ii) Special category states for domestic and non-commercial categories (not availing accelerated depreciation): 60% capital subsidy or loan at 5% interest on 80% of the benchmark cost. The subsidy can be availed through Programme Administrators only.
 - iii) Special category states for commercial users' category (availing accelerated depreciation): 30% capital subsidy or loan at 5% interest on 80% of the benchmark cost
2. MNRE would provide financial support through a combination of 30 % subsidy and/or 5% interest bearing loans for off-grid and decentralised solar application.

List of Associations in field of Solar endorsed by MNRE

1. National Solar Energy Federation of India (NSEFI)

702, Chiranjeev Tower, Nehru Place, Opp. Eros Hilton Hotel, New Delhi 110003
Email: pranavcreative@gmail.com

2. Indian Solar Manufacturers Association (ISMA)

81/2, 1st Floor, Sri Aurobindo Marg, Near Hero Honda Showroom Adhchini, New Delhi 110 017

3. Solar Energy Society of India (SESI)

2nd Floor, Central Board of Irrigation and Power (CBIP), Malcha Marg, Chanakyapuri New Delhi - 110021 Tel.: +91.11.65649864, 41635200 Tele fax: +91.11.41635200
E-mail: info@sesi.in

Website: <http://www.sesi.in>

4. All India Solar Industries Association (AISIA)

602, Western Edge-I, Western Express Highway, Borivali (East). Mumbai-400066 Maharashtra

5. Confederation of Indian Industry (CII)

Renewable Energy, India Habitat Centre (IHC), Confederation of Indian Industry, CII Central Office, Mantosh Sondhi Centre, 23 Institutional Area, Lodi Road, New Delhi-110003, Delhi, India

Phone: 91-11-246299947 Fax: 91-11-2462 6149

6. Federation of Indian Chambers of Commerce & Industry (FICCI)

Renewable Energy, Federation House Tansen Marg, New Delhi 110001
Phone No.: 23325110 +91 11 23738760-70 (Extn 354)

Email: rita.roychoudhury@ficci.com

7. Solar Thermal Federation of India (STFI)

T-301, Ashoka Mall, 21/2, Bund Garden Road, Opp. Hotel Sun and Sand, Pune 411001 (India) Ph: 020-26166162 Mob. 09890033399

Email: info@stfi.org.in

8. Solar Power Developers Association (SPDA)

T-11, 3rd Floor, Vasant Square Mall, Sector B, Pocket-5 Vasant Kunj, New Delhi-110070 Ph: 09810242969/07065500230/9560999297/8750394442

Email: spda.delhi@gmail.com

9. Karnataka Renewable Energy System Manufacturers Association (KRESMA)

No 4, 80 ft Ring Road, Next to BDA Complex, Nagarabhavi, 2nd Stage, Bangalore-560072 Fax: 080-23188483

10. Rajasthan Solar Association (RSA)

602, Trinita Mall, Swej Farm, New Sanganer Road, Jaipur-302019 Phone-0141-5106602

Other companies for solar energy

1. Tata Power Solar Systems Ltd.
2. EMMVEE
3. Icomm Tele Ltd.
4. Indosolar Ltd.
5. Kotak Urja Pvt Ltd.
6. Moser Baer Solar Ltd (MBSL).
7. Vikram Solar Pvt Ltd.
8. Waaree Energies Ltd.
9. Websol Energy System Ltd.

Biogas/gobar gas plant

Use of cow dung in biogas plant lead to production of biogas which can be used for burning stoves, lamps, diesel engine, etc. and even a biogas operated electricity generators prototype have been developed. Thus biogas can play an important renewable energy source for rural areas.

Biogas production is a clean low carbon technology for conversion of organic wastes into clean renewable biogas and organic manure/fertilizer. It will not only help to overcome the problems associated with domestic LPG gas supply especially rural areas, but also help in maintaining community hygiene and production of quality organic matter for maintaining soil health.

Gaushalas must have a gobar gas plant or biogas plant. Biogas plants may be installed

with desirable capacities. Number of such plants depends upon their capacities and number of animals in the Gaushala. (as discussed on page 49)

Government of India provides subsidies depending upon various parameters. National biogas and manure management programme is a central sector scheme, which provides for setting up of different type of biogas plants.

Economics of setting up a biogas unit

Biogas plants of desirable capacities may be installed. Although, size of biogas plant is determined by the number of animals kept at the Gaushala, which must be at least 50 animals. Proposed capacity of biogas plants based on the number of cows in Gaushala with power generation capacity are as follows:

Sr. No.	No. of Animals	Biogas plant capacity (m ³)	Requirement of dung (kg)	Plant capacity in kW	Cost of biogas plant including 4 years maintenance (in lakhs)
1	50	25	625	03	11.40
2	80	35	875	04	12.30
3	110	45	1125	06	13.25
4	140	60	1500	08	14.40
5	200	85	2125	10	16.30

The units with 200 animals and more may be more economical and viable. If at the cow shelter, more than 200 animals are kept, multiple plants may be installed.

The biogas thus produced may be used as gas for cooking or for the power generation. For 3-20 kw power generating capacity units Government of India provides subsidy limited to ₹ 40,000/kw for power generation and ₹ 20,000/kw eq. for thermal applications which is grossly 40% of the cost of the system or whichever is less, (File No. 25-2/2013-BE dated 26.08.2014 of Ministry of New and Renewable Energy, Government of India).

Various state governments are also providing subsidy for such projects e.g. Government of Uttarakhand is also giving equal amount of subsidy as given by the Government of India. Government of Gujarat provides a financial assistance of 75% of total expenditure for Gobar gas plant, which could be a maximum of ₹ 4.00 lacs.

Companies specialising in setting up and manufacturing biogas equipment

- GGE Power Pvt. Ltd.**
26 / 24 East Patel Nagar, New Delhi, Delhi 110008
Phone: +91 11 25736114, 25817751
- Green Elephant Engineering Pvt. Ltd.**
Bhatia Building, 13, Park Avenue, Aundh, Pune, Maharashtra 411007
Phone: +91 9881090693
- SKG Sangha**
H.No. 532, 2nd Main Road, Kolar, Karnataka 563 101
- Indian Biogas Association**
B-2/ 2392 Vasant Kunj, New Delhi 110 070, India

Ph: +91 9876208843
Email: info@biogas-india.com
Web site: www.biogas-india.com

5. **Era Hydro- Biotech Energy Pvt. Ltd.**

Milind Kulkarni (CEO)

Villa No. 789, S. No. 120/1/1/1, Near Ganraj Mangal Karyalaya, Saikar Complex Lane Baner Mhalunge Road, Baner, High Street, Cummins Road, Pune - 411045, Maharashtra, India

Contact: +91-8079451286, +91-9422078412

Flexible bag like biogas plant

It takes 10-15 days to construct a traditional biogas plant. Bricks, mortar, cement, other supplies are required along with the services of mason. When operational, it can stop working even due to a minor crack or damage, which is main reason for large number of failed plants in India.

An organization named Sustain Earth Energy Solutions has designed pre-fabricated flexible bag like biogas plant, which can be installed without the help of mason. The plant is installed with a device that sends signal to the matn server and service assistance is provided immediately. A family having 2-3 cows or families residing near Gaushalas can cook meals using this biogas plant.



Flexible bag like biogas plant.

Address (Sustain Earth Energy Solutions): 197A, 7th Cross, Kesavayanagunta, Tirupati, Andhra Pradesh, Tirupati, Andhra Pradesh- 517501

Economics for mechanical electricity generation by use of bulls

In the present scenario, cows/bulls if used in the proper manner can help us tide over the current problem of power deficiency. It is very much possible to use the ox power in generating electricity. There have been many attempts at putting similar project to work.

The oxen are paired and made to walk around a circular ramp connected at the centre to a dynamo which generates electricity. A single unit should be of 15 Kva which would need 4 bulls at a single time to do the job and since the ox needs to be given rest, they are used in shifts. A single shift is of 8hrs and we need 3 set of oxen for a single unit to be fully operational.

For one MW of electricity production

1 Mw = 15Kva * 6, therefore we need 6 operational units and since it may take one hour for the required momentum to generate electricity, we may need another 6 additional units and equal number of oxen to have a steady generation. Thus one hour before a shift is completed the standby units start operations.

The economics of one such generator already established in a Gaushala has been discussed below:

Ox-power generator capacity	20 kwh	30 kwh	80 kwh	100 kwh
Electric bill saved every two month (₹)	10,000/-	20,000/-	40,000 to 3,00,000/-	3,50,000/-
Running hours	8	16	16	16
Cost (₹)	4,00,000/-	6,00,000/-	12,00,000/-	18,00,000/-
OX Required for two shift	4	16	32	40
Battery Required + 200 amph x 24 Volt	6	14	20	30
Maintenance (₹)	400/-	1600/-	3200/-	4000/-
Labour required @ ₹ 350/- day	(1) 350	(3) 1050	(6) 2100	(7) 2450
Dung & urine collected per day (₹)	200	800	1600	2000
Electricity generated in 16 hrs.	160 units	480 units	1280 units	1600 units
Maintenance of Ox-power unit per day (₹)	50/-	100/-	100/-	100/-
Net profit per day (₹)	520/-	1410/-	5260/-	6750/-
Payback	36 months	24 months	14 months	14 months
Space Required	6400 Sq. ft.	6400 Sq. ft.	6400 Sq. ft.	6400 Sq. ft.
Manufacturing Time	60 days	60 days	60 days	60 days
Installation Time	1 month	1 month	1 month	1 month
Payment	90% advance + 10% at delivery	90% advance + 10% at delivery	90% advance + 10% at delivery	90% advance + 10% at delivery
Service	1 year free	1 year free	1 year free	1 year free
Guarantee of plant	5 years	5 years	5 years	5 years
Cow Shed	₹ 96,000/-	₹ 4,00,000/-	₹ 7,68,000/-	₹ 9,60,000/-
Total Investment	₹ 5,00,000	₹ 10,00,000	₹ 20,00,000	₹ 28,00,000

Cow sheds would be available in Gaushalas. Still their cost may be deducted from the total investment.

Total area of the cattle shed	: 6400 feet ²
Total covered area	: 2134 feet ²
Total open area	: 4266 feet ²
Cost of concrete grooved floor @ ₹ 36/ feet ²	: 6400 X 36= ₹ 2,30,400
Cost of roofing covered area with asbestos cement sheet @ ₹ 140/ feet ²	: 2134 X 15= ₹ 32,010
Miscellaneous cost for covered area @ ₹ 140/ feet ²	: 2134 X 140= ₹ 2,98,760
Miscellaneous cost for open area @ ₹ 40/ feet ²	: 4266 X 40= ₹ 1,70,640
Total cost of shed	: ₹ 7,31,810.

Benefits of the project

Benefits from the project

Electricity 24/7

Generation and supply of electricity without any hindrance without disturbing or damaging the environment. The supply can be done continuously as standby units start operation in a shift basis. There is no dependence or influence on any seasonal or climatic conditions, such as clouds, rains or floods. Ox Power Electricity Generator can solve the power crisis of the area to an extent.



Employment

The project will generate employment directly and indirectly. There is direct requirement of labourers to take care of the oxen and cows, to operate the units, maintenance of units etc. To grow fodder for these animals' people will also get indirect employment.

Low cost manure production

Use of high priced fertilizer and pesticides as external inputs for intensive agriculture raises the cost of production along with having a negative impact on soil.

Alternate organic farming practices to restore soil back to health and reduce cost of production is gaining popularity in various regions of India.

One such practice is manufacture and use of liquid manure from cow dung and cow urine. The only major investment for this liquid manure manufacturing technology is purchase of a plastic barrel costing ₹ 800/- only and rest of the inputs can be sourced from a Gaushala.



Requirements

- 200 litre plastic barrel
- 3 plastic gate valves
- Fresh desi cow dung and urine
- 1 kg jaggery

- Decomposed fruits, vegetables or any vegetable matter
- Thin piece of cloth

Method:

- 1) Mix 10 parts of water with one part of cow dung and urine and allow it to ferment for a day.
- 2) Add one kg jaggery next day along with decomposed fruits, vegetables or any vegetative matter available in Gaushala.
- 3) Leave the solution undisturbed after covering it with thin piece of cloth to prevent mosquitoes or other insects from laying eggs.
- 4) After a week the solution can be used by opening the valve at the top allowing fermented liquid to flow freely along with irrigated water or through drip irrigation.

Precautions:

Use only cow dung and urine of indigenous cows because microbial activity is more in indigenous cows as compared to crossbred cows.

Water must be cleaned and sediments should be allowed to wash out by opening the valve at the back every 20-25 days.

Benefits:

- By adopting this technique a farmer can save ₹ 4,000-20,000 per hectare
- It increases water holding capacity of soil and improves the beneficial micro-organisms in the soil.

Production of Panchgavya Products

Ayurveda has been very successful in proving the utility of Panchgavya (Cow dung, urine, milk, curd, ghee and buttermilk) in agriculture and human health, animal health, as renewable energy source and preparation of utility products.

Panchgavya contains macronutrients like nitrogen, phosphorus, potassium, 13 essential micronutrients necessary for plants, many vitamins, essential amino acids, growth promoters like 3-Indole acetic acid (IAA), Gibberellic acid (GA) and beneficial microorganisms like azospirillum, azotobactor, phosphobacteria and pseudomonas. It also contains useful fungi and actinomycetes.

The 5 entities classified under Panchagavya are:

1. Gomutra (Cow Urine)
2. Goghrita (Ghee)
3. Godadhi (Curd)
4. Gomaya (Cow Dung)
5. Godugdha (Cow Milk)

Panchagavya Chikitsa has not only proved to be helpful in treating humans, it plays an

important role in veterinary medicine too.

Traditional treatment claims of panchgavya

Sr.No.	Milk	Urine	Ghee	Curd	Dung
1	Psychosomatic Disorders	Skin Diseases	Fever	Fever	Skin Diseases
2	Constipation	Leucodermia	Constipation	Oedema	Cough
3	Anaemia	GI diseases	Anorexia	Blood disorders	Asthma
4	Piles	Piles	Skin disorders	Piles	Arthritis
5	Diarrhoea	Asthama	Epilepsy	Rhinitis	-
6	Ulcers	Anaemia	Dementia	Anorexia	-
7	GI diseases	Jaundice	Ophthalmic diseases	Jaundice	-
8	-	Urinary Tract infections	Tuberculosis	-	-

Panchagavya combination

The combination of Godugdha (cow milk), Godadhi (curd), Goghrita (cow ghee), Gomutra (cow urine) and Gomaya (cow-dung) in equal quantities is called "Panchagavya".

It is beneficial in the following diseases:

1. Epilepsy
2. Swelling
3. Fever
4. Jaundice
5. Cough
6. Tuberculosis
7. Leprosy
8. Skin diseases
9. Anaemia
10. Skin, bone and muscle disorders



Panchagavya combination.

Dose: 5-10 ml or as prescribed by the physician.

Mode of Administration: Milk, lukewarm water

The Panchagavya (Milk, Curd, Ghee, Urine, Dung) which are obtained from the cow is used for the production of medicines, manure, pesticides, dhoop, tooth powder, soaps etc.

Panchgavya for plants

Panchgavya acts as a pest repellent, improves quality and fertility of soil by nourishing it and used in treating plant diseases. It also helps in excluding use of synthetic inputs such as fertilizers, pesticides, hormones, etc. Panchagavya suited to various agricultural and horticultural crops, has been standardized as given below. The cost of production is around ₹ 25/Litre.

If the volume is more the cost can be further reduced. By using the below specified quantity of ingredients, 20 litres of Panchagavya can be obtained.

Ingredients for making Panchagavya for plants

1. Fresh cow dung	5 Kg
2. Cow's urine	3 Lt
3. Cow's milk	2 Lt
4. Cow's curd	2 Lt
5. Cow's ghee	1 Kg
6. Sugarcane juice	3 Lt
7. Tender coconut water	3 Lt
8. Banana (ripe)	12 Nos.
9. Toddy or grape juice	2 Lt

Preparation method:

For preparing Panchagavya, a wide mouthed mud pot, concrete tank or plastic drum is required. Metal containers should not be used. First, put the fresh cow dung and cow's ghee into the container and mix it thoroughly twice for 3 days. On the fourth day add the rest of the ingredients and stir it twice daily for 15 days.

The Panchagavya stock solution will be ready after the 18th day. It should be kept in the shade and covered with a wire mesh or plastic mosquito net to prevent houseflies from laying eggs and formation of maggots (worms) in the solution. If sugarcane juice is not available, add 500 grams of jaggery dissolved in 3 litres of water.

Likewise, if toddy is not available, add 100 grams of yeast powder and 100 grams of jaggery to 2 litres of warm water. After 30 minutes, add this solution to replace toddy in Panchagavya.

If stirred twice daily, the Panchagavya solution can be kept for 6 months without any deterioration in its quality. Solution becomes thick due to evaporation of water over a long period. Suitable quantity of water can be added to keep it in a liquid state

Application method:

Spray system: Three per cent 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 sprayer of 10 litres capacity may need 300ml of Panchagavya. When sprayed with power sprayer, sediments are to be filtered

and when sprayed with hand-operated sprayers a nozzle with higher pore size is to be used.

Flow system: The solution of Panchagavya can be mixed with irrigation water at 20 litres/acre either through drip irrigation or flow irrigation.

Seed/Seeding treatment: Three per cent solution of Panchagavya can be used to drench the seeds, soak or dip the seedlings before planting. 20 minutes soaking is sufficient. Rhizomes of turmeric, ginger and cuttings of sugarcane can be soaked for 30 minutes before planting.

Seed storage: The 3% Panchagavya solution can be used to dip the seeds before drying and storing them.

Periodicity of Application

Pre-flower phase (20 days after planting)-	Once in 15 days (two sprays depending upon duration of the crops)
Flowering and pod-setting stage-	Once in 10 days, (two sprays)
Fruit/pod maturation stage-	Once during pod maturation

General effects:

Plants sprayed with Panchgavya produce bigger leaves and have bigger canopy, rooting is profuse and dense, higher yield with improved taste and enhanced shelf life of vegetables, fruits and grains.

Beneficial effects on commercial crops

Mango

Induces dense flowering with more female flowers.

Irregular or alternative bearing habit stops and the tree continues to fruit regularly.

Enhances keeping quality of mango by 12 days at room temperature.

Flavour and aroma of the mango is extraordinary.

Lemon

Continuous flowering is ensured round the year.

Plump fruits with strong aroma.

Shelf life is extended by over 10 days.

Guava:

Shelf life extended by 5 days.

Banana

In addition to adding with irrigation water and spraying, a 100 ml of the 3 percent solution is tied up at the navel end of the bunch after the flower is removed. The bunch size becomes uniform. The fruits split faster due to faster growth of pulp.

Harvesting can be done one month earlier.

Turmeric

Enhances the yield by 22 per cent.

Extra long fingers.

Ensures low drying loss.

Helps survival of dragon fly, slugs, spiders 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 budworm.

Continuous flowering throughout the year.

Vegetables

Yield enhancement by 18 per cent, 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.

Paddy

Heavy tillering (production of side shoots).

300 grains per ear head.

No chaffy grains.

The harvest is advanced by 15 days.

Percentage of broken rice is reduced during milling.

Grain weight is higher by 20%

The cooked rice remains edible on the next day.

Panchagavya was investigated on sugarcane, gingelly, groundnut, mustard, jowar, bajra, ragi, makka (corn), wheat, sunflower and coconut. In all the above crops, Panchagavya acted as a growth stimulant (75%) and disease pest inhibitor (25%).

General effects of panchagavya on plants

- **Leaf:** PPlants 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 growth into deeper layers was also observed. All such root parameters 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 economic gain and liberates the organic farmers from loans.

- **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 the plants to withstand long dry periods. Both the above factors contribute to reduce the irrigation water requirement by 30% and to ensure drought hardiness.

Other preparations for farmers:

These eco-friendly products can be prepared by the Gaushala on order by local farmers and sold.

1. **Amritpani (Soil Health Improver)**

Contents:

The ingredients are

1. Urine of indigenous cow- 20 litres.
2. Cow Dung- 20 Kg.
3. Jaggery- 250 gm.

Preparation Method

The above ingredients are mixed in a big earthen or cement vessel and kept after mixing for 7-10 days. (In humid and hot atmosphere Amritpani gets ready in 7-8 days (bubbles can be seen on top))

Application

Take one litre of above prepared 'Amritpani' in 200 litres water and sprinkle over the crops. It is sufficient for one-acre land. It can also be dripped in roots.

Properties

It is crop-preservative, pest repellent, antibacterial, fungicidal. It helps in the growth of plants. It is useful for all crops, vegetables, fruits etc. It is also useful for saplings of flowers.

Precautions

1. Gomutra must be fresh.
2. Vessels for collection of Gomutra and preparation of Amritpani must be clean.

2. Kamdhenu keetnivantrak (Pest repellent)

Contents

The ingredients are

1. Urine of indigenous Cow- 10 Litres
2. Leaves of Neem- 2.5 kg.

Preparation method

2.5 kg Neem Leaves are to be mixed in 10 litres of gomutra in an earthen pot

Application

One litre of Kamdhenu Keetnivantrak is to be mixed with 100 litres of water for spraying on crops. Maximum 5 litres of Keetnivantrak is mixed in hundred litres of water. Spraying on crops is done twice a month or as per requirement.

Properties

Pest repellent, fungicidal, bactericidal, eco-friendly and harmless to human beings.

Useful on all types of crops, green vegetable, fruits, saplings of flowers etc. It can be dripped for roots also. It increases the immunity and vegetation grows faster.

Kamdhenu

The ingredients are:

Cow urine 10 litres

Neem leaves 2.5 kg

Earthen pot

Copper pot

Preparation

2.5 kg of fresh neem leaves are mixed with 10 litres of cow urine in an earthen pot. The pot is buried in soil for 21 days. It is then taken out and the cow urine and neem leaves mixed thoroughly and poured into a copper pot. This pot is then cooked till its volume is one fourth of the original.

Properties: Used for management of sucking pests and viral diseases. Mix one litre of formula in 100 litres of water. Spray twice a month.

3. Bijamrita (Seed treatment formula)

Contents

1. Water- 20 litre
2. Local cow dung- 5 kg
3. Local cow urine- 5 litre
4. Lime- 50 gram

Preparation method

Take 5 kg cow dung in a cloth, make it into a bundle and tape the bundle. Hang this in 20litre water up to 12 hours.



Then next morning, squeeze this bundle of the cow dung in that water thrice continuously, so that the essence of cow dung accumulates in that water.



Add a handful of clean soil in the water solution and stir well.



Take one litre water and add 50 gm lime juice, let it settle for a night.



Add 5 litre desi cow urine in the solution, add lime water and stir well.



Now Bijamrita is ready to treat the seeds.

Application

Add Bijamrita on the spread seeds of any crops by hand, dry the seeds well and use for sowing.

Properties



Bijamrita is a substitute for fungicides and medicines for seed treatment

4. Jiwamrita (Microbial culture)

Contents

1. Water- 200 litre
2. Local cow dung- 10 kg
3. Cow urine- 5 to 10 litre
4. Jaggery- 2 kg
5. Pulses flour (dal ka atta)- 2 kg

Preparation method

Add 10 kg local cow dung and 5 to 10 litre. cow urine in the water.

Add 2 kg Jaggery, 2 kg pulses flour and handful of rich soil in it.

Stir the solution well and leave it to ferment for 48 hours in the shade.

After 48 hours Jiwamrita is ready for application.

Application

Apply the Jiwamrita to the crops with irrigation water or directly to the crops.

Jiwamrita spray: Spray 10% (10 litre Jiwamrita in 100 litres of water) filtered Jiwamrita on the crops.



5. Ghan-Jiwamrita

Contents:

1. Local cow dung- 100 kg
2. Jaggery- 2 kg
3. Pulses flour- 2 kg

Preparation method

Take 100 kg local cow dung, 2 kg Jaggery, 2 kg pulses



flour and handful of soil in a container.

Mix well by adding small amount of cow urine.

Spread and keep it in the shade for drying.

Make its powder by hand

Application

Apply to the crops in the proportion of 10 kg Ghan Jiwamrita in 100 kg farmyard manure.



6. Agniastra (Pesticide)

Contents:

1. Local cow urine- 10 litre
2. Tobacco- 1 kg
3. Green chili- 500 gram
4. Local garlic- 500 gram
5. Neem leave pulp- 5 kg



Preparation method

Take a pot and put 10 litre cow urine in it.

Add 1 kg tobacco by crushing it in the urine.

Crush 500 gram of green chili and add to the mixture.



Crush 500gram garlic and add it to the mixture.

Add 5 kg neem leaf pulp.



Boil this solution well for 5 minutes continuously.

Application

Let this solution ferment for 24 Hrs. After filtering it by cloth, this can be sprayed as pesticide.



Properties

Agniastra acts on the pests like leaf roller, stem borer, fruit borer, pod borer.

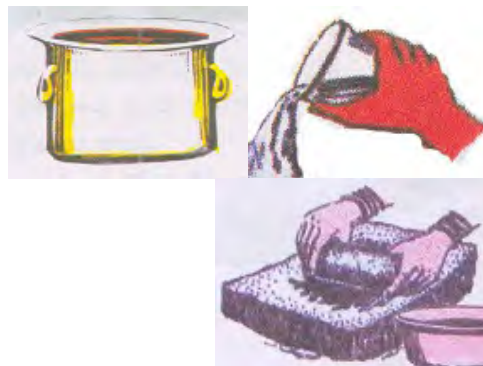
7. Bramhastra (Pesticide)

Contents

- Local cow urine- 10 litre
- Neem leaves- 3 Kg



- Pulps of Sitafal (custard apple) leaves- 2 Kg
- Pulps of Papaya leaves- 2 kg
- Pomegranate leaves pulp- 2 kg
- Guava leaves pulps-2 kg
- Lantana camara leaves pulp- 2 kg
- White Dhatura leaves pulp- 2 kg



Preparation method

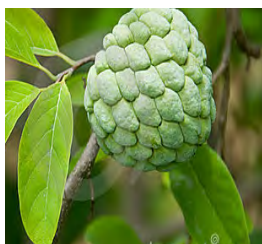
Take a pot and put 10 litre local cow urine in it.

Crush 3 Kg of neem leaves and add this neem pulp in this water.

Then Add 2 Kg pulps of Sitafal (custard apple) leaves, 2 kg pulp of Papaya leaves, 2 kg Pomegranate leaves pulp, 2 kg of Guava (Peru) leaf pulp, 2 kg *Lantana camara* leaf pulp and 2 kg white Dhatura leaf pulp in it. (Use *Lantana camera* and Dhatura leaves if available).



Neem leaves



Custard Apple



Papaya leaves



Pomegranate leaves



Gauva leaves



Lantana camara leaves



White dhatura leaves

Boil this solution for 5 minutes.

Filter this solution by cloth. Let this solution ferment for 24 Hrs.



Application

For spraying, mix 2 litre Bramhastra in 100 litre water.

Properties

Spray this medicine on the trees to control all the sucking pests, pod borer, fruit borer etc.



8. Neemastra (Pesticide)

Content:

- Local cow urine- 5 litre
- Local cow dung- 5 kg
- Neem leaves- 5 kg

Preparation method

Take 100 litre water and put 5 litre local cow urine in it. Add 5 kg local cow dung.



Crush 5 kg of neem leaves and put this neem pulp in this water. Let this solution ferment for 24 hrs. Stir this solution twice a day with a stick and filter through a cloth.



Application and properties

Spray this Neemastra on plants to get rid of sucking pests and mealy bug.

Cowdung or Gobar known also as Gomaya is a rich fertilizer, an efficient fuel and biogas producer, a useful building material, a raw material for paper making, an insect repellent and a disinfectant.



Gomaya dung cakes.

Gomaya or gomaya household remedies

Apart from various medicinal preparations using cow-dung as mentioned before, cow-dung can be used as household remedy too. Its uses are as follows:

1. For purifying environment, dhoopan etc., gomaya is very useful. From ancient times gomaya is used in homes for application on the floors. It absorbs the ultraviolet rays and protects us from the ultraviolet rays. Therefore, application of Gomaya in homes or outside keeps the environment healthy and protects us from the harsh U-V rays.

2. In Asthma, Gomaya swarasa (juice) is used in the form of nasya i.e. adding 2-2 drops in the nostrils.
3. In epistaxis, mere smelling Gomaya stops the bleeding at once.
4. Gomaya is rich in vitamin B₁₂. Hence, in Vitamin B₁₂ deficiency Gomaya can be beneficial.
5. In case of diarrhoea, drinking Gomaya extract is beneficial.
6. In various teeth disorders, Gomaya is used in the form of ash for brushing the teeth.
7. Gomaya is an easily available germ-killer.

Godugdha (Milk)

Superiority of cow milk over milk of other species: the A₁ Vs A₂ milk story

Milk is divided into A1 and A2. A1 milk is given by exotic or mixed breeds and has been linked to autism and diabetes Type-1 in children. It was found that a chemical substance called Beta Casein Morphine 7 (BCM7) separates out during digestion of dairy milk. BCM7 being a member of morphine family has also been associated with Alzheimers, Cancer, Diabetes, Heart trouble etc.

The milk of Bos indicus, the Indian cow is found to be free of BCM7. A2 milk is now being sold across the country in NZ, Australia, Japan and Korea and in USA.



Godugdha

Godadhi (Curd)

Indications

Curd improves Agni, Abhishyandi (obstructive), helps in easy excretion of mutra. Should be consumed along with sugar or salt, not plain

Consumption of fresh curd is beneficial in the following:

1. Aruchi
2. Allergic disorders
3. Malaria



Godugdha (Curd)

4. Piles
5. Bleeding disorders
6. Anaemia
7. Weakness
8. Insomnia

Contra-indications

1. Obesity
2. Amavata
3. Skin diseases
4. Bleeding
5. Ulcers
6. At Night

Gotakra (Buttermilk, Whey)

Procedure

1 litre fresh curd should be taken. Add 4 times (4 Litre) water and mix until butter is extracted. When butter begins to gather on top, add lukewarm water to it. Mix thoroughly again. When the butter has completely gathered and can be differentiated from the liquid part, separate it from it. This buttermilk is fat-free and beneficial.



Gotakra (Buttermilk, Whey)

Mode of Administration

100-250 ml by adding sendha (Rock salt), jeera (Cumin) powder or adrak (Ginger) according to taste.

Indications

Gotakra increases taste, stimulates digestive fire and is beneficial in stomach disorders.

The use of Gotakra is beneficial in the following:

- | | |
|-------------------------------|----------------------------------|
| 1. Diarrhoea | 2. Diarrhoea associated with Aam |
| 3. Anaemia | 4. Jaundice |
| 5. Diabetes | 6. Celiac Disease |
| 7. Malaria | 8. Obesity |
| 9. Poisoning (gara visha) | 10. Stomach Disorders |
| 11. Aruchi (absence of taste) | 12. Vomiting |
| 13. Excessive salivation | 14. Piles |

For preparing buttermilk, fresh curd should always be used. If gotakra is consumed after meals along with rock salt and cumin powder, it improves digestive action and helps in the cure of diseases related to it.

Contra-indications

1. Accidental wounds and injuries
2. Weakness during autumn and summer season
3. Giddiness
4. Heat Stroke
5. Bleeding Disorders

Godadhi/Gotakra- Household Remedies

1. Pimples: Curd 4 teaspoons and 500 mg/0.5g tankan powder (special Ayurvedic powder prepared from Borax) should be mixed and applied on acne, pimples etc. It gives immediate relief.
2. Cold and Cough: If 4 black peppers and 100 g curd are consumed for 1 month, recurrent cold & cough is cured.
3. During pregnancy, curd that is stored in silver vessel is the best for normal delivery. This curd is beneficial in Uterine bleeding as well as in premature delivery.
4. Application of curd on hair kills lice.
5. Regular consumption of butter milk is very beneficial in piles.

Goghrita (Ghee)

Indications

Cow ghee increases intelligence and memory power, increases digestive fire, body strength, semen, beneficial for eyes, children and elderly people. It also improves complexion.

It is beneficial in the following:

1. In weakness that arises due to long-standing fever, a teaspoonful of ghee should be consumed every morning and evening with milk.
2. Constipation
3. Epistaxis
4. Anorexia
5. Unconsciousness
6. long-standing cough
7. Massage of Goghrita should be done for 10 minutes on the soles of the feet in case of loss of sleep.
8. Skin diseases

9. Dementia, Epilepsy

Properties of Old Ghee

Old Ghee alleviates all the 3 doshas (Vata, Pine, Kapha), psychological disorders, ear, eye disorders, head-ache, Asthma, Fever, Cough etc.

Dose- 1 Teaspoon

It should be consumed with lukewarm water/Milk

Goghrita- Household remedies

- 1) In various Vata disorders, ghee is used for massage except in Rheumatoid Arthritis.
- 2) If Nasya of cow's ghee is done (warm ghee administered in nostrils, 2-2 drops), it cures various diseases. It increases the power of sense organs.
- 3) If melted ghee is administered in quantity of 2-4 drops in the nostrils, various disorders like hair fall, greying of hair, headache are cured. To be practiced for 45 days.
- 4) Allergic Rhinitis-Consumption of ghee is very beneficial. 1 teaspoonful ghee with hot water, 2 times a day.
- 5) In Body-ache or heaviness of body due to weakness, muscle laxity, disability of body (difficulty in sitting, standing, walking) massage of ghee after surgical procedures improves strength.
- 6) Goghrita increases intelligence, grasping power. It should be consumed in a dose of 1 teaspoon full daily. It induces good sleep.
- 7) Application of ghee on various types of wounds (Ulcers or burns), hastens healing and reduces burning sensation.
- 8) In Cardiac Disorders, the ghee of an Indian Cow should be used to cook food in.
- 9) In chronic fever, Goghrita 2 tea spoon full ghee + Rock Salt + Lemon juice increases appetite and improves digestion.

Household Products and their Procedure for Preparation

1. Mosquito coil (Repellent)

Mosquito repellent coils can be prepared by using neem leaves and cow dung. These are very effective, cheap and keep the environment pleasant and health friendly.

Ingredients

1. Leaves from old Neem tree
2. Black mustard seeds (100 gm)
3. Black salt (100 gm)
4. Cow dung

Procedure



Mosquito coil (Repellent)

Dry the neem leaves under sunlight and make 100 g powder.

Also make fine powder from mustard seeds (100 g) and black salt (100g).

Mix them thoroughly and store in a container, away from humidity and direct sun light.

Prepare cakes with cow dung and let them dry. Break these dry cakes into small pieces and burn them in a vessel.

Once they start emitting smoke, place it in the middle of house and close all doors and windows.

Add small amounts of above mixed powders to these burning cakes.

Dried powder of Uttareni (*Achyranthes Aspera*) leaves, turmeric powder, basil or tulsi leaves, sugar-apple (*Annona squamosa*) leaves, Bael (*Aegle marmelos*) leaves can also be added to eliminate mosquitoes and other insects effectively. Ajowain, Lemon Grass (*Cymbopogon*) Oil and Peppermint (*Mentha × piperita*, *Mentha balsamea* Wild) oil can also be used.

Uses

This smoke will kill all mosquitoes and their eggs. It is good for humans to breathe this smoke as it eliminates many common diseases like cold, cough, headaches etc.

2. Dhoop Batti

It is made from Havan Samagri, which includes cow-dung and herbs.

Ingredients

1. 1800 gm of Havan Samagri
2. 200 gm of maida powder
3. 500 gm of fresh cow dung
4. 1.8 litre of water



Procedure

- Mix Havan Samagri and maida powder well.
- Put cow dung in water and dissolve it well.
- Add cow dung solution in the powder after sieving it.
- Mix them well for half an hour to 45 minute.

Uses: They are used for air purification and acts also as mosquito repellent.

3. Face pack

Time taken to prepare: 1 day

Ingredients

Dhoop Batti

- 1) 150 gms Desi Gobar
- 2) 150 gms Swarna Gairika (Ochre/Sona Geru)
- 3) 500 gms Multani Mitti (Fuller's earth)
- 4) No. 85 sieve
- 5) 50 gms Shatawari (*Asparagus racemosus*) Churn
- 6) 80 gms Vacha (*Acorus calamus*) Churn
- 7) 20 gms Kapurkachri (*Hedychium spicatum*)
- 8) 80 gms Haldi (*Curcuma longa*) churn
- 9) 50 gms Haritaki (*Terminalia chebula*) churn
- 10) 40 mL Rose perfume

Procedure

- 1) Mix Swarna Geru, Multani mitti and Cow dung and add water in it.
- 2) Make a semi-liquid paste and dry it in the sun.
- 3) After drying, make a fine powder of it by grinding it.
- 4) Sieve them and add Satwari churn, Vacha Churn, Kapurkachri, Haldi churn and Haritki churn.

Indications to use:

Take one teaspoon full of pack. Add double the amount of cow milk/rose water/water and apply it on the face. Wash it with warm water after drying.

Benefits

- Effective on pimples and acne.
- Cures all types of skin diseases.
- Removes wrinkles.
- Improves lusture and tone of the skin.

3. Multani mitti soap

It consists of cow-dung, multani mitti and herbs

Time taken to prepare: 3 days

Ingredients

1. 800 ml gaumutra ark
2. 1 litre water
3. 500 gm caustic soda
4. 3 kg multani mitti



Multani Mitti soap

5. 2100 gm coconut oil
6. 1000 gm mustard oil
7. 50 gm desi ghee
8. 50 gm sandalwood oil

Procedure

Mix Gaumutra arka, water and caustic soda and keep for a day.

Mix coconut oil, mustard oil and desi ghee. Add the previously kept solution in it.

Keep them in a tray with plastic sheet in it. One-day storage for saponification is enough.

Take multani mitti and sandalwood oil in a tub. Mix the soap wax with it .

Measure them and make soap in a mould.

Note:

All the ingredients are to be mixed well to avoid any kind of disintegration.

Benefits

- Cures any skin related disease.
- Keeps the skin healthy and smooth.
- Removes any blemishes or acnes.

Another method of making soap

Ingredients required

Frozen desi cow milk- 100 gm

Turmeric powder (Haldi)- 5 gm

Coconut oil- 100 gm

Caustic soda- 25 gm

Perfume

Method of preparation

Put caustic soda onto the frozen desi cow milk and mix. The milk will melt in a few minutes.

Put Turmeric powder (Haldi) into the coconut oil and mix.

Put a few drops of fragrance into the oil mixture. Put milk and oil into a deep steel container and mix with an electric handled mixer.

Pour the uniform preparation into mould which can be a ceramic cup. Keep it in a fridge for one day and use.

Crushed and boiled neem leaves may also be added.

Precautions

Do not use aluminium cup for moulding.

4. Gaunyle (floor cleaner)

Due to cow-urine's anti-fungal and anti-bacterial properties, it is used to make natural floor cleaner along with neem ark and pine oil.

Time taken to prepare: 2 days

Ingredients

1. 1 litre gaumutra
2. 200 g neem leaves
3. 1 litre pine oil
4. 100 g emulsifier



Procedure

First, boil 1 litre of gaumutra with 200 g of neem leaves till it becomes 250 ml. This solution has to be kept for 6 hours and turns into Neem kadha.

Mix 100 ml of pine oil solution and add 875 ml of distilled water is added. Next, put 25 ml of neem kada in it and mix well after adding emulsifier.

Benefits

- Effectively cleans the floor.
- Eco-friendly.
- Gaumutra being anti-bacterial and anti-fungal, kills germs.

5. Logs and pots

Conventionally firewood, electricity or LPG gas is used for human cremation all over the world. Compared to wood and other alternatives, cremation using cow dung logs cost less. This has led to the increased demand of cow dung logs but due to difficulty in manufacturing long logs, availability remains a problem. This opportunity of innovation inspired many firms to develop a machine that makes long cow-dung logs with minimum manual intervention. Cow dung log making machines are manufactured and supplied at reasonable prices.

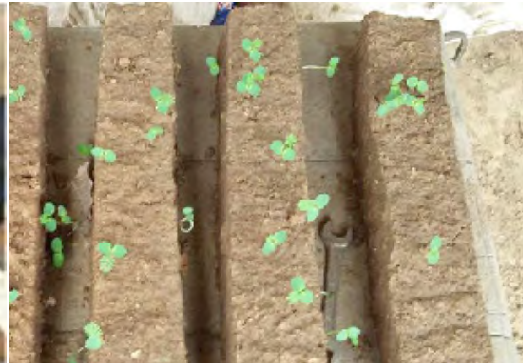
A combination of dung and straw (or any agro waste/harvested crop residues) is fed into the hopper of the machine. Screw mechanism is provided in the machine, which helps in mixing raw materials thoroughly, compress it and extrude out. By using different sizes of dye, logs of different shapes and sizes can be made easily.

Logs are then put under the sunlight to dry out the moisture inside them, making them hard and sturdy. Similarly, pots of varied sizes can be manufactured by installation of the pot specific machines.

Salient features

Helps in cow dung/animal waste management in Gaushala by making value added products there by supplementing the income of Gaushalas.

Cow dung log making machine can be operated on electricity (1 hp motor) or even manually.



The machine is easy to operate, requires little maintenance and no hard labour. Even women can efficiently operate it.

Throughout the length of the log, a cylindrical hole in the centre is provided to facilitate easy drying and efficient combustion

Size of logs can also be increased or decreased as per requirement for various applications

The machines available are capable of making one log per minute and 50 to 60 logs per hour (3 x 3 inches, 3 feet long). Logs can also be cut into small pieces for use in "Chulla" and 'Havan" purpose.



An innovative machine for making cow dung logs for eco-friendly cremation.

Slurry from biogas can also be used for making logs by mixing it with straw or any other harvested crop residues.

It is an eco-friendly application saving the forest trees and better utilization of the agro waste. Logs can be sold to all village cremation grounds.

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Flower pots

Another machine by the same maker exists to make flowerpots of different sizes. These can be offered commercially and sold to the Forest Department for their nurseries. The Forest Department usually buys black plastic to grow their trees in. These are expensive, but even worse, are usually planted along with the plastic by careless forest labour resulting in 100% mortality. The pots give nutrition to the plants, withstand the rain and irrigation and can be planted in the soil along with the plants.

The logs and pot making machines with approximate price of ₹ 25,000 and ₹ 35,000/piece can be purchased from:

Dip Technologies 10-11, Umiya Estate, Near Bharat Party Plot Rabari Colony, Amraiwadi, Ahmedabad, Gujarat-380026

08048018796

Fuel and Biogas from cow manure

Dried cow dung is an excellent fuel. Dung from domestic cows or buffalo can be routinely collected and dried for fuel, sometimes after being mixed with straw. Pieces of dung are lit to provide heat and a flame for cooking. Dried dung loses its objectionable odour.

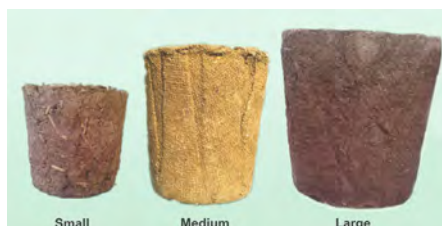
Using cow dung as building material

A mud and cow dung paste is often applied to the floors of rural homes in India and may be applied to the walls as well. The mixture reportedly forms a waterproof layer that helps to insulate the house from heat entry or loss and doesn't smell unpleasant. A relatively new process is to make building bricks from cow dung.

Eco-friendly bricks manufactured from cow manure can help curb the destruction of local environment caused by clay quarries. The cow manure bricks are made using 75 % cow manure and cured in bio gas heating process that reduces the brick factory's Carbon dioxide emission significantly. Besides mitigating Carbon dioxide gas levels in environment, these also raise the income of Gaushalas. These bricks are 20 % lighter but have 20 % more compressive strength than clay bricks.

Material required

- Wheelbarrow
- Commercial grade Hydrochloric Acid
- Spade
- Gloves



Pots of different sizes



Cow dung pot making machine.



Spade



Brick moulder



Masonry Trowel

- Brick moulder
- Gumboots
- Masonry Trowel

Method

- Pick up dried manure in a wheelbarrow using a spade, or by gloved hand. Treat cow manure using hydrochloric acid to kill possible worms and bacteria. And let it dry.
- Fill brick moulder with the manure. Put on a pair of gumboots and press the manure into the moulds with your feet, until the manure is compacted and evenly distributed into moulds. Pressure may also be applied using hands.
- Let it dry in a well-ventilated area for two days, or until dehydrated enough to remove from the moulds.
- Remove the bricks from the brick moulder and stack them in a spread out pattern so that air can circulate between the bricks. Leave them to dry in the open for three-four weeks.
- Preheating in an oven makes the bricks stronger, firmer and harder.

Cowdung as paper

Fibre portion of cow dung can be converted into good quality handmade paper and may fetch substantial income for the Gaushalas.

Cow dung is considered very sacred in the community and used in worshipping. If the paper from cow dung is made available to the community all the publisher of religious books will use it as paper material.

Paper manufacturing unit in a Gaushala having more than 1000 cows will boost the economics of Gaushala, eradicate unemployment in areas surrounding and inspire youth to work in their own village.

High fibre content of cow dung enables people to make paper from dung. Dung is washed to extract the fibres, which can then be pressed into paper on a screen.

Cow Dung and Disease Prevention

Cow dung is basically applied in agriculture to enhance soil fertility. It not only improves the different properties of soil but also acts as a source of microorganisms producing biological nematicidal agents with no negative effect on environment. Therefore, use of cow dung should be promoted in the field of agriculture.

Cow dung is a very effective manure for reducing the bacterial and fungal pathogenic disease. Cowdung has antifungal properties that inhibits the growth of coprophilous fungi. It also shows positive response in suppression of mycelial growth of plant pathogenic fungi like *Fusarium solani*, *Fusarium oxysporum* and *Sclerotinia*. Cow dung extract spray is also effective for the control of bacterial blight disease of rice and is as effective as penicillin and streptomycin. Cow dung as organic manure increase the vigour of plants and reduces the disease incidence of root rot in cotton caused by *Phymatotrichum omnivorum*. Therefore, application of cow dung in a proper and sustainable way can

enhance not only productivity of yield but also minimizes the chances of disease.

Many biodynamic preparations obtained from cow dung have shown antagonistic effect against plant pathogens such as *Rhizoctonia bataticola*.

Addition of cow dung to biomass generated from palm oil industries improves the physical and chemical properties including the nutritional composition of compost. Palm oil biomass mixed with cow dung in the ratio of 1:3 significantly improves the compost quality with respect to various parameters such as pH, electrical conductivity and Carbon:Nitrogen ratio. Thus, cow dung may not only act as a substitute for chemical fertilizers because it supplements organic matter, but also as a conditioner for soil.

Integrated Soil Fertility Management (ISFM), a technique that makes use of both organic and inorganic resources resulting in greater yield response and better nutrient storage can be used to deal with fertility issues of soil. For example, combination of cow dung and Nitrogen:Phosphorous:Potassium (15:15:15) in the concentration of 3 tons/hectare and 100 kg/hectare, respectively, showed increase of 8.9 tons/hectare yield of potato tuber as compared to 1.8 tons/hectare of non-treated soils. The organic carbon of the soil after treatment with this combination increases from 1.33 to 3.21 %. The combination also improved soil organic matter, phosphate availability, exchangeable ions, effective cation exchange capacity and pH in comparison to untreated soil. The same combination increases the yield of maize also.

Bioremediation of environment pollutants

Cow dung contains diverse group of microorganisms such as *Acinetobacter*, *Bacillus*, *Pseudomonas*, *Serratia* and *Alcaligenes* spp. which makes them suitable for microbial degradation of pollutants (drugs, insecticides, pesticides, oil spills, etc.) in water bodies. The application of cow dung also proves very efficient in bioremediation of water contaminated with motor oil.

Cow dung slurry maintained in the ratio of 1:10 or 1:25 is able to degrade the rural, urban and hospital wastes, including oil spillage. Cow dung can reduce total petroleum hydrocarbons to 0 % in polluted soils.

The bacteria in cow dung involved in this process belonged to genera *Pseudomonas*, *Bacillus*, *Citrobacter*, *Micrococcus*, *Vibrio*, *Flavobacterium* and *Corynebacterium*, while fungal isolates in cow dung belonged to the species *Rhizopus*, *Aspergillus*, *Penicillium*, *Fusarium*, *Saccharomyces* and *Mucor*.

Another useful application of cow dung microorganisms is the treatment of biomedical and pharmaceutical waste. *Cyathus stercoreus*, isolated from aged cow dung, is not only capable of degrading lignocelluloses in vitro but also degrades the antibiotic enrofloxacin. Complete biodegradation of biomedical waste is possible when placed in culture medium of cow dung fungus, *Periconiella*.

Cow dung microbial organisms that included bacteria, fungi and actinomycetes are found effective in degrading phenol (pesticides) ranging from 100 to 1000 mg/litre concentrations. Cow dung slurry in the ratio of 1:10 for bioremediation of pesticides namely chlorpyrifos, cypermethrin, fenvalerate and trichlopyr butoxyethyl ester and found that all these pesticides are degraded into some intermediate or less harmful compounds.

Two bacteria namely *Pseudomonas plecoglossicida* and *Pseudomonas aeruginosa*

present in cow dung have also been detected to completely degrade hazardous chemicals like cypermethrin and chlorpyrifos.

Cow dung and its microorganisms also cause remediation of heavy metals like chromium, strontium and arsenic.

Another heavy metal, i.e., radiotoxic strontium which is very hazardous due to half-life of 29 years, imitates calcium in the body and increases the risk of bone cancer and leukaemia. Biosorption of radiotoxic strontium (^{90}Sr) by dry cow dung powder has been proved in various researches.

White ants/termites are attracted to hot fresh cowdung. In order to remove white ants from an area, a mound of fresh cowdung is piled up and when the termites enter it and start feeding, the mound can be burnt.



13 | PUBLIC RELATIONS, FUND RAISING, GRANTS AND DONATIONS

Public Relations

A public relation (PR) campaign is a planned and well-organized program that communicates a specific message to the public. The main point is to gain exposure and create connections with the public that will benefit the Gaushala in the long run.

Catchy newspaper or radio broadcast advertisements; interesting and accessible website, brochures, special events, etc. are all possible PR strategies. Well-orchestrated PR can help a Gaushala attract potential donors, volunteers, and attendees to well devised cattle welfare program/fund raisers/events, etc.

However, PR does not stop at attracting these potential clients. PR is also the impression they get while engaging with your facility. PR staff should be friendly and competent in providing a picture that the Gaushala is welcoming, clean and looking after cattle.

Effective public relations methods

Local Panchayat members, MP, MLA, and administrative officers of the area should be regularly persuaded to visit the Gaushala with a small group of people. The main purpose of such visits is that they see cattle welfare activities going on in there and sense of responsibility is inculcated in them.

Principals of private and public schools should be contacted and students must be encouraged to volunteer and donate.

Rotary Clubs, Lions Club and other clubs participating in the social and welfare activities of the area should also be contacted for support both financially and voluntarily.

An E-mail list of probable donors/volunteers should be prepared and weekly/fortnightly/monthly newsletters with cow and cattle welfare news, volunteer of the specified period, sponsors during the period and donors during the period should be sent to these. Detailed successful events that have happened or events that are going to happen must be advertised, encouraging more and more people to donate/volunteer. Mail it to bureaucrats, businessmen, shopkeepers, clubs, union leaders, local administration, schools, etc.

Besides email, short service messaging (SMS) can also be an effective tool for advertising the welfare activities of Gaushalas.

Upload the facebook page along with use of twitter and other social networking sites for building effective and good relations.

Interns can come from colleges for social work experience if you register yourselves on sites like internshala.com. Introduce cold calls. Make a list of manufacturers/suppliers of cement, bricks, paint, buckets, mugs, hose, sanitary fittings, tiles, mats, gunnysacks, medicine, surgical kits, betadine etc. and call them to donate surplus/defective items or sell at zero profit. Names of these sponsors/donors should be mentioned in newsletters and a certificate of appreciation with the chairperson's signature should also be issued.

Rope in well-known personalities of the area and encourage them to volunteer and participate in daily activities of Gaushala. Take their pictures while working in Gaushala. Publish and report statements in newspapers, channels, newsletters etc. They can become ambassadors for the Gaushala.

Attractive and eye catching cattle shelter brochures to display in resorts should be prepared encouraging tourists to donate and volunteer to various cattle welfare activities.

Donation boxes should be installed at strategic locations like hotels, shops, temples, etc. Apart from this Gaushalas can also get T shirts, mugs, wrist bands, etc. manufactured for sale to develop brand name and advertisement.

Certificates of appreciation to the best newspaper and reporter, volunteers and donors should be issued regularly.

School children should be welcomed on weekends to work in cattle care at the Gaushala. Also issue them certificates of appreciation for the social cause they have contributed to.

Gaushala can be made a "must see" place by requesting tour operators to put it on their itinerary.

Contact local hotels, gurudwaras, restaurants and food caterers for clean leftovers. These are also good place to get chapattis, left overs of vegetables, rice water, etc. for feeding of cattle in Gaushalas.

Advertisement in cinema houses may be put up encouraging people to donate towards a noble cause. There should be provision of online donation.

Fund Raising

No organization can service a community without funds. The executive director of the Gaushala and the committee or board should be in charge of strategizing and planning fund raising efforts. First accurately determine how much money is needed on an annual basis to keep all necessary aspect of the Gaushala in motion and then aim for it.

A transparent donation box can be placed in the entry office and next to the cash at the OPD. Taking part in fairs and exhibitions with donation request boards should also have a positive effect. Acknowledgment and sending thank you notes to donors will facilitate repeated donation. Corporate companies can be approached for donations.

Mandirs should also be contacted for fund for Gaushalas and to display/install organization's donation box which should be checked regularly. A Mandir can also be constructed at the entrance of the Gaushala in order to attract donations.

Monthly expenditure list and a wish list of requirements for shelter with their approximate cost should be displayed on the website or Gaushala notice board prominently to attract donors.

Getting funds/grants for Gaushala

Gaushala registered under Society Registration Act can approach local administration for funds.

Gaushalas should be registered with Animal Welfare Board, Chennai which has provision to provide funds under different heads.

Gaushala applying for grants can go through AWBI's website www.awbi.org and download the form and sent it through post / courier or e-mail.

Gaushala donors have provision to 80 G tax exemption in income tax to donors.

Gaushala can approach corporate companies for Corporate-Social Responsibility (CSR) funds for setting up of modern sheds, biogas plant, solar units, etc.

Gaushala can organize events to sell work by prominent artists, music concerts or performances can get money by sponsorship or by selling tickets.

Organising gaukathas by seers and saints will further improve the monetary prospects of Gaushala fund raising.

Gaushala can start gaugrass rickshaws, which collect chapattis/vegetables /fruit peels from households to feed cows.

At the entrance of Gaushala, rent out a chara shop. Donors will buy chara from there, by this way, Gaushala will get rent as well as fodder for cows.

Donors should also be provided with option to adopt a cow from Gaushala for a specific period of time which can fetch adoption fees of ₹ 15000-18000 for one year per cow.

NAME OF THE GAUSHALA WITH ADDRESS	
DATE: _____	RECEIPT No.: _____
AMOUNT RECEIVED: Rs. _____	IN WORDS _____
() CASH	
() CHEQUE:	CHEQUE NO. _____
() MONEY ORDER	MONEY ORDER NO. _____
MONEY DONATED BY: MR./MRS./MISS. _____	
MONEY RECEIVED BY: MR./MRS./MISS. _____	
MONEY DONATED FOR: MR./MRS./MISS. _____	

Animal welfare board of India (AWBI)

13/1, Third Seaward Road, Valmiki Nagar, Thiruvannamipur, Chennai- 600 041

Phone: 044-24571024, 24571025 Fax. 044-24571016

E-mail: awbi@md3.vsnl.net.in, animal welfare board

URL: www.awbi.org

Pilferage of Funds

Gaushala management should ensure that there is no pilferage and leakage of funds from the Gaushala. For this purpose, the following points should be addressed. Some examples of how the pilferage/leakage can occur and the remedial measures to be adopted are as given below:

1. Purchase department can overcharge for the things they purchase.

Solution: For every item worth more than ₹ 10,000/ at least three quotations from different vendors must be received and every month a market survey must be conducted to get the current market price of the things most commonly used at the Gaushala.

2. Medicines and others consumable items.

Doctors and other para-veterinary staff normally throw away bottles of medicines and other items like bandages etc. after consuming only half.

Solution: Every month's consumption should be cross checked and compared with the number of animals treated.

3. Petty cash: Ambulance drivers keep cash with them for gas / diesel / petrol etc.

Solution: Proper log books for each and every vehicle should be maintained and distance covered by the vehicle should be logged. Along with this whenever the gas / diesel / petrol is filled in the vehicle it should be recorded in the log book along with the kilometre reading at which it has been filled along with the quantity filled. At the end of the month mileage of the vehicle per unit of fuel used should be calculated and checked for any steep discrepancy.

4. Donors giving money to individuals.

Solution: Put up boards at different places in the Gaushala advising donors that they should take receipt for every donation they contribute and all donations must be made in the office only. Ambulance drivers must also carry receipt books and give receipts for all donations received during pickups or release of animals.

5. Staff stealing animals for personal gains.

Staff at the shelter can steal animals for selling them in the market especially if staff quarters are in the shelter premises and a cartel develops between different members of staff.

Solution: It is advised that a proper inventory of all animals be kept and their numbers should be displayed outside on a board.

6. Staff members can also steal medicines / food items meant for animals

Solution: Entry and exit of all items and animals must be properly recorded at the gate and valid gate passes must be issued for exit of any animal from the Gaushala. In case repeated theft cases are reported then frisking of staff at the exit points can also be done.

Gaushala

Links

S. No.	Title	URL
1	Desi gau ke gobar se dhup batti banaye pollution ko ghar se dur bhagaye	https://www.youtube.com/watch?v=YV4txZbptg8
2	Soap making from desi cow milk	https://www.youtube.com/watch?v=b9hGCuwwhig
3	Desi gau ke gobar se manjan banaye dato ke rogo ko dur bhagao	https://www.youtube.com/watch?v=LEqXnX-WZo8
4	xkse; xkscj ls lkcqu cukus dh fof/k - Panchgavya Soap Making Process	https://www.youtube.com/watch?v=9NH1Ae_GOys
5	xkse; vdZ cukus dh fof/k How Gowmutr Ark is made	https://www.youtube.com/watch?v=DN5HNFp54ZE
6	xkse; t+gj dSls [kRe djrk gS How cow urine detox your body	https://www.youtube.com/watch?v=0pwZMs29H08
7	Incredible Zero Cost Formula For Organic Farming Using Cow Dung & Urine-Rajiv Dixit	https://www.youtube.com/watch?v=0_n86om-VUew
8	Cowpathy Cow dung soap benefits	https://www.youtube.com/watch?v=EJzeJcOJ8dA
9	Lamp made with desi Cow Dung and ghee	https://www.youtube.com/watch?v=3oOYEleMaH4
10	Turmeric and Cow Urine for Cancer Treatment Better than Chemotherapy	https://www.youtube.com/watch?v=TUea4vAzQSo
11	DNA: Sikkim, India's first 100 per cent organic state	https://m.youtube.com/watch?feature=youtu.be&v=bB0wwZJgU6g
12	Best Fuel is Cow Dung The Living Connection with Ekayani Chamberlin Health & Lifestyle Coach	https://www.youtube.com/watch?v=TjPPJcHMIPE
13	Indian women cook potatoes by burning cow dung patties	https://www.youtube.com/watch?v=scYmd8IEHV4
14	Cow Manure/Dung/Poop And The Garden Plants	https://www.youtube.com/watch?v=eEMahG3jTio
15	Biogas production in India, from cow poop!	https://www.youtube.com/watch?v=RMrRv_B2NL4
16	Cow dung bricks	https://www.youtube.com/watch?v=rguawpCMzT4
17	Cow dung blocks replace plastic sapling bags!	https://www.youtube.com/watch?v=NhfBTRHtB68&t=122s

Regional Languages

18	Mosquito coil preparation from cow dung	https://www.youtube.com/watch?v=4CTjcJ9Cjq8
19	Parmeshwar Talekar's success story of products from cow dung (Marathi)	https://www.youtube.com/watch?v=bQ2PUVRqdsW
20	Solapur Exporting Cow-Dung-Cakes in Various Foreign Countries, Special Report-TV9	https://www.youtube.com/watch?v=FXPI18ZP7vo

FINANCIAL EXPRESS

Government to help entrepreneurs promote desi cow by-products

With an aim to double farmers' income, the government would promote entrepreneurs keen to manufacture products using desi cow by-products like urine and cow dung among others, an official source said.



With an aim to double farmers' income, the government would promote entrepreneurs keen to manufacture products using desi cow by-products like urine and cow dung among others, an official source said. Various products which can be manufactured using cow milk, urine and cow dung have been identified and the Ayush Ministry has been asked to give its views, the source said. The issue was deliberated in detail in a meeting called by Minister of State for Agriculture Krishna Raj today. Senior officials from various ministries attended the meeting. Once the products are identified for business scale up, the small enterprises will be encouraged by providing financial help under a scheme run by MSME Ministry.



Panchagavya... if cow urine could cure cancer

Leave alone that there is no peer-reviewed and endorsed scientific basis for the 'cancer-curing medicinal benefits' of Panchagavya — a mixture of milk, dung, curd and cow urine. Why is an agricultural university discussing it?



Panchagavya, an Indian traditional mixture involving cow urine and boasting medicinal benefits, could be a concoction in more than one sense. | The Hindu

"One lady with psoriasis all over the body was under allopathic treatment for over one and a half years. She happened to prepare panchagavya for field use and stir the contents with her forearm. After 15 days, the psoriasis in her forearm got fully cured. Following her own intuition, she smeared panchagavya all over the body and to everyone's surprise the psoriasis disappeared in 21 days," the Tamil Nadu Agricultural University (TNAU) website claims.

FRONTLINE

Of 'cowpathy' & its miracles



Workers fill a bottle of Brantone+ cow urine syrup at the factory of Jan's Cow Urine Therapy Health Clinic in Indore, Madhya Pradesh, on June 27.

Promotion of cow urine and dung as super drugs is part of the cow politics of the Sangh Parivar. Not only have these claims not been substantiated scientifically, but propaganda based on pseudo science seems to thrive under BJP-led governments. By R. RAMACHANDRAN

Extraordinary claims of the medical benefits of the excretions of the "holy cow"—milk, you, only the cow, and not any other cattle, including the buffalo—has been part and parcel of the Sangh Parivar's "cow politics". During the tenure of the Bharatiya Janata Party (BJP)-led National Democratic Alliance (NDA) government (1999-2004), one saw not only their active promotion (as was apparent from the questions related to it raised in Parliament by BJP members) but also some laboratories of the Council of Scientific and Industrial Research (CSIR) being asked to do research on cow urine's beneficial effects.

With Murli Manohar Joshi as the Minister in charge of Science and Technology as well as Human Resource Development, it was perhaps easy to identify the Hindutva camp followers in the CSIR system to engage in such questionable research. It was the Joshi-Hari Gautam (former University Grants Commission Chairman) combine that pushed through UGC-approved degree courses in astrology in Indian universities. It was during this period that the CSIR obtained four patents in the United States related to medical uses of cow urine formulations. Interestingly, the CSIR laboratory in question collaborated with Go-Vigyan Anusandhan Kendra (GVAK; Centre for Cow-science Research), a front organisation of the Rashtriya Swayamsevak Sangh (RSS), located in Deolapur near Nagpur, where the RSS is headquartered. With the reported proximity of the then CSIR chief Ramesh A. Mashelkar to the RSS, it was perhaps easy for Joshi to push through his "cow urine" agenda as well.

THE TIMES OF INDIA CITY

Over 42k UP govt schools use cow dung, wood to prepare midday meal



Representative Photo

AGRA: In the absence of LPG connections, a large number of government schools in UP are forced to use cow dung and wood to prepare midday meals for children. This not only increases air pollution, but directly affects the health of teachers and students every day.

According to government records, as many as 42,442

schools across the state use cow dung and wood to prepare food for students. Of these, over 1,000 schools fall in Agra region. Officials said that these institutes not only put the health of their staff and students at risk, but also violate the guidelines of Taj Trapezium Zone (TTZ) by indulging in practices which adversely impact the environment in the eco-sensitive area.

Talking to TOI, Rajeev Verma, Agra city president of Uttar Pradesh Primary Teachers' Association, said, "The education department should provide LPG connections in all schools as teachers have to struggle every day to arrange wood or cow dung to prepare meals for children. Apart from other problems, the exercise affects the academic environment in an institute. It also leads to hygiene-related issues. We have come to know that the state government has taken note of this problem and are hoping to get LPG connections soon."

At a time when the government is strictly enforcing ban on old petrol and diesel vehicles and is adopting other measures to bring down pollution levels in India's largest state, this problem seems to have completely gone unnoticed. When asked about this issue, Girijesh Chowdhary, assistant director, basic education, said, "We have provided LPG connections in a majority of schools. However, a few institutes in rural areas continue to use old and polluting fuels for cooking. Soon, we will provide gas connections to them. The issue is being taken up on priority basis."

Sources in education department said that there are 167,594 government schools in the state that provide midday meals to students. These schools include primary, upper primary and aided schools. Out of these, 42,442 schools don't have LPG connections till date.

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